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BULLETIN NO. 22, NEW SERIES.

AGRICULTURAL EXPERIMENT STATION,

OF THE

Agricultural and Mechanical College,

AUBURN, ALA., - - JANUARY, 1891.

EXPERIMENTS WITH COTTON.

REPORT OF ALABAMA WEATHER SERVICE.

☞ The Bulletins of this Station will be sent Free to any citizen of the State, on application to the Director.

Smith, Allred & Co., State Printers and Binders, 24 Commerce St., Montgomery, Ala.

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EXPERIMENTS WITH COTTON—1890.

J. S. NEWMAN—JAS. CLAYTON.

Comparison of Varieties.

Seven varieties of cotton were planted April 28th, 1890, for the purpose of comparing their productiveness, yield of lint from seed cotton and quality of lint. The Cook and King varieties were received from the Secretary of Agriculture at Washington, Storm Proof was planted from seed presented by W. J. Smilie, Baileyville, Texas, who originated it; Southern Hope and Peterkin were from seed grown on the station in 1889, Peerless and Truitt were presented by Mr. James Clayton from his farm near Opelika, Ala.

The soil upon which the first five varieties were grown was a uniform piece of sandy creek bottom which has been gradually brought up to an excellent state of productiveness during the last seven years.

The comparison is perfectly accurate and reliable in every respect. The following tabulated statement shows the comparative yield per acre in seed cotton and lint, and the per cent. of lint.

The King and Cook varieties were on a somewhat different soil from the others and upon smaller areas, and hence, are not comparable with them as to yield per acre, but are compared with each other.

As the seed cotton was picked, each variety was securely stored in a bin to itself and at the time of ginning all were weighed under like conditions and ginned separately. A sample of the lint of each was taken, numbered and sent by express to Mr. H. C. Parker, an expert at Montgomery, for classification and valuation. His report contains matter of much interest to producers of cotton. Mr. Parker, as is shown in his report, knew the samples by number only, but he seems to have had no difficulty in separating the longer stapled varieties from the short in grading them. The season for gathering cotton was not favorable for good samples.

RESULTS.

Plot	Name of Varieties.	Yield in lbs. Seed Cotton per acre.	Yield in lbs. Lint per Acre.	Per cent of Lint.	Value per Acre.	Priced by Mr. Parker.
1	Peerless..........	2650	876	33 1-17	$76 65	8¾
2	Peterkin.........	2212	786	35½	72 70	9¼
3	Southern Hope...	2239	638	28½	70 18	11
4	Storm Proof......	2170	717	33 1-24	60 94	8½
5	Truitt...........	2400	783	32⅝	67 53	8⅝
* 6	W. A. Cook......	1405	385	27⅓	53 90	14
7	T. J. King........	1745	580	33 1-5	49 30	8½

*These were on poorer soil than 1 to 5 and compare only with each other except in price.

REPORT OF MR. HENRY C. PARKER, CLASSIFYER OF COTTON FOR LEHMAN, DURR & CO., MONTGOMERY, ALA.

No.	Classification.	Length in Inches.	Price.	REMARKS.
1	Shy Midling........	⅞	8¾	These have nothing specially to recommend them. The price is mainlv a question of handling.
4	Strict Low Midling..	⅞	8½	
5	Fully Str't Low M'd'g	⅞	8⅝	
7	Strict Low Midling..	⅞	8½	
2	Midling	1⅛	9¼	½c for length, stronger and longer.
3	Midling	1⅜	11	Like Allen variety.
6	Strict Low Midling..	1½	14	Touch of Sea Island......

"These last require particular attention as to their prolificness and yield of lint. The light lands are hardly adapted to them without continual renewal of seed as they lose in strength and length. Fertilizers aid considerably in keeping them up." The numbers of samples above correspond to plot numbers in table of results.

These varieties of cotton were all planted in checks four feet each way. The plants were thinned by hand and plowed both ways, thus entirely dispensing with hoeing.

This was too thick for the long limb varieties which so completely shaded the early fruit as to cause rotting of the bolls. The stalks of the Peerless variety fell over with their weight of fruit and suffered from rotting where the bolls rested upon the ground. It was not practicable to ascertain the comparative loss by the different varieties from this cause. The season was very favorable for production but very unfavorable for picking. The following statement of rainfall from April to October, inclusive for 1890, kindly furnished by Mr. J. M. Quarles, assistant in meteorology, compared with the average precipitation for twelve years as given in Bulletin No. 18, *Climatology of Alabama*, shows an abnormal precipitation in May, August, September and October. Since the cotton boll is opened by the drying and consequent contraction of the exterior of each lobe of the bur, long continued wet weather during September and October is disastrous, not only to the quantity, but the quality of the product.

PRECIPITATION FROM APRIL TO OCTOBER, 1890, AND AVERAGE.

	1890	AVERAGE 12 Y'RS. 1855—1889.
	INCHES	INCHES.
April	1.52	3.82
May	6.18	3.17
June	3.82	5.28
July	4.80	4.37
August	5.75	4.20
September	5.53	3.29
October	7.24	2.48

It will be observed that there were 12.74 inches of rain during September and October of last year against 5.77 inches as the average of twelve years, or more than twice the normal quantity.

EXPERIMENT WITH PHOSPHATE.

Question:—Will the vegetable matter in freshly cleared land supply all the nitrogen needed by the cotton plant?

This experiment was conducted upon land from which the large timber, principally longleaf pine, had been removed many years before, but was cleared for the plow during the winter of 1889-90. It was very thoroughly broken for "new ground," was very uniform in character and, as shown by the yield where no manure was used, was naturally very poor. As shown by the results of the "soil test of fertilizers" conducted on an adjacent acre, the soil is decidedly deficient in phosphoric acid. In addition to the above question, an inquiry as to the quantity of phosphate that can be profitably applied upon such land is made. The results show that the plant was not commensurately profited by the additional 500 lbs. and that the decomposition of the vegetable matter did not furnish all of the nitrogen needed by the cotton plant.

PHOSPHATE ALONE, AND PHOSPHATE AND NITROGEN ON NEW GROUND.

Plot No.	Names of Fertilizers.	Pounds used per acre.	Yield in pounds Seed Cotton per acre.						Cost of Fertilizers per acre.	Profit from use of Fertilizers	% profit from use of Fertilizers.
			1st picking Sept. 1st.	2d picking Sept. 18.	3d picking Oct. 15.	4th picking Nov. 10.	5th picking Nov. 25.	Total.			
1	Acid Phos.	500	212	382	168	25	32	819	$ 4 12½	$ 6 67	48½
	C. S. Meal.	500	....	....	....	....	....	......	....	....	....
2	Acid Phos.	500	310	453	152	47	55	1017	9 55	7 19	52 1-5
3	Acid Phos.	1000	270	400	150	29	34	883	8 25	4 47	32½
4	No man're	....	9	60	147	169	74	459	....	....	....
	C. S. Meal	1000	....	....	....	....	....	......	....	....	....
5	Acid Phos.	1000	226	406	349	119	113	1213	19 10	3 52	25½

Floats vs. Acid Phosphate.

In several experiments, previously conducted to ascertain the comparative agricultural value of the phosphate rock, ground to impalpable powder, known as floats, with that of acidulated phosphate, the results have indicated, that used in conjunction with cotton seed meal, floats were more prfitable than the acid phosphate, taking into consideration the fact that floats contain nearly twice the percentage of phosphoric acid.

The soil used in this experiment was sandy drift that had been lying out many years. No commercial fertilizer had been previously applied to it. It had been closely depastured for seven years.

The floats were at some disadvantage in comparison of costs, since they were purchased at ton rates, while the acid phosphate was bought at car load rates. The results are so plainly set forth in the table that comments are unnecessary.

ACID PHOSPHATE AND FLOATS COMPARED.

RESULTS.

PLOT.	Fertilizers used per Acre.		Seed Cotton gathered per Acre.					Total Yield per Acre.	Cost of fertilizer per Acre.	Profit from Fertilizers.	Per ct. profit from Fertilizers.
	Pounds.	Names.	1st Picking Sept. 1.	2d Picking Sept. 17.	3d Picking Oct. 15.	4th Picking Nov. 1.	5th Picking Nov. 25.				
No. 1..	400	Floats.	40.0	167.2	218.4	73 6	42.4	541	$3.14	$2.77	26¾
No. 2..	800	Floats.	72.0	220.0	319.2	76.8	43 2	731	6.28	5.33	51½
No. 3..	....	No manure.................	....	....	....	....	....	344	.....	......	......
No. 4..	800	400 Floats, 400 C. S. Meal....	208.0	389.6	172.8	38.4	24.8	833	7.48	7.19	69 3-5
No. 5..	800	400 C. S. Meal, 400 Acid Phos.	344.0	341.6	83.2	24.0	21.6	814	7.64	6.46	62.3-5

Cotton at Different Distances in Row and Drill,

With same quantity of manure per acre and same distance, with different quantities of manure.

This experiment was conducted upon land, of almost exactly uniform quality, which had been somewhat improved by rotation of crops and fertilizing during six years. It produced without manure, in 1884, 3½ bushels of corn per acre, under the influence of a favorable season. After thoroughly preparing and bedding the land, a Thomas harrow was drawn across the beds to reduce their height and leave them in good condition for the planter.

Owing to the difficulty previously experienced in securing and maintaining a stand when planted in hills, the seed were sown in the usual way along the row with the planter. In order to secure perfect accuracy and insure a stand, lines were stretched across the rows at the desired distances apart, and the cotton chopped between them, leaving two stalks to the hill, under or as near as practicable to the lines.

By this means a perfect stand was secured. After danger of attack from cut worms was past, the stand was reduced to one stalk to the hill. Besides the comparison of the effects of giving different areas to the plants, the effects of doubling the quantity of manure per acre is tested in plats 1 and 5 and 2 and 6, which are adjacent, and have the plants at the same distance each way, 1 and 5 being planted 4 ft. by 5 ft., and 2 and 6, 4 by 4 ft.

To half of plat 8, 200 ℔s. of kainit were applied,* August 13th, and to the other half, 200 ℔s. of cotton seed meal. The object of these applications was to prolong and thereby increase the fruitfulness of the plants. Each of these is compared with plot 4, which had the same quantity of manure, applied before planting, that plot 8 had, and received no additional application. The labor of applying them, as well as the additional manures, seems to have been wasted.

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*Owing to the continued rains this application was made later than intended.

It will be observed that crowding the plants as in plots 7, 10 and 11, hastened maturity, as is shown by the yield at the first picking. Half the crop on these plots was gathered September 7th. As appeared in similar experiments in 1889, 4 by 2 seems to be the best distance for *such land* as was used for this experiment. Doubling the fertilizer was not profitable.

COTTON AT DIFFERENT DISTANCES AND WITH DIFFERENT QUANTITIES OF MANURE.

PLOT No.	Distance Planted.	Fertilizers Used per Acre.		Yield in lbs. Seed Cotton per Acre				Total.
		Pounds.	Names.	1st Picking Sept 7.	2nd Picking Sept. 19.	3rd Picking Oct. 20.	4th Picking Nov. 10	
1	4 x 5 ft.	1000	500 lbs. Cotton Seed Meal, 500 lbs. Acid Phos	198 4	574.0	297.6	62 0	1132
2	4 x 4 ft.	1000	" " " "	273.2	580.0	219.6	28 0	1101
3	4 x 3 ft.	500	250 lbs. Cotton Seed Meal, 250 lbs. Acid Phos	290.8	509 2	198 0	16 0	1014
4	4 x 2 ft.	500	" " " "	372.8	557.6	176.0	24.8	1131
5	4 x 5 ft.	500	" " " "	130.4	460 8	382 0	65.6	1039
6	4 x 4 ft.	500	" " " "	192 0	472 8	166 4	20.0	851
7	4 x 1 ft.	500	" " " "	430 4	374 8	64.4	8.4	878
8	4 x 2 ft.	700	250 lbs. Cotton Seed Meal, 250 lbs. Acid Phos., and 200 lbs. Cotton Seed Meal, extra, August 13th......	284.8	487.2	231 2	30 4	1034
8½	4 x 2 ft.	700	250 lbs. Cotton Seed Meal, 250 lbs. Acid Phos., and 200 lbs. Kainit, extra, August 13th	321.6	465 6	140.0	23 2	950
9	3 x 3 ft.	500	250 lbs. Cotton Seed Meal, 250 lbs. Acid Phosphate	407.2	398 8	198.8	24.8	1030
10	3 x 2 ft.	500	" " " "	410.8	293.2	111.2	8 4	824
11	3 x 1 ft.	500	" " " "	404.8	268 0	115.2	15.2	803
*12	4 x 5 ft.	500	" " " "	142 8	260.4	270 0	13 2	686.4

*This compared with plot 5.

DIAGRAM OF PLOTS.

PLOT 9. 3 x 3 feet. 250 lbs. C. S. Meal. 250 " Acid Phosphate per acre.	PLOT 5. 4 x 5 feet. 250 lbs. C. S. Meal. 250 " Acid Phosphate per acre.	PLOT 1. 4 x 5 feet. 500 lbs. C. S. Meal. 500 " Acid Phosphate per acre.
PLOT 10. 3 x 2 feet. 250 lbs. C. S. Meal. 250 " Acid Phosphate per acre.	PLOT 6. 4 x 5 feet. 250 lbs. C. S. Meal. 250 " Acid Phosphate per acre.	PLOT 2. 4 x 4 feet. 500 lbs. C. S. Meal. 500 " Acid Phosphate per acre.
PLOT 11. 3 x 1 feet. 250 lbs. Acid Phosphate. 250 " C. S. Meal. 250 " Acid Phosphate per acre.	PLOT 7. 4 x 1 feet. 250 lbs. C. S. Meal. 250 " Acid Phosphate per acre.	PLOT 3. 4 x 3 feet. 250 lbs. C. S. Meal. 250 " Acid Phosphate per acre.
PLOTS ¼ acre each except 8 and 8½, which are ⅛ acre each.	PLOT 8. 4 x 2 feet. 250 lbs. C. S. Meal. 250 lbs. acid phosphate per acre. 200 lbs. of kainit added 13th August. PLOT 8½. 4 x 2 ft. 250 lbs. C. S. Meal. 250 lbs. acid phosphate per acre. 200 lbs. C. S. Meal added 13th Aug.	PLOT 4. 4 x 2 feet. 250 lbs. C. S. Meal. 250 " Acid Phosphate per acre.

Plot 12 extends along the side of plot 5, and partly by 1 and 9, and is compared with plot 5, the object being to test the effect of so-called rest while closely pastured.

During 1883 the land occupied by both 5 and 12 was cultivated in cotton by a negro tenant without fertilizer. During the winter of 1883–'4, that occupied by 12, was turned out into a standing pasture, and has been since very closely pastured. Plot 5 has been in cultivation continuously. The question, therefore, is, does such rest improve land? Plot 12 had the same treatment in every respect as plot 5 in 1890.

Plot 5 has produced profitable crops each season since 1883, plot 12 has produced no crop since that year.

Plot 5 produced 1,039 ℔s. seed cotton and 12 produced 686 ℔s., a difference of 353 ℔s. per acre in favor of the land continuously cultivated over that supposed to have *rested* seven years. The value of the difference in production is more than the market value of the land.

Soil Test of Fertilizers With Cotton.

For the purpose of learning the *chemical needs* of the various soils of the State, chemicals already prepared and weighed, ready for application, were furnished thirty *volunteer experimenters* cultivating typical soils of as many sections of the State, with the request that they be applied, as far as practicable, to soil upon which no commercial or other fertilizer had ever been used.

In order to compare the soil of this section with those in the different parts of the State, the same chemicals in character and quantity were applied upon an old field which had been lying out for many years, and for the last seven closely pastured. No commercial fertilizers was ever applied to this soil previous to 1890. It had been cleared so long that even the long-leaf pine stumps had disappeared.

The following diagram of the plots will convey a clear idea of the arrangement for securing accuracy of results. The two centre rows of each plot were used since the outside rows are influenced by the manure in the apjacent plots:

DIAGRAM OF EXPERIMENT PLOTS.

210 FEET

14 feet

1	1 2 3 4	6 lbs. Sul. Ammonia.
2	1 2 3 4	13 lbs. Dis. Bone Black.
3	1 2 3 4	10 lbs. Kainit.
4	1 2 3 4	No manure.
5	1 2 3 4	6 lbs. Sul. Ammonia. 10 lbs. Kainit.
6	1 2 3 4	6 lbs. Sul. Ammonia. 13 lbs. Dis. Bone Black.
7	1 2 3 4	13 lbs. Dis. Bone Black. 10 lbs. Kainit.
8	1 2 3 4	No manure.
9	1 2 3 4	6 lbs. Sul. Ammonia. 13 lbs. Dis. Bone Black. 10 lbs. Kainit.
10	1 2 3 4	20 lbs. Floats.
11	1 2 3 4	20 lbs. Floats. 6 lbs. Sul. Ammonia.
12	1 2 3 4	No manure.
13	1 2 3 4	53 lbs. green cotton seed.
14	1 2 3 4	53 lbs. green cotton seed. 20 lbs. Floats.
15	1 2 3 4	265 lbs. stable manure.

The manures were applied with the utmost care, and almost a perfect stand secured. The cultivation throughout was perfectly satisfactory. When the cotton was large enough to be exempt from attack by the cut worm, the stalks in the two last rows in each plot were counted and reduced to the same number in each by pulling out from those having the largest number, down to the last number found in any plot. This is the only practicable plan by which an absolutely uniform stand can be secured.

Observations were made, as shown in the table, upon the height, condition and appearance of the plants on the different plots, June 14th, July 8th, August 11th, and September 11th. The quantity gathered at the different pickings was recorded and is printed to show the effects of different manures in hastening the growth and maturity of the crop. It will be observed, that while from some plots more than *ninety* per cent. of the crop was gathered by the 15th of October, from others less than *sixty* per cent. was gathered. This is often a very important effect of manures, since the price is usually better during September and October than later, and a laborer can gather fully one-third more per day in September than in November or December. Besides, by reference to the table giving the average rainfall it will be observed that September and October are generally comparatively dry months, and hence favorable for maturing and gathering cotton. In order to have a check upon the accuracy of the field weights, the seed cotton from each plot was kept separate, tied up in sacks and suspended from the joist of the gin house, where it was exempt from liability to be disturbed by either men or mice. At the time of ginning, the cotton was re-weighed under like conditions. The columns in the table headed " field weights " and " gin house weights" show the loss of each plot up to December 17th, when it was ginned. The results indicate that the soil upon which the experiment was conducted was especially deficient in phosphoric acid, since a marked increase in production results from its application in every instance, whether used alone or in combination with potash or nitrogen. The results from kainit and sulphate of ammonia used either singly or together, indicate that the plant was unable to utilize these without phosphoric acid. That the soil needed both potash and nitrogen is shown by the increased yield where these are combined with phosphoric acid.

That these, potash and nitrogen, were to some extent available in the soil is shown by the fact that phosphoric acid alone gave good results. The *indications* from the results of this experiment are therefore, that the soil needs all three of the principal ingredients, nitrogen, potash and phosphoric acid but is most deficient in the latter.

Attention is invited to the *per centages* of increase from the use of the different manures, as shown in the table.

It is interesting also to note the cost of fertilizers applied per acre, the actual profit and the per cent. of profit. As the profit and per cent. are calculated upon and due to the increase resulting from the fertilizers and as all other expenses are the same on the unfertilized land as upon the fertilized the effects of the fertilizers alone are considered.

While the stable manure produced the largest increase and the largest profit per acre, attention is called to the fact that it was applied at the rate of nearly *two tons* per acre or half a ton more than the amount annually saved from each mule kept. There is no question about the efficacy of good stable manure properly used but the available supply is too small.

The late fall was favorable to the plots which produced little since a larger per cent. of the fruit on these was produced late in the season than upon the plots upon which the plants grew off more promptly in early summer.

Attention is invited to the effect of kainit in retarding the appearance of blight as well as to the fact that early growth and heavy fruitage was favorable to its attack—see and compare plots 2, 3, 5, 7 and 9.

SOIL TEST OF

Plot No.	Fertilizers used per Acre.		June 14th.		July 8th.		August 11th.		
	Pounds.	Names.	Condition of Plant.	Height in inches	Condition of Plant.	Height in inches	Condition of Plant.	Height in inches	Leaf Blight.
1	90	Sulphate Ammonia,	Yellow,	2 to 5	Yellow, not vig.	4 to 11½	Green, vig. and fruit'g rapidly	7 to 16	Free.
2	195	Dissolved Bone Black,	D'k green & vig'us	5 to 10	Color good & vig	11 to 24	Gr'n and fruit ing ended.	15 to 30	Badly.
3	150	Kainit,	Green,	2 to 6	" "	6½ to 14	Gr'n, vig. and mak'g rapidly	10 to 18	Free.
4		No manure,	Yellow,	2 to 5	Yellow, not vig.	4½ to 9	"	7 to 13	"
5	240	150 Kainit, 90 Sul. Am.	"	2 to 5	Col. g'd and vig.	4½ to 9	"	9 to 20	"
6	285	195 Dis. Bone Black 90 Sul. Ammonia,	D'k green & vig'us	4 to 8	" "	7 to 22	Vigorous and fruitg slightly	11 to 30	Slight.
7	345	195 Dis. Bone Black, 150 Kainit,	" "	5 to 10	Vig., col. little off	8 to 24	"	11 to 30	Free.
8		No Manure,	Yellow,	2 to 5	Yel. and not vig	4½ to 9	Vig and making rapidly.	6 to 13	"
9	435	195 Dis. bone blk, 90 sul. am., 150 kainit,	Green,	4 to 8	Col. g'd and vig.	10 to 22	Vig. and fruiting slightly.	14 to 30	Slight.
10	300	Floats,	Light Green,	2 to 6	" "	7 to 12	Vig. and making rapidly.	11 to 24	"
11	390	300 Floats, 90 sul. am.	" "	2 to 6	" "	8 to 15	Vig. and making moderatly	12 to 26	"
12		No manure,	Yellow,	2 to 5	Yellow not vig.	4½ to 9	Vig. and making rapidly.	7 to 13	Free.
13	795	Green cotton seed,	Yellow,	2 to 5	Very yellow.	9 to 15	"	12 to 28	Slight.
14	1095	795 Green cot'n seed 300 Floats.	Light Green,	2 to 6	Col. g'd and vig	9 to 20	"	11 to 30	"
15	3975	Stable manure,	Very vigorous and dark green,	5 to 10	Col. little off and vigorous,	12 to 26	Fruiting ended.	18 to 30	very sl't

FERTILIZERS, 1890.

September 11th.			Yield in Pound Seed Cotton per Acre. Field Weight.													
Plot.	Condition of Plant.	Leaf Blight.	1st Picking Sept. 1.	2nd Picking Sept. 17	3rd Picking Oct. 15.	4th Picking Nov. 8.	5th Picking Nov. 25.	Field Weights Total.	Ginhouse weights. Total.	Per ct. of increase over no manure.	Cost of Fertilizers per acre.	Profit per acre.	Per cent of profit.	Loss.	Per cent of loss.	Per cent gathered to Oct. 15th.
1	Mak'g sm'll and vig	V'y slight	9	33	108	75	39	264	255		$3 30			5 70	1 23	57
2	Matured,	V'y badly	183	270	141	36	18	648	624	88.4	2 53	6 59	64			92
3	Vigorous and mak'g	Free,	6	27	174	135	72	414	390	20.3	1 37	73	7			50
4	Vig'us and mak'g,	Slight,	9	45	138	108	51	351	330							55
5	Vig'us and mak'g,	Free,	6	30	123	144	75	378	369	9.9	4 67			3 65	55	42
6	Matured,	Badly,	180	345	186	66	36	813	765	136.3	5 83	8 24	80			88
7	"	Slight,	198	411	222	69	39	939	900	173.0	3 90	13 95	135			88
8	Small, vig.and m'kg	V'y slight	12	42	129	105	36	324	309							55
9	Matured,	Badly,	198	450	303	63	33	1047	963	204.4	7 20	13 86	134			91
10	Matured and small,	Badly,	81	225	162	45	24	537	510	56.1	2 36	3 43	33			87
11	Matured,	Badly,	105	255	258	105	36	759	732	120.6	5 66	6 79	66			81
12	Making,	Slight,	9	66	159	93	30	357	342							66
13	Matured,	Badly,	48	228	222	69	21	588	570	71.0	3 57	3 75	36			85
14	Matured,	Badly,	156	420	249	63	30	918	882	167.2	5 93	11 29	109			90
15	Matured,	Badly,	345	585	162	33	21	1146	1119	233.1	3 97	20 09	194			95

INTERCULTURAL FERTILIZATION.

In order to test the efficacy of the application of additional fertilizer during the growth of the plant in prolonging its fruiting period and increasing the yield, two hundred pounds of cotton seed meal per acre were applied at the 2nd plowing of the cotton June 18th, and covered lightly with scrape.

Two hundred more were applied in the same way at the last plowing, July 30th. These were applied to two plots to which two hundred lbs. of cotton seed meal and acid phosphate, mixed in equal parts of each, were applied in the drill before planting, and were compared with a third plot to which the same quantity of cotton seed meal and acid phosphate were used before planting but to which no subsequent applications were made.

The results presented in the accompanying tabulated statement show that the average increase caused by the additional applications was 339 lbs of seed cotton.

The intercultural applications had the effect of continuing the growth and fruitfulness of the cotton after that on plot 3 had ceased to grow.

The results are plainly set forth in the tabulated statement.

INTERCULTURAL FERTILIZATION.

Plot No.	Fertilizers per Acre.		How and When Applied.	1st Picking Sept. 1st	2nd Picking Sept. 17.	3rd Picking Oct. 15.	4th Picking Nov. 8.	5th Picking Nov. 25.	Total yield seed cotton per acre.
	Pounds.	Names.							
1	600	Cot'n Seed Meal and Acid Phos.	200 lbs. C. S. Meal and Acid Phosphate in equal parts before planting. 200 lbs. C. S. Meal at second plowing. 200 lbs. C. S. Meal at last plowing.	222.3	288.6	195 0	97.5	62.4	865.8
2	600	Cot'n Seed Meal and Acid Phos.	200 lbs. C. S. Meal and Acid Phosphate in equal parts before planting. 200 lbs. C. S. Meal at second plowing. 200 lbs. C. S. Meal at last plowing.	206.7	265 2	195.0	81.9	54.6	803.4
3	200	C. S. Meal and Acid Phos. in equal parts...........	100 lbs. C. S. Meal. 100 lbs. Acid Phosphate mixed and applied before planting.	202.8	175.5	78.0	23.4	15.6	495.3
4		Without manure.............		9	45	138	108	51	351

Recapitulation.

1. The high price commanded by the long staple varieties will justify the most careful effort through selection and breeding to increase their productiveness.

2. While the decomposition of the vegetable matter in the "new ground" did not furnish all of the nitrogen needed by the cotton, the increase from phosphate alone is satisfacfactory, and the increase caused by the addition of nitrogen did not justify its use.

3. A part of the phosphoric acid in floats plainly becomes available to plants the first season. This is facilitated by combining them with cotton seed meal.

Floats and cotton seed meal have uniformly equaled acid phosphate and cotton seed in producing power.

4. Of the different distances experimented with, 4 ft. by 2 ft. gave best results in 1889 and 1890. Thick planting hastens maturity. 1,000 ℔s. fertilizer per acre was not as profitable as 500 ℔s. The addition of cotton seed meal as late as August 13th was not profitable.

5 This experiment indicates that land improves more under continuous, judicious cultivation than uncultivated, in closely grazed pasture.

6. The unfertilized soil of this station needs nitrogen, potash and phosphoric acid. It is especially deficient in the latter. Kainit causes the cotton plant to retain its leaves after they have blighted where none is used.

Needed fertilizers hasten the maturity of the cotton plant. The *per cent* of *profit* from a *judicious use of fertilizers*, followed by intelligent cultivation, is most satisfactory.

7. Cotton seed meal, applied interculturally, in June and July, increased the crop more than cotton seed meal and acid phosphate, applied before planting.

REPORT

OF THE

ALABAMA WEATHER SERVICE.

Co-operating with the U. S. Signal Service.

December, 1890.

State Polytechnic Institute,
Auburn, Ala., January 15th, 1891.

The month began with clear and cool weather, but the temperature gradually rose, and the average for December was 3.°2 above the normal. The weather was generally mild and pleasant, but never too warm to prevent the saving of meat. The middle of the period was dry and dusty, almost as much so as mid-summer. Flowers were in bloom during most of the month. The lowest recorded temperature was 20° at a few stations, and this low range occurred only on three days, during the first and last weeks of December.

The amount of rain that fell during the month was small, the average being 2.19 inches below the normal.

A low pressure passed over the State on the 3d that was followed by rain in all sections, with an immediate depression in temperature. Another low pressure occurred on the 24th and 25th that produced a similar result; the rain fall at Auburn being as high as 1.50 inches in less than twelve hours. The temperature fell to 31° at the Central Station on the 27th, while in North Alabama the reading of the thermometer was as low as 20°.

The season was excellent for sowing small grain, and the reports from the observers indicate that the farmers have availed themselves of these fine conditions.

P. H. Mell,
Director.

J. M. Quarles,
Assistant.

MONTHLY SUMMARY.

Atmospheric pressure (in inches.) — Monthly mean, 30.227; maximum observed, 30.632, at Auburn on 28th; minimum observed, 29.780, at Uniontown on 3d; range for State, .852

Temperature (degrees F.) — Monthly mean, 49.8; highest monthly mean, 58.2, at Brewton; lowest monthly mean, 42.4, at Valley Head; maximum, 91, at Brewton, on 5th; minimum, 20, at Valley Head, 4th, 28th and 29th, and at Citronelle on 9th; range for the State, 71; greatest local monthly range, 68, at Brewton; least local monthly range, 39, at Chattanooga.

Precipitation, including melting snow, (in inches).—Average for the State, 2.30; greatest, 3.97, at Double Springs; least, 1.35, at Bermuda.

Mean relative humidity, 68, at Auburn; 66 at Uniontown; 86 at Valley Head.

Wind — Prevailing direction, N. W. Miles traveled, 5,515, at Chattanooga; 6,332, at Mobile; 4,030, at Montgomery; 3,236, at Auburn.

ANNUAL SUMMARY.

Maximum barometer, 30.632, at Auburn, 28th of December. Mean barometer for year, 30.110 inches. Minimum barometer, 29.615, at Chattanooga, Tenn., on 29th of October; range, 1.017.

Mean relative humidity, 74.6; average temperature, 65.6; maximum temperature, 105, at Opelika, 1st and 3d of July; minimum, 10, at Valley Head, 2d March; range, 95. Clear days, 132; fair days, 117; cloudy days, 116; days of rain, 91; annual rain fall, 50.69 inches, is 1.2 below the normal; monthly rain fall, 4.22; highest rain fall for any month, 12.10, at Fayette Court House, during February; lowest, 0.00, at Bermuda and Columbiana, during November.

NOTES FROM OBSERVERS.

Livingston, (J. W. A. Wright).—The average temperature for this month was 47°, which is 1° warmer than the normal for December. The coldest day was 24° on 19th, which is 4° higher than the coldest for the past three winters. The entire rainfall for the month 1.59 inches, the smallest amount for December in 20 years with one exception, when in 1873, we had only 1.25 inches. Our average or normal for December in past 20 years is 5.09 inches. Our rainfall by month, for 1890, has been as follows: January, 1.67; February 6.72; March, 4.73; April, 3.06; May, 4.15; June, 4.50; July 4.80; August, 5.75; September, 5.93; October, 2.60; November, 0.67; December 1.59, making a total of 46.17 inches. Total rainfall in 1889, 39.38; 1888, 57.21; 1887, 44.90 inches.

Greensboro, (M. H. Yerby).—It has been unusually dry and mild for December. Some days it was as dusty as mid-summer; the street sprinklers were in constant use throughout the entire month. There are a few tender plants still blooming in open air. I have in my garden a young peach tree now in full bloom. There has been a considerable quantity of pork slaughtered in this vicinity.

TABLE OF SOIL TEMPERATURES—December, 1890.

(The observations for this table were taken at Auburn, Ala.)

A. M. LLOYD, Observer.

NOTE—There are three sets of thermometers—Nos. 1 and 2 are situated on a hill in sandy soil, and No. 3 is placed near a small stream in bottom land. The depth of instruments range from 1 inch to 96 inches below the surface, and the observations are made three times each day—morning, noon, and evening.

Depth in Inches.	Set No. 1, on Hill.	Set No. 2, on Hill.	Set No. 3, in Bottom.
1	50.0°	52.1°	50.6°
3	49.7	51.6	49.9
6	49.4	51.1	50.0
9	49.3	50.4	50.0
12	49.9	50.2	50 7
24	53 8	53.9	54.8
36	56.4	56 3	56.0
48	58.7	58.1	57.3
60	60.0	....	60.0
72		61.0	
84		62.3	
96		63.9	

Meteorological Summary for Alabama for December, 1890.

STATIONS.	COUNTIES.	Altitude.	Latitude.	Longitude N.	BAROMETER.					TEMPERATURE.									Total precipitat'n	Clear Days.	Fair Days.	Cloudy Days.	Days of Rain.	Prevailing Wind.	OBSERVERS.
					Monthly Mean	Max.		Min.		Monthly mean.	Mean of Max.	Mean of Min.	Max.		Min.		Monthly R'nge	Me'n d'ly r'nge							
						Height.	Date.	Height.	Date.				Height.	Date.	Height.	Date.									
Selma	Dallas		32.28	87.																					†
Valley Head	DeKalb	1031	34.34	85.37						42 4	53 7	31 1	68	2–23	20	4,28,29	48	22.6	3 84	15	3	13	5	N E	E. P. Nicholson.
Pine Apple	Wilcox.		31.35	87.																					†
Florence	Lauderdale		34.48	87·37																					C. W. Ashcraft.
Chattanooga	Tenn.	783	35.03	85.30	30 196	30.512	13	29 815	3	44 8	54 5	35 1	65	2	26	13	39	19 4	3.13	12	8	11	11	N w	L. M. Pindell.
Montgomery	Montgomery	219	32.22	86.23	30.198	30 470	28	29.873	3	51 1	61 6	41 7	73	5	29	13	44	19 9	1.85	13	11	7	4	N w	L. Dunne.
Marion	Perry		33.12	87.42																					†
Union Spgs.	Bullock	516	32.12	83.39																					R. J. Grady.
Bermuda	Monroe		31.43	87.12						52			76	6	24	10	52		1.35						Wm. Fowler.
Mobile	Mobile	30	30.41	88.20	30 212	30.525	28	29 868	3	54.1	62 7	44.5	76	3	31	9	45	19.2	1.55	9	16	6	5	N	A. Pritchard.
Carrollton	Pickens			88.03																					M, L. Stansel.
Auburn	Lee	826	32.40	85.30	30 345	30.632	28	29.950	3	50 1	58 7	41.4	70	7–22	28	3	41.5	17.3	2.62	16	9	6	3	N w	J. M. Quarles.
Livingston	Sumter	150	32.34	88 08	30.220	30 490	28	29 890	3	50.7	62	39 5	72	5	24	19	48	22.5	1.59	14	4	13	5	N w	J. W.A. Wright.
Greensboro	Hale	220	32.41	87.36						48 3			69	23	28	28	41		3.37	0	17	14	3	N w	M. A. Yerby.
Mt. Willing	Lowndes		32.07	86.45						49.5			71	5	31	9–10	40		1.50				2		Wm. Garrett.
Uniontown	Perry	273	32.28	86 44	30,190	30.500	28	29 780	3	52 3	60.5	40 1	74	5	28	28	46	20 4	2.47	15	6	10	3	N w	W. H. Newman.
Citronelle	Mobile	352	31.03	87.30						55.7	68.4	43	80	5–6	20	9	60	25 4	1.71	15	4	12	4		J. G. Michael.
Fayette C H	Fayette		33 42	83.12																					Daniel Collier.
Opelika	Lee		32.45	85.28																					†
Guntersville	Marshall	655	34.24	86.18																					A. J. Baker.
Chepultepec	Blount	890	33.58	86.20																					W. B. Allgood.
Columbiana	Shelby	560	33 15	86.38						46.5	59	34	69	2	22	19	47	25	1.91				3		W. D. Lovett.
Centre	Cherokee	728	34.10	85 42																					Thos. Bradford.
Double Spgs	Winston		34.08	85.35						48 6		36.5	69	5	21	13	48		3 97				6		A. M. Weiler.
Butler	Choctaw		32.05	87.24																					B. F. Gilder.
Jasper	Walker	310	33.49	88.12																					Howard Lamar.
Tuscumbia	Colbert		34.42	87.38						45 7			73	5	23	9	50		2.61	21	00	10	6	S w	L. B. Thornton.
Fort Deposit	Lowndes		34.42	86.39																					†
Piedmont	Calhoun																								R. Swaine Perry
Mt Home	Lawrence																								A. J. Weaver.
Bessemer	Jefferson									47	55.8	38.2	65	22	24	28	41	17.6	1 58				5		Wm. Swan.
Brewton	Escambia									58.2	72	44.4	91	5	23	10	68	27 6	1.70						W. J. Holland.
Wiggins	Covington																							N w	M. D. Jones.
Talladega	Talladega									46.6			68	25	22	4-5	46								J. O. Huey.
Means					30.227					49.5	60.9	39.1					44.7	21.5	2 30	13	8	10	5		

BULLETIN NO. 23. NEW SERIES.

Agricultural Experiment Station

OF THE

Agricultural and Mechanical College,

AUBURN, ALA., - - - - - - - FEBRUARY, 1891.

Co-Operative Soil Tests of Fertilizers.

Report of Alabama Weather Service.

☞ The Bulletins of this Station will be sent Free to any citizen of the State, on application to the Director.

THE BROWN PRINTING CO., PRINTERS, MONTGOMERY, ALA.

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CO-OPERATIVE SOIL TESTS—1890.

J. S. NEWMAN.

So great is the variety of soils in Alabama and such the demand for knowledge of their needs, that a call for volunteer experimenters was issued in January, 1890, through the official organ of the Farmer's Alliance of the State. The response was prompt and the desired number—thirty—soon secured.

The results printed in this bulletin show how faithfully and intelligently they have discharged their duty thus voluntarily assumed for the general good of the tillers of soils similar to their own.

Notwithstanding the fact that the first shipment of chemicals to the experimenters was lost in a railroad wreck, and some two weeks passed before the loss was reported, rendering it necessary to duplicate the order for the chemicals, as well as all of the labor of mixing and labeling them, thus delaying their reception by the experimenters, the number of reports as well as the manner in which the experiments were conducted leave no room for complaint. Indeed, the number of satisfactory reports is most gratifying.

The following extract from Bulletin No. 12, New Series, illustrates the plan of the experiments and embodies the detailed instructions then furnished each experimenter:

DIRECTIONS FOR CONDUCTING SOIL TESTS WITH FERTILIZERS, 1890.

SELECTION OF LAND.

The area upon which the experiment is made should be level, or nearly so; should represent in character of soil and subsoil the section in which the experimenter lives, should not have been fertilized for several years, or better still, never at all, but should not be new or fresh land; the object being to learn what fertilizer the ordinary cultivated lands of the section need.

ARRANGEMENT OF PLOTS.

The accompanying diagram shows the arrangement of the plots. There will be fifteen plots of 1-15 of an acre each. For convenience, the "farmer's acre," seventy yards square, is used. Each plot is, therefore, 210 feet long and 14 feet wide, admitting of four rows of cotton 3½ feet apart. All of the experiments will be made with cotton this year.

DIAGRAM OF EXPERIMENT PLOTS.

	1 ...... 210 Feet	
1	2 3 14 feet 4	6 lbs. Sul. Ammonia.
	1	
2	2 3 4	13 lbs. Dis. Bone Black.
	1	
3	2 3 4	10 lbs. Kainit.
	1	
4	2 3 4	No Manure.
	1	
5	2 3 4	6 lbs. Sul. Ammonia. 10 lbs. Kainit.
	1	
6	2 3 4	6 lbs. Sul. Ammonia. 13 lbs. Dis. Bone Black.
	1	
7	2 3 4	13 lbs. Dis. Bone Black. 10 lbs. Kainit.
	1	
8	2 3 4	No Manure.
	1	
9	2 3 4	6 lbs. Sul. Ammonia. 13 lbs. Dis. Bone Black. 10 lbs. Kainit.
	1	
10	2 3 4	20 lbs. Floats.
	1	
11	2 3 4	20 lbs. Floats. 6 lbs. Sul. Ammonia.
	1	
12	2 3 4	No Manure.
	1	
13	2 3 4	53 lbs. Green Cotton Seed.
	1	
14	2 3 4	53 lbs. Green Cotton Seed. 20 lbs. Floats.
	1	
15	2 3 4	265 lbs. Stable Manure.

FERTILIZERS.

The fertilizers are sent, *freight prepaid*, to the depot designated by each experimenter. That intended for each plot bears two labels—one showing its contents, the other the number of the plot to which it is to be applied. As shown in the diagram, each fertilizer is to be applied to four rows. Each row should receive as nearly as possible the same quantity. Numbers 4, 8 and 12 are to receive no fertilizer. The experimenter is expected to furnish the cotton seed for plots 13 and 14, and the stable manure for 15.

Apply the cotton seed in a deep furrow and distribute the floats over the seed in plot 14. In plots 13 and 15 distribute the cotton seed and stable manure respectively, and bed upon them as on the fertilizers in the other plots.

PREPARATION.

First break the land "flush," deeply and thoroughly after accurately measuring the area 210 feet square. Lay off rows *exactly* 3½ feet apart, distribute the fertilizers and bed with a good turn plow, making a high bed. Then draw a harrow or heavy brush across the beds. It is important to secure a perfectly uniform stand of plants, and hence the seed-beds ahould be thoroughly prepared.

PLANTING.

Use the same kind of seed upon the whole area and plant all of the plots the same day. If a part was planted before and the rest after a rain, the experiment would be worthless. Use every precaution necessary to secure a full stand. If a uniform stand is not secured at the first planting, plow up promptly and plant again.

CULTIVATION.

As soon as the plants are large enough "side" with a scrape or sweep and, several days after, chop to *two stalks* every *two feet*. As soon as danger of loss by cold or cut worms has passed reduce the stand to *one stalk* in the hill. Rows 2 and 3 of each plot are to be gathered to determine the yield from each fertilizer. This reduces the "test area" to 1-30 of an acre. One missing stalk on this area would therefore represent 30 to the acre. To make the experiment reliable, therefore, there must be the same number of stalks upon each such "test area." To insure this, when the plants are eight or ten inches high, count carefully the stalks in rows 2 and 3 of each plot. A perfect stand would give 105 stalks to the row or 210 on rows 2 and 3.

Suppose the count shows that the number of stalks range from 210 to 190 to the test areas. *Reduce the number of plants to* 190 *in all of the test areas* (rows 2 and 3 of each plot), by pulling from each the number of stalks it was found to contain *above* 190. This is the only *reliable* way to secure uniformity of stand, without which the experiments *cannot be accurate.* Replanting, the method often resorted to, will not answer.

Let all the plots be cultivated on the same day and in exactly the same manner through the season. See that no tree stands within 100 feet of any of the plots.

MEMORANDA.

Record in a book kept exclusively for that purpose the time and manner of performing every operation connected with the experiment, from the preparation of the land to the gathering of the crop. Make weekly or bi-weekly notes on the appearance of the cotton on the plots. Note especially the effects of either excessive moisture or drouth upon plants of the different plots. Record any changes in the weather likely to affect the growth or fruitfulness of the cotton plant, such as unusually high or low temperature, excessive rain-fall or continued drouth, and note the different effects, if any upon the plots; keep a careful record of the "seasons" and their apparent effects upon soil and plants.

GATHERING.

Before the crop matures printed blanks upon which to record results will be furnished. The slightest mistake in gathering or weighing the seed-cotton will destroy the value of the experiment. The utmost care is necessary to prevent such mistakes· The picking and weighing of the product of the different plots must be done under uniform conditions.

Picking should not be commenced until the morning dew has disappeared from the cotton. If some plots are picked and weighed in the early morning and others in the afternoon, accuracy will be sacrificed. Each experimenter must exercise a sound judgment in these matters of detail, looking constantly to securing *perfect accuracy* in the comparison of the effects of the fertilizers. Experiments, like statistics, unless full and accurate, are misleading.

No account need be kept of the production of rows one and four, as they being only 3½ feet from the adjacent plots to which different fertilizers are applied, receive, by the spread of their roots, the benefit of both fertilizers. The product of rows two and three will be used to compare the effects of the different fertilizers. The plants in these rows being seven feet from those to which a different fertilizer was applied, only the extremities of their longest roots will reach it, and hence will not be materially affected by it. Pickings should be made with sufficient frequency to avoid risk of having the experiment vitiated by storm. Record the weight and date of each picking. Record the average height of the stalks upon each "test area," rows two and three in each plot. Note the character and extent of injury to the plants by any casualty, such as storms, boll worm, caterpillar, rust or blight. When the plants are sufficiently advanced in growth to show plainly the effects of the fertilizers, invite the farmers of the neighborhood to inspect the plots at intervals during the season. This is important, since the object of the experiment is to be benefit the farmers who cultivate the character of land upon which the experiment is made.

The chemicals were sent in the spring of 1890, to the following named gentlemen for experiment. Several of them failed to receive the chemicals or received them in such a mingled condition as to render them unfit for experimental use. One who received two sets of chemicals for different types of soil was prevented from giving the work such personal attention as he deemed necessary to secure accuracy on account of protracted illness. Twenty-four reports, however, out of thirty, is very satisfactory.

The results of several years of such inquiry must prove profitable to the farmers of the State, since there will be but few who cannot find in some of the reports a counterpart to their soils and *indications* of their chemical deficiencies.

Experimenters, 1890.

NAMES.	COUNTY.	POST-OFFICE.
Askew, B. F	Chambers	Cusseta, Alabama.
Aday, L. C., Rev	Franklin	Newburgh.
Beasley, E. J	Covington	Red Level.
Brown, D. L	Bibb	Randolph.
Bishop, M. A	Madison	Madison.
Compton, Geo. W	Marengo	Dixon's Mills.
Cross, R. H	Lowndes	Letohatchie.
Davis, E. M., Maj	Autauga	Prattville.
Davison, J. A	Choctaw	Yantly Creek.
Dick, R. M	Etowah	Attalla.
Ewing, R. T	Cherokee	Centre.
Eubank, A. H	Montgomery	Pine Level.
Ellison, J. M	Macon	Creek Stand.
Gordon, John, Dr	Washington	Healing Springs.
Hobdy, J. M	Barbour	Louisville.
Hall, S. M	Marion	Hackleburgh.
Jeter, O. T	Chambers	Boyd's Tank.
Killebrew, J. C	Dale	Newton.
Miller, W. H	Greene	Union.
McEwin, G. W	Coosa	Rockford.
Martin, William	Hale	Greensborough.
Newman, W. H	Perry	Uniontown.
Newman, C. L	Limestone	Athens.
Oliver, J. P	Tallapoosa	Dadeville.
Perkins, J. W	Marshall	North.
Reeves, W. M	Wilcox	Nellie.
Stroud, Z. T	Bullock	Aberfoil.
Stephens, A. B	Etowah	Keener.
Watlington, T. M	Henry	Abbeville.

EXPERIMENT BY REV. L. C. ADAY—NEWBURG, FRANKLIN CO.

Soil—Red cedar land with clay subsoil. Mr. Aday lives seven and one-half miles east of Russellvile, Alabama.

Mr. Aday's report shows very thorough preparation of the soil and cultivation of the crop. He used the sweep throughout the cultivation.

He remaks that, "Owing to the amount of rain from August 1st, to about October 1st, the plants went too much to weed and became so rank that the bottom bolls rotted. An early frost cut off the top crop to a large extent."

The results obtained from plots four, eight and twelve indicate a want of uniformity in the soil to the disadvantage of the plots adjacent to four. The general indications from the results are that the soil needed nitrogen and phos. acid. Further inquiry, however, is needed, since the loss from rotting of the bottom crop was probably greatest where the plants matured the largest per cent. of early fruit, and with the fertilizers which induced the most luxuriant growth.

Mr. Aday remarks that the season was very unfavorable for cotton in his section, and hence he was desirous of repeating the experiment.

The following tabulated statement gives results as reported by Mr. Aday:

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking.	Total yield per plot.	Total yield per acre.	Remarks.
			Oct. 15.	Nov. 28.			
1	6 lbs. Sul. Ammonia.....	90 lbs. Sul. Ammonia....	22½	2½	25	750	Plot No. 1 very promising till 1st of Aug. Rust appeared on it then, and caused the leaves and small fruit to fall off. Plots Nos. 3, 7 and 11 turned yellow owing to a dry spell from June 1st to 24th, which caused it to shed the forms to some extent.
2	13 lbs. Dis. Bone Black...	195 lbs. Dis. Bone Black..	22	4	26	780	
3	10 lbs. Kainit.............	150 lbs. Kainit...........	24	4	28	840	
4	No Manure..............	No Manure..............	16½	3	19½	585	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit............	90 lbs. Sul. Ammonia, 150 lbs. Kainit...........	26½	6	32½	975	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	28½	6	34½	1035	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	26	7½	33½	1005	
8	No Manure..............	No Manure..............	23½	6½	30	900	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Cone Black..	31	5½	36½	1095	
10	20 lbs. Floats............	300 lbs. Floats..........	24	7	31	930	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats............	90 lbs. Sul. Ammonia, 300 lbs. Floats...........	30½	8	38½	1155	
12	No Manure.............	No Manure.............	24	7½	31½	945	
13	53 lbs. Green Cotton Seed.	795 lbs. Green Cotton Seed	24	8	32	960	
14	20 lbs. Floats, 53 lbs. Green Cotton Seed.	300 lbs. Floats, 795 lbs. Green Cotton Seed	20	12½	32½	975	
15	265 lbs. Stable Manure...	3,975 lbs. Stable Manure..	24	2½	26½	795	

EXPERIMENT OF MR. E. J. BEASLEY—RED LEVEL, COVINGTON CO.

Soil—Red sandy ; subsoil, clay.

The effects of phosphoric acid are especially marked upon Mr. Beasley's soil. While neither potash nor nitrogen, used singly with the phosphoric acid, materially increased the yield over that of phosphoric acid used alone, when the proper allowance is made for the difference in the soil indicated by the unfertilized plots, still their combined effect upon plot nine to which the complete manure was applied, shows that their presence materially increased the productive power of the phosphoric acid. The three elements combined upon plot nine produced 330 lbs. of seed cotton per acre more than phosphoric acid and nitrogen, without the potash, and 300 more than the phos. acid and potash, without the nitrogen. The three combined produced 390 lbs. seed cotton per acre more than the phosphoric acid alone, and 770 lbs. more than the production of the unaided soil as indicated by the *average* yield of the unfertilized plots.

The complete manure used on plot nine nearly quadrupled the average production without manure.

The effect of the phosphoric acid in hastening the maturity of the cotton is most strikingly illustrated by the weights gathered in September.

The complete manure matured 62 lbs. in September, while the average from the unfertilized land was only $6\frac{2}{8}$ in that month.

The indications drawn from this experiment are that phosphoric acid is the element especially deficient in this soil, but that its efficiency is increased by combination with potash and nitrogen.

So far as can be judged from this one experiment, the results correspond very closely to those obtained from similar inquiries made upon the soil of this station. Attention is invited to the tabulated statement :

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking.	Lbs. Cotton, 3rd picking.	Total yield per plot.	Total yield per acre.	Remarks.
			Sept.	Oct.	Nov			
1	6 lbs. Sul. Ammonia.....	90 lbs. Sul. Ammonia ..	6	8	4	18	270	I Prepared the land as instructed in Bulletin No. 12—planted April 15—cultivated regularly, had six weeks drouth in the last of June and July, then had four weeks rainy weather. The cotton threw off all but the grown bolls. About the 20th of August the blight struck it and it did no more. I gave it a fair test aud was very careful in cultivating it.
2	13 lbs. Dis. Bone Black...	195 lbs. Dis. Bone Black..	42	8	2	52	780	
3	10 lbs. Kainit............	150 lbs. Kainit	8	8	6	22	330	
4	No Manure..............	No Manure.............	6	6	6	18	270	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit............	90 lbs. Sul. Ammonia, 150 lbs. Kainit	4	6	6	16	240	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	48	6	2	56	840	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black...	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	42	14	2	58	870	
8	No Manure..............	No Manure..............	8	8	6	22	330	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	62	12	4	78	1170	
10	20 lbs. Floats............	300 lbs. Floats	14	14	4	32	480	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats............	90 lbs. Sul. Ammonia, 300 lbs. Floats...........	22	10	6	38	570	
12	No Manure..............	No Manure...............	6	8	6	20	300	
13	53 lbs. Green Cotton Seed.	795 lbs. Green Cotton Seed	22	8	6	36	540	
14	20 lbs. Floats, 53 lbs. Green Cotton Seed.	300 lbs. Floats, 795 lbs. Green Cotton Seed	30	16	4	50	750	
15	265 lbs. Stable Maure.....	3,975 lbs. Stable Manure .	40	10	2	52	780	

EXPERIMENT OF MR. D. L. BROWN, RANDOLPH, BIBB COUNTY.

Soil—Light Sandy, Subsoil Clay.

The land had been cultivated in cotton for three years previous to 1890, and the results indicate that phosphates had been applied.

The crop was cultivated with sweeps.

* The results indicate that the soil was reasonably well supplied with phosphoric acid and potash, but deficient in nitrogen. Having been subjected to clean culture in cotton for three years previous to 1890, it was natural to expect results from the application of nitrogen, which readily leaches or volatilizes, while phos. acid remains in the soil. A decided increase results from the use of manures containing nitrogen or ammonia in every instance, while neither phos. acid nor potash meets with appreciable response. Attention is invited to the tabulated statement following.

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* Since writing the above a card received from Mr. Brown states that 200 pounds of acid phos. was used per acre in 1888-9.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot Number.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking.	Lbs. Cotton, 3rd picking.	Total yield per Plot.	Total yield per Acre.	REMARKS.
			Sept. 15	Oct. 8th	Nov. 1st			
1	6 lbs. Sul. Ammonia...	90 lbs. Sul. Ammonia....	6	22	2	60	900	
2	13 lbs. Dis. Bone Black.	195 lbs. Dis. Bone Black..	3	13	2	30	540	
3	10 lbs. Kainit.........	150 lbs. Kainit.	1	12	3	32	480	
4	No Manure..........	No Manure	¼	10	4	28½	427½	Died worse than any.
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit.........	90 lbs. Sul. Ammonia, 150 lbs. Kainit...........	6	21	3	60	900	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	13	25	1	78	1170	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black.	150 lbs. Kainit, 195 lbs. Bone Black.......	3	18	3	48	720	
8	No Manure.........	No Manure	¼	14	4	36½	547½	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black..	12	21	1	68	1020	Suffered from drouth.
10	20 lbs. Floats..........	300 lbs. Floats.....	1	19	4	48	720	
11	6 lbs. Sul. Ammonia. 20 lbs. Floats..........	90 lbs. Sul. Ammonia, 300 lbs. Floats...........	5	30	3	76	1140	
12	No Manure.........	No Manure..........	½	19	5	49	735	
13	53 lbs. green Cotton seed	795 lbs. green Cotton Seed.	1½	27	4	65	975	
14	20 lbs. Floats, 53 lbs. green cotton seed	300 lbs. Floats, 795 lbs. green Cotton Seed.	4	30	3	74	1110	[any.
15	265 lbs. Stable Manure..	3,975 lbs. Stable Manure..	9	26	½	71	1065	Suffered from drouth almost as badly as

NOTE.—Comparing results from plots 4, 8 and 12 it will be seen that there was lack of uniformity in the quality of the soil in favor of the fertilzers adjacent to number 12.

EXPERIMENT OF MR. M. A. BISHOP, MADISON, MADISON COUNTY.

Soil—Deep red, with stiff, red subsoil; the typical red soil of the Tennessee Valley. Mr. Bishop says the soil is "destitute of gravel," and has only "a trace of sand."

"It has been planted in cotton twenty-four years consecutively, and vegetable matter apparently, entirely exhausted from it. No fertilizer of any kind had ever been applied to the land previous to 1890. Twenty years ago the land produced in favorable seasons 800 lbs. seed cotton per acre without manure.

"A perfect stand was secured May 10th. May 22nd, sided with Barton harrow—fine season in the ground. May 31st, chopped to two stalks every two feet. June 17th, cultivated shallow with Syracuse stock cultivator, run twice to the row and thinned to one stalk every two feet—195 stalks to the test rows. Cultivated every two weeks with cultivator or sweep until July 17th, when rain stopped all farm work for the season.

"The early part of the season was unfavorable on account of cold nights in May. June was dry but otherwise favorable. Rains commenced July 13th and continued till August 20th, causing the cotton to shed.

"Farmers from every portion of the county visited and inspected the crop during the growing season. All were forcibly struck with plots 6, 9, 14 and 15, which showed favorably throughout the season."

The results of this experiment indicate the need of phosphoric acid in the land under investigation, as shown in plots to which the disolved bone black was applied. It indicates also the need of nitrogen and potash as shown by the increased productive power of the dissolved bone black, when combined with these, over its use alone. The nitrogen and potash, however, though needed, were powerless without phosphoric acid. See plots 1, 3, and 5, and compare them with 6, 7 and 9. Cultivators of red valley lands may profit by an examination of these results.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. Cotton, 1st picking. Sept. 20.	Lbs. Cotton, 2nd picking. Oct. 31.	Lbs. Cotton, 3rd picking. Nov. 22.	Total yield per plot.	Total yield per acre.	REMARKS.
1	6 lbs. Sul. Ammonia....	90 lbs. Sul. Ammonia...	......	4	2¾	6¾	202½	Height 2½ ft., foliage dark green, fruit small and scattering, 3 weeks late in blooming, branches small.
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black.	4	3¾	......	7¾	232½	Height 2 ft., green foliage, good stalks, formed well, but shedded during wet weather in Aug., bloomed early.
3	10 lbs. Kainit...........	150 lbs. Kainit..........	3	3½	....	6½	195	Stalk small, 16 in., foliage yellow, fruit small.
4	No Manure.............	No Manure..............	.....	3	1	4	120	Stalks 14 to 16 in. high, very yellow, retained the forms, late, some unmatured at frost, like No. 1.
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit...........	90 lbs. Sul. Ammonia, 150 lbs. Kainit	3	3	¼	6¼	187½	Height 16 to 18 ins., foliage yellow, fruit medium, grew late, matured slowly.
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	14	7	.....	21	630	Height 2 ft., early fruit, good size, foliage green, good stalk, shedded some during the wet weather in July & Aug.
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black.	14	7	....	21	630	Growth resembled No. 6 at all stages, result equal.
8	No Manure..............	No Manure..............	....	3½	1½	5	150	The growth of Nos. 4, 8 and 12 was about the same, only No. 4 was short by accident.a few hills which is shown in yield.
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black.	16	7½	......	23½	705	Height 2½ ft., foliage dark green, very stockey, first to bloom, fruit large, retained it well, matured early.
10	20 lbs. Floats...........	300 lbs. Floats	3½	2	2	7½	225	Height 18 in., foliage light, rather late, grew until frost, few bolls frosted.
11	6 lbs. Sul. Ammonia, 20 lbs. Floats...........	90 lbs. Sul. Ammonia, 300 lbs. Floats.........	7½	5	3	15½	465	Growth like No. 10, retained its fruit well but rather late, some green fruit when frost came.
12	No Manure.............	No Manure............	......	3½	1½	5	150	Like No. 8.
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed	9	5	2	16	480	Height 2½ ft , foliage dark green, fruit not so thick, set as Nos. 15 and 9, later on all matured, started slow, caught up.
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed	11	5	1	17½	525	Appearance like No. 13, only started off more promptly. All matured in Oct , good picking Sept. 15th.
15	265 lbs. Stable Manure...	3,975 lbs. Stable Manure.	16½	7	.....	23½	705	The appearance of No. 9 only 2 or 3 days earlier.

EXPERIMEMT OF MR. G. W. COMPTON, DIXON'S MILLS, MARENGO COUNTY.

Soil—Sandy, with clay subsoil; has been in cultivation sixty years. Original growth, oak, hickory, dogwood and pine. The land was sown in oats in 1888 and 1889, and fertilized with 40 bushels cotton seed in 1888, and 30 in 1889. Pastured after the oats were harvested in 1889.

Preparation—Laid off rows with eight inch shovel, applied the fertilizers in these furrows; bedded with one-horse turn-plow; opened bed with scooter; sowed the seed, and covered with a board. The seed were planted 25th of April. May 6th, a good stand was up.

The cotton was *"barred off" with turn-plow May 15th and followed with 14 inch solid sweep. Chopped to a stand May 28th and plowed with solid sweep; subsequent cultivation done with wider sweeps. Seasons were good 'till August 24th, then a drouth of six weeks. "Plots to which nitrogen and phosphoric acid were applied shedded most, having most to shed." "Plots with kainit shed less because they did not have much to shed." Mr. Compton concluded his report with the remark: "Will send copy of my report to our county paper, as a good many farmers have asked me to do so. Our people seem to be very much interested in the experiment, and some have come many miles to see it, as it is a new departure in this county."

An examination of the following tabulated statement reveals the plain indication of the need of phosphoric acid in the soil under experiment.

The producing power of the phosphoric acid is, however, much increased in every instance by association with nitrogen, but not at all by adding kainit. See and compare plots two and seven with six, nine and eleven. The effect of phosphoric acid in hastening the maturity of the crop is plainly shown by the weight of the first pickings in plots two, six, seven and nine.

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* "Barring off," was not included in the "directions."

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking	Lbs. Cotton, 3rd picking.	Lbs. Cotton, 4th picking.	Total yield per plot.	Total yield per acre.	Remarks.*
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia...	5½	13	5½	1	25	375	Greenest all the season.
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black.	11¼	15¼	11¼	....	37¾	566¼	Greener than No. 3.
3	10 lbs. Kainit..........	150 lbs. Kainit..........	5¼	9	5¼	....	19½	292½	Yellow all the time.
4	No Manure............	No Manure	2½	9¾	2½	...	14¾	221¼	Greener than No. 3.
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit..........	5¾	11½	5¾	1	24	360	Not as green as No. 1.
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	22	17	22	1¼	62¼	933¾	Came up best and remained in better health.
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black.	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	10¾	16¼	10¾	....	37¾	566¼	Little better than Nos. 4, 8 or 12.
8	No Manure	No Manure	4¼	11¾	4¼	...	20¼	303¾	Improved by a spot from which I dug up locust stump [about five years ago.
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black.	20¾	16½	20¾	1½	59½	892½	About same as plot No. 6.
10	20 lbs. Floats	300 lbs. Floats.	6	14¼	6	...	26¼	393¾	Little better than Nos. 4, 8 or 12.
11	6 lbs. Sul. Ammonia, 20 lbs. Floats..........	90 lbs. Sul. Ammonia, 300 lbs. Floats..........	12¾	16½	12¾	¼	42¼	633¾	Not good as 9 & 6, better than where no ammonia was.
12	No Manure	No Manure	3¼	10¼	3¼	¼	16¾	251¼	Greener than No. 3.
13	18 lbs. Cotton Seed Meal.	270 lbs. Cotton Seed Meal	14½	15¼	14½	¼	44¼	663¾	First came so late I used value of green seed in meal, [fearing seed would not come up—18 lbs. meal.
14	20 lbs. Floats, 18 lbs. Cotton Seed Meal.	300 lbs. Floats, 270 lbs. Cotton Seed Meal	15	15½	15	¼	45½	682½	Used meal instead of seed—18 lbs.
15	265 lbs. Stable Manure ..	3.975 lbs. Stable Manure	9	14½	9	¼	32½	487½	Stable manure used was at least ½ pine straw & leaves

* Remarks refer to the appearance of the cotton until it was knee high.

EXPERIMENT OF MR. R. H. CROSS, LETOHATCHIE, LOWNDES COUNTY.

Soils—Sandy Loam, with Yellow Clay Subsoil.

Mr. Cross says: "The area upon which the tests were made was nearly level, had been in cultivation more than sixty years, and had never been fertilized before. The soil was of the character which generally prevails in this section, viz: sandy loam with yellow clay subsoil. It had not been in cultivation for several years. This gave me a pretty good crop of grass and weeds to plow under the first of January. The acre was broken, fallowed with two-horse Avery plow, turning under the vegetation to rot. The 10th of April it was again broken with one-horse plows across the original fallow. It was then laid off into plots according to your instructions. The 2nd of May the fertilizers were distributed in furrow of a long scooter plow and covered with single Avery plows at least eight inches. The 12th of May planted with an Avery planter in Ozier silk cotton. In a few days had up a fine stand, which was preserved throughout the entire year. The land being well pulverized to a depth of ten or twelve inches, in the outset, it was only necessary to cultivate the crop with wide winged sweeps, never running them deeper than an inch. Hoed only twice—25th of May chopped to two stalks two feet apart—12th of June thinned to one stalk and quit it so far as hoeing was concerned. "Laid it by" the last of June flat and clean of grass and weeds. The seasons were very favorable, except slight drouth about the middle of July.

This soil plainly needed all three of the elements, but the effect of phosphoric acid are less marked than usual upon sandy soil while that of potash is more conspicuous than usual.

COTTON EXPERIMENTS WITH FERTILIZERS.—RESULTS.

Plot Number.	Lbs. Fertiliizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 12th.	Lbs. Cotton, 2d picking Sept 25th.	Lbs. Cotton, 3rd picking. Oct. 13th.	Lbs. Cotton, 4th picking. Nov. 12th.	Total yield per Plot.	Total yield per Acre.	REMARKS.
1	6 lbs. Sul. Ammonia...	90 lbs. Sul. Ammonia....	7	12	6	4	29	435	Average height 2½ feet. Didn't rust at all. Drouth injured it in July very little. Pods large, and well developed.
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black..	9	11	5	3	28	420	Average height 2 ft. 8 in. No perceptable change in this except it stood the drouth a little better.
3	10 lbs. Kainit............	150 lbs. Kainit............	10	12	6	5	33	495	Average height 2½ feet. Stood the drouth very well. Pods large and well matured.
4	No Manure...........	No Manure...........	6	8	3	2	19	285	Average height 2 feet 2 inches. Rusted.
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit......	90 lbs. Sul. Ammonia, 150 lbs. Kainit...........	8	10	9	5	32	480	Average height 2 ft. 10 inches. Grew off nicely at first and held its own throughout.
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	9	11	12	4	36	540	Average height 3 feet. An excellent composition for our soil.
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	12	13	11	6	42	630	Average h't 3 feet. The kainit evidently kept this growing and vigorous throughout the entire season.
8	No Manure...........	No Manure......	6	4	7	2	19	285	Average height 2 feet 2 inches. Rust killed all No Manure plots dead.
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Bis. Bone Black..	13	14	10	6	43	645	Av. h't 3 ft. 2 in. Grew off finely at first, and was done making earliest of any.
10	20 lbs. Floats............	300 lbs. Floats	8	9	6	3	26	390	Average h't 2 ft. Pods well grown; no rust; drouth in July parched it severely.
11	6 lbs. Sul. Ammonia, 20 lbs. Floats............	90 lbs. Sul. Ammonia 300 lbs. Floats............	16	19	14	10	59	885	Av, h't 3½ ft, Seems best composition for our soil.
12	No Manure...........	No Manure...........	6	9	4	1	20	300	Average height 2 feet. Rusted.
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed.	16	13	10	4	43	645	Average height 3 feet 2 inches. Made on after all other plots seemed done.
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	12	7	6	2	27	405	Average h't 2 ft. 10 in. Plot 15 seemed to injure this, it fired badly in July, same as plot 15.
15	265 lbs. Stable Manure....	3,975 lbs. Stable Manure..	7	8	6	2	23	345	Average height 3½ ft. Parched badly in July.

EXPERIMENT OF MAJ. E. M. DAVIS, PRATTVILLE, AUTAUGA, CO.

Soil—Red Sandy, with Stiff Clay Sub-soil.

This experiment was in part vitiated by previous applications of manure, as is explained by Mr. Davis as follows:

"You notice that No. 1 is better than No. 2, and that No. 2 is better than No. 3, and then No. 4, without manure, is better than any of them. This I account for in this way: I had last year a compost heap of about ten or twelve feet in diameter on the land, where I had composted cotton seed, stable manure and acid phosphate, and plot No. 4 ran right through that spot, and I found that the cotton grew much larger and was much better there than anywhere else. No. 5 also got some of the benefit of that spot. Then Nos. 7 and 8 ran through a spot where I had a similar heap two years before. The last unmanured plot, No. 12, as compared with the plots immediately around it, is about the only correct list that I had. None of the plots, from eight up, had any advantage of any excess of manure for the past two years. The whole acre was manured in checks, 3 feet by 3 feet, for two years previous to 1890.

"What astonished me most is that No. 15, with such an application of stable manure, is not as good by a little over 100 lbs. as No. 12 without manure, though I noticed that that plat grew off more rapidly than the others at the start and seemed to quit earlier. All of the manured plots quit fruiting earlier than the unmanured plots. The manured plots seemed to have been affected more by a little dry spell in July than those without manure.

"I conclude from this experiment that my land doesn't need any kainit and not much acid phosphate; that is, unless the phosphate is combined with a good share of nitrogen. No. 6, you observe, is the best plot. No. 9, which has the same manure as No. 6, with kainit added, is not so good.

"The floats seem to be a poor form of phosphate, as it seems to have been a disadvantage.

"Another thing I think I have proved, and that is that a thin stand is not better than a thick one. The outside rows of the plots were not thinned to one stalk, as the test rows were, but two stalks were left to the hill, wherever there were two, and I gathered 74 lbs. cotton more from the outside rows than from the test rows, making a difference of 148 lbs. to the acre in favor of the thick stand.

"I wish you would send me the cost of the different fertilizers used, so that I can tell the actual advantage that one has over another."

Mr. Davis was unfortunate in the selection of his soil for experiment. Besides the influence of the compost heaps, the whole having been manured for two years previous to 1890, caused an element of uncertainty in interpreting the results. Since nitrogen disappears from the soil more promptly than phosphoric acid the influence of the residue from previous applications would supply more of the latter than the former, and hence, in the results, would be misleading, since the unmanured plots would not correctly measure the producing power of the unaided soil, as shown in plots 4 and 8, and would prove less favorable to applications of phosphoric acid than to those of nitrogen.

The observations mentioned in regard to the low yield from the stable manure, may be explained possibly by the injurious influence of the drouth in July, resulting from the firing effects of the manure. One of the effects of manure is to hasten growth, and the more fruit cotton produces previous to a drouth the more it suffers from its effects.

Conclusions drawn from this experiment are premature. This is especially true as regards the influence of the thickness of stand in the outside rows of the plots. The reason assigned for not using these outside rows in the test of the fertilizers, applies here. These rows have the advantage, by the spread of the roots of the plants, not only of the manure applied to them but of that applied to the adjacent plots also. This influence is often very marked in favor of the outside rows.

The prices of the chemicals used are given in this bulletin in connection with the soil test experiment made on this station.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking.	Lbs. Cotton, 3rd picking.	Total yield per plot.	Total yield per acre.	Remarks.
			Sept. 16.	Oct. 28				
1	6 lbs. Sul. Ammonia.....	90 lbs. Sul. Ammonia ...	23	13	1¼	37¼	1117½	The land was prepared and cultivated as directed in Bulletin No. 12.
2	13 lbs. Dis. Bone Black...	195 lbs. Dis. Bone Black..	19	11	1	31	930	
3	10 lbs. Kainit...........	150 lbs. Kainit...........	12	13½	1¼	26¾	802½	
4	No Manure...............	No Manure...............	15	21¼	1½	37¾	1132½	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit.............	90 lbs. Sul. Ammonia, 150 lbs. Kainit	18	23	2¼	43¼	1297½	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	25	19	1	45	1350	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black...	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	18½	15½	1½	35½	1065	
8	No Manure...............	No Manure...............	14½	18	1¾	34¼	1027½	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black.	24½	12	1¼	37¾	1132½	
10	20 lbs. Floats.	300 lbs. Floats	12	16¾	1½	28¼	847½	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats.............	90 lbs. Sul. Ammonia, 300 lbs. Floats...........	Sept. 17. 17	11½	1¼	29¾	892½	
12	No Manure...............	No Manure...............	11½	15	1¾	28¼	847½	
13	53 lbs. Green Cotton Seed.	795 lbs. Green Cotton Seed	20½	11¼	1	32¾	982½	
14	20 lbs. Floats, 53 lbs. Green Cotton Seed.	300 lbs. Floats, 795 lbs. Green Cotton Seed	20½	9	¾	30¼	907½	
15	265 lbs. Stable Maure....	3,975 lbs. Stable Manure..	16	11¼	¾	28	840	

EXPERIMENT OF MR. J. A. DAVISON, YANTLEY CREEK, CHOCTAW COUNTY. *Soil—Sandy, with some lime, Clay Sub-soil.*

The results of this experiment point to the need of phosphoric acid, the effect of which is, however, improved by the addition of nitrogen and potash in 6 and 7, but not in plot 9. As is usually the case, the activity of floats is developed by the addition of nitrogen. The effects of stable manure and green cotton seed are again disappointing.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. Cotton, 1st picking. Sept. 19.	Lbs. Cotton, 2nd picking. Oct. 10.	Lbs. Cotton, 3rd picking. Dec. 1.	Total yield per plot.	Total yield per acre.	REMARKS.
1	6 lbs. Sul. Ammonia....	90 lbs. Sul. Ammonia...	14	11	2	27	810	This acre of cotton was showing up remarkably well until about the 12th July; at that time we had a cool north wind which seemed to poison the cotton, and but little has been made since that time. Commenced picking on Sept. 15th, in the afternoon, with plot No. 15, and picked up to plot No. 7 (inclusive), when there came up a very unexpected rain, and it was not dry enough to finish picking 'till Sept. 19th, when the remaining plots were picked. Besides the apparently poisonous wind, rust struck it, and also the boll-worm, both doing much damage.
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black.	17	10	1½	28½	855	
3	10 lbs. Kainit...........	150 lbs. Kainit..........	11	10	1	22	660	
4	No Manure.............	No Manure.............	8	11	1¼	20¼	607½	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit...........	90 lbs. Sul. Ammonia, 150 lbs. Kainit..........	12	11	1½	24½	735	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	24	10	1	35	1050	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black	Sep.15 20	13	1	34	1020	
8	No Manure.............	No Manure.........	6	12	2	20	600	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	17	10	1	28	840	
10	20 lbs. Floats...........	300 lbs. Floats	9	12	1¼	22¼	667½	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats...........	90 lbs. Sul. Ammonia, 300 lbs. Floats..........	18	13	1	32	960	
12	No Manure.............	No Manure.............	6	11	1	18	540	
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed	12	9	1	22	660	
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed	12	12	½	24½	735	
15	265 lbs. Stable Manure...	3,975 lbs. Stable Manure.	17	10	½	27½	825	

EXPERIMENT OF MR. R. M. DICK, ATTALLA, ETOWAH COUNTY.

Mr. Dick writes as follows: "Land nearly level; soil, gray sandy, 3 to 5 inches deep, with yellow sandy clay sub-soil. It has made twelve crops. First corn and then eleven cotton crops in succession, without commercial fertilizers, since 1884, and very little of other manure. Rows formerly ran east and west; the test rows were planted north and south, to give each fertilizer the benefit of manures remaining in the soil. Instructions were closely followed. The first planting, made April 29th, was destroyed by frost May 6th. Planted again May 15th; stand a little irregular (caused by east winds eight days in succession), but made reasonably uniform in all of the plots. The cultivation was thorough and shallow with harrow, sweeps and Planet, jr., cultivator. Each working was done on all the plots the same day and when the soil was in good working order. Cotton all picked from one to five p. m., perfectly dry. There was excessive moisture during June and July to August 5th. Plots Nos. 1, 2, 3 and 4 had some advantage in soil for twenty feet at the north ends of the rows. With this exception the plots were of very uniform fertility."

Description of Plants on Different Plots.

"No. 1 passed through the rains and cool nights with moderate growth, very good color, and at the end of the drouth a little yellow, throwing off but little. No. 2, vigorous grower, fine color, fruited well, but fired at the end of the drouth. No. 3, yellow cast through the entire season and grew slowly, did not fruit well but retained its fruit better than any other. No. 5, like No. 1, only more yellow through the growing season and at the end of the drouth. No. 6, the best for dry soils, fired but little.

"Bone black to push through the water and cool nights and ammonia to pull through the dry is what I tell my neighbors."

No. 7, good for damp soils—did well with excessive moisture—fired considerably. No. 9 "lead the troop" in everything until the drouth, when it fired and threw off terribly. No. 10, "if this is good for anything I have not found it out." No. 11, no better than No. 1, but a little earlier. No. 13 grew slowly throughout the season and was yellow at the close of the drouth. No. 14 more yellow than No. 13. No. 15 did a little better through the moisture than No. 6, but not so well through the drouth.

The appearance of the plants upon the different plots at the first of the months of June, July, August and September is recorded under the head of "Remarks." It will be observed that plot nine, upon which the complete manure was used, was graded No. 1 for the first three months, while No. 6, having the same manure, except the potash, ranked next during June, July and August and *one* in September. These results indicate that the soil needs phosphoric acid and nitrogen.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. Cotton, 1st picking. Oct. 15.	Lbs. Cotton, 2d picking. Nov. 8.	Lbs. Cotton, 3d picking. Nov. 19.	Total yield per plot.	Total yield per acre.	First bloom. July.	REMARKS. Appearance of plants on the plots at the dates named grade from 1 to 11. DROUTH FROM AUGUST THE 5TH TO 28TH.			
									June 1st.	July 1st.	Aug. 5th.	Sept. 1st.
1	6 lbs. Sul. Ammonia....	90 lbs. Sul. Ammonia...	9	10	5	24	720	14	6	7	6	2
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black	14	9	6	29	870	14	4	6	4	10
3	10 lbs. Kainit...........	150 lbs. Kainit..........	9	8	4	21	630	16	9	11	11	5
4	No Manure.............	No Manure.............	6	5	4	15	450	15	....	....	....	....
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit.	11	9	4	24	720	14	5	8	5	3
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	15	9	6	30	900	9	3	3	2	1
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis Bone Black.	9	8	4	21	630	14	7	4	7	9
8	No Manure........	No Manure	5	4	2	11	330	16	....	....	....	....
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black.	18	7	4	29	870	6	1	1	1	11
10	20 lbs. Floats...........	300 lbs. Floats..........	6	5	2	13	390	17	No good.	....	....	....
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs. Floats.....	12	7	5	24	720	12	8	5	8	6
12	No Manure............	No Manure.........	5	4	2	11	330	13	....	....	....	....
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed	9	6	4	19	570	12	11	10	10	8
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed	10	6	4	20	600	16	10	9	9	7
15	265 lbs. Stable Manure...	3,975 lbs. Stable Manure	14	10	6	30	900	12	2	2	3	4

EXPERIMENT MR. R. T. EWING, CENTRE, CHEROKEE COUNTY.

Soil—Black Sandy, with Stiff Red Clay Sub-soil.

Preparation.—The land was thoroughly broken with scooter 20th March, and again with same plow 20th April and harrowed. May 7th and 8th applied the fertilizer, bedded, harrowed off the beds and planted Jones' improved seed. As soon as the cotton was up harrowed three times. June 9th, sided with scooter and scrape and chopped to two stalks, two feet apart. June 10th, after cultivation done with scooter, scrape and hoe. July 2d, counted stalks and got 102 to each test row. Completed the cultivation August 2d with harrow. A drouth of six weeks, commencing 20th June, injured the cotton somewhat. There was then too much rain until October 1st. This caused excessive growth of weed. No difference could be discovered in the appearance of the plants upon the different plots at any time during their growth. The stalks averaged from 3½ to 4 feet in height.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot Number.	Lbs. Fertilizers per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st. picking. Oct. 1.	Lbs. Cotton, 2nd picking. Nov. 1.	Total yield per Plot.	Total yield per Acre.	REMARKS.
1	6 lbs. Sul. Ammonia....	90 lbs. Sul. Ammonia....	33	16	49	735	
2	13 lbs. Dis. Boue Black..	195 lbs. Dis. Bone Black..	32	17	49	735	
3	10 lbs. Kainit..........	150 lbs. Kainit...........	30	25	55	825	
4	No Manure..........	No Manure...........	24	29	53	795	
5	6 lbs. Sul. Ammonia 10 lbs. Kainit...........	90 lbs. Sul. Ammonia 150 lbs. Kainit..........	33	38	71	1065	
6	6 lbs. Sul. Ammonia 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia 195 lbs. Dis. Bone Black..	30	30	60	900	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	36	24	60	900	
8	No Manure..........	No Manure....... ...	27	27	54	810	
9	6 lbs. Sul. Ammonia 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia 150 lbs. Kainit, 195 lbs. Dis. Bone Black..	39	32	71	1065	
10	20 lbs. Floats..........	300 lbs. Floats	32	17	49	735	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats...........	90 lbs. Sul. Ammonia 300 lbs. Floats....	35	17	52	780	
12	No Manure..........	No Manure...........	27	18	45	675	
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed.	33	23	56	840	
14	20 lbs. Floats.......... 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	33	19	52	780	
15	265 lbs. Stable Manure....	3,975 lbs. Stable Manure..	44	15	59	885	

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot Number.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Aug. 12th.	Lbs. Cotton, 2nd picking. Aug. 20th.	Lbs. Cotton, 3rd picking. Aug. 30th.	Lbs. Cotton, 4th picking, Oct. 20th.	Total yield per Plot.	Total yield per Acre.	REMARKS.
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia	3	6	10	11	30	450	About the centre of No. 1, what we call a "wet-weather spring" commenced on the 10th of June; thereby about half made nothing. This hurt No. 2 some, and No. 3 a little, otherwise, this has been a fair experiment.
2	13 lbs. Dis. Bone Black.	195 lbs. Dis. Bone Black	4	10	15	22	51	765	
3	10 lbs. Kainit	150 lbs. Kainit	11	14	20	26	71	1065	
4	No Manure	No Manure	8	12	13	21	54	810	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit	6	13	21	28	68	1020	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	10	11	13	14	48	720	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black.	150 lbs. Kainit, 195 lbs. Bone Black	9	12	18	16	55	825	
8	No Manure	No Manure	11	13	18	18	60	900	EXPERIMENT OF MR. J. M. ELLISON. *Creek Stand, Macon county.* *Soil—Sandy, with sandy subsoil.* Mr. Ellison describes the land used in this experiment as "trod land." The results indicate a want of uniformity in the quality of the soil, which possibly resulted from an irregular distribution of the manure previously applied.
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	13	16	25	24	78	1170	
10	20 lbs. Floats	300 lbs. Floats	7	11	15	15	48	720	
11	6 lbs. Sul. Ammonia. 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs. Floats	10	14	20	18	62	930	
12	No Manure	No Manure	8	9	15	10	42	630	
13	53 lbs. green Cotton seed	795 lbs. green Cotton Seed.	10	15	25	47	97	1455	
14	20 lbs. Floats, 53 lbs. green cotton seed	300 lbs. Floats, 795 lbs. green Cotton Seed.	8	15	20	23	66	990	
15	265 lbs. Stable Manure.	3,975 lbs. Stable Manure.	12	18	25	25	80	1200	

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking.	Lbs. Cotton, 3rd picking.	Lbs. Cotton, 4th picking	Total yield per plot.	Total yield per acre.	Remarks.
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia	Sept. 15 3	Sept. 26 3	Oct. 15 4½	Oct. 25 4	29	435	EXPERIMENT BY DR. JOHN GORDON, HEALING SPRINGS, WASHINGTON COUNTY. *Soil—Blended Sandy and Lime.* The soil seemed to lack uniformity, as indicated by the unmanured plots. Dr. Gordon writes: "The cotton did not have a fair showing; the season did not suit it and the land was too wet."
2	13 lbs. Dis. Bone Black	195 lbs. Dis. Bone Black	Sept. 2 6¼	Sept. 15 7¾	Sept. 26 5	Oct. 15 3½	45	675	
3	10 lbs. Kainit	150 lbs. Kainit	Sept 9 1½	Sept. 15 1½	Sept. 26 3	Oct. 20 7	26	390	
4	No Manure	No Manure	Sept. 15 2¾	Sept. 26 3½	Oct. 17 5½	Oct. 20 7	37½	562½	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit	Sept. 2 3¼	Sept. 18 4¼	Oct. 21 5	....	25	375	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	Sept. 2. 5¼	Sept. 18 6	Sept. 26 1¾	Oct. 24 7	40	600	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black	150 lbs. Kainit, 195 lbs. Dis. Bone Black	Sept. 18 5	Oct. 24 8½	......	....	27	405	
8	No Manure	No Manure	Oct. 24 2¾	....	....	....	5½	82½	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	Sept. 3 2¼	Sept. 18 4	Oct. 25 9	....	30½	457½	
10	20 lbs. Floats	300 lbs. Floats	Sept. 3 ¾	Sept. 19 5	Oct. 27 9½	....	30½	457½	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs. Floats	Sept. 4 2¼	Sept. 19 5	Oct. 27 9½	....	33½	502½	
12	No Manure	No Manure	Sept. 9 1½	Sept. 19 2	Oct. 27 5½	....	18	270	
13	53 lbs. Green Cotton Seed	795 lbs. Green Cotton Seed	Sept. 4 5¼	Sept 19 9½	Oct. 27 9¾	....	49	735	
14	20 lbs. Floats, 53 lbs. Green Cotton Seed	300 lbs. Floats, 795 lbs. Green Cotton Seed	Sept. 5 9	Sept. 19 12¾	Oct. 27 11¾	....	67	1005	
15	265 lbs. Stable Manure	3,975 lbs. Stable Manure	Sept. 9 4	Sept. 20 5½	Oct. 27 7¾	.....	34½	517½	

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot Number.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 19th.	Lbs. Cotton, 2nd picking. Nov. 1st.	Total yield per Plot.	Total yield per Acre.	REMARKS.
1	6 lbs. Sul Ammonia....	90 lbs. Sul. Ammonia....	12	10	22	660	**Experiment of Mr. J. M. Hobdy,** **Louisville, Barbour Co.** *Soil—Sandy—Subsoil red-sandy.* Second growth, pines; had been cleared a few years before and cultivated in corn and oats previous to 1890. The 1st planting was partly destroyed by cut-worms. Planted second time May 13th, and secured a good stand. Cultivated shallow throughout. This land seems to have been quite uniform and to have needed all three of the important elements.
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black..	9	14½	23½	705	
3	10 lbs. Kainit...........	150 lbs. Kainit..........	7	17	24	722	
4	No Manure..........	No Manure..........	7	12	19	570	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit..........	90 lbs. Sul. Ammonia 150 lbs. Kainit...........	12	24	36	1080	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	22	11	33	990	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	10½	22½	33	990	
8	No Manure..........	No Manure..........	7½	10	17½	525	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black..	18½	22½	41	1230	
10	20 lbs. Floats...........	300 lbs. Floats..........	7½	11	18½	555	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats..........	90 lbs. Sul. Ammonia, 300 lbs. Floats..........	12½	13	25½	765	
12	No Manure..........	No Manure..........	6½	11	17½	525	
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed.	12	16	28	840	
14	20 lbs Floats........... 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	14	17	31	930	
15	265 lbs Stable Manure...	3,975 lbs. Stable Manure..	25	15	40	1200	

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	MIDDLE ROWS OF THE PLOTS						Remarks.
			Lbs. Cotton, 1st picking. Sept. 16.	Lbs. Cotton, 2nd picking. Oct. 9.	Lbs. Cotton, 3rd picking. Oct. 25.	Lbs. Cotton, 4th picking. Nov. 13.	Total yield per plot.	Total yield per acre.	
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia	5½	9	6¾	3	24½	735	Experiment of Mr. S. M. Hall, Hackleburgh, Marion County. *Soil—Clayey with dark sandy sub-soil.* Mr. Hall gathered the outside and middle rows separately and has reported the weights of both. He reports that plots 9 and 10 were somewhat injured by excessive rains. There was plainly a mistake made, however, in reporting results from plot 9 of the middle rows. The yield of the outside rows is given as 832½ lbs. seed cotton per acre, while that from the inside rows on the same plot is only 367½ lbs. Attention is invited to the difference in yield of the outside and middle rows in the unfertilized plots. The plants on the adjacent fertilized rows start off more vigorously than the unfertilized, their roots spread proportionately and thus overshadow, as it were, the more feeble unfertilized plants.
2	13 lbs. Dis. Bone Black	195 lbs. Dis. Bone Black	7	14	5¼	2½	28¾	862.2	
3	10 lbs. Kainit	150 lbs. Kainit	5½	8	5¼	3½	22¼	667.2	
4	No Manure	No Manure	4	7	4½	3¾	19¼	577.2	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit	5	10	5¼	2½	22¾	682 2	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	12	11	4¾	3	30¾	922.2	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black	150 lbs. Kainit, 195 lbs. Dis. Bone Black	9½	5	3½	2½	19½	585	
8	No Manure	No Manure	3	7	4¼	2½	16¾	502.2	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	2	5	3¼	2	12¼	*367½	
10	20 lbs. Floats	300 lbs. Floats	3½	5¼	4¼	2¼	15¼	457.2	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs. Floats	3	8½	4	2	17½	525	
12	No Manure	No Manure	3½	9	4	3	19½	585	
13	53 lbs. green Cotton Seed	795 lbs. green Cotton Seed.	6½	7	4	2½	20	600	
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	9	9½	7½	3½	29½	885	
15	265 lbs Stable Manure	3,975 lbs. Stable Manure	5	14½	5¾	4¾	30	900	

* Evidently a mistake.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	OUTSIDE ROWS OF PLOTS.						Remarks.
			Lbs. Cotton, 1st picking. Sept. 16.	Lbs. Cotton, 2nd picking. Oct. 9.	Lbs. Cotton, 3rd picking. Oct. 25.	Lbs. Cotton, 4th picking. Nov. 13.	Total yield per plot.	Total yield per acre.	
1	6 lbs. Sul. Ammonia.....	90 lbs. Sul. Ammonia....	5	9	6¾	4½	25	750	
2	13 lbs. Dis. Bone Black...	195 lbs. Dis. Bone Black..	5½	11	5¼	3	24¾	742.2	
3	10 lbs. Kainit............	150 lbs Kainit	4.3	6	5¼	3¼	19¼	577 2	
4	No Manure.	No Manure....	3	5½	4½	2½	15½	465	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit............	90 lbs. Sul. Ammonia, 150 lbs. Kainit	5	8¼	5¼	2¾	21¼	637.2	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	11½	11	4¾	3	30¼	907.2	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black...	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	8	9¾	3½	2½	23¾	712.2	
8	No Manure.	No Manure.....	2¾	5½	4¼	3	15½	465	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black..	12½	10	3¼	2	27¾	832.2	
10	20 lbs. Floats............	300 lbs. Floats	2¼	4½	4¼	2	13	390	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats............	90 lbs. Sul. Ammonia, 300 lbs. Floats.....	2½	4½	3¾	2½	13¼	397 2	
12	No Manure.	No Manure.	2¾	5	4	3½	15¼	457.2	
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed.	5¾	7	4	3	19¾	592 2	
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	6	12	7½	5½	31	930	
15	265 lbs. Stable Manure....	3,975 lbs. Stable Manure..	8	13½	5¾	5	32¼	967 2	

Experiment of Mr. John C. Killebrew—*Newton, Dale county.—Soil—Sand and clay, mixed with clay subsoil six inches below the surface.* The land was old and worn in 1866, when he came into possession of it and has not been specially improved since. Peterkin cotton was planted. This variety has small seed, and, hence, does not yield as much weight in seed cotton in proportion to lint as other varieties. This soil seems to have needed all of the three principal elements, but more especially nitrogen.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot Number.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking.	Total yield per Plot.	Total yield per Acre.	Remarks.
1	6 lbs. Sul. Ammonia...	90 lbs. Sul. Ammonia....	13	8	21	630	Foliage green; growth large; fruit scattering.
2	13 lbs. Dis. Bone Black.	195 lbs. Dis. Bone Black.	11½	7	18½	555	Not so green, and one-fourth smaller.
3	10 lbs. Kainit.........	150 lbs. Kainit..........	8⅓	7¾	16½	495	Alike in foliage and color.
4	No Manure.........	No Manure...........	7½	5¼	12¾	382½	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit..........	90 lbs. Sul. Ammonia, 150 lbs. Kainit............	10	13½	23½	705	Greener, and continued so longer than 3 and 4.
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black.	16	7½	23½	705	Rusted or burned badly.
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black.	150 lbs. Kainit, 195 lbs. Bone Black......	9½	8	17½	525	
8	No Manure.........	No Manure.........	5¼	4¾	10	300	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black..	12	8¼	20¼	607½	
10	20 lbs. Floats..........	300 lbs. Floats..........	7	5½	12½	375	
11	6 lbs. Sul. Ammonia. 20 lbs. Floats.........	90 lbs. Sul. Ammonia, 300 lbs. Floats............	8½	7	15½	465	
12	No Manure.........	No Manure...........	4	6	10	300	
13	53 lbs, green Cotton seed	795 lbs. green Cotton Seed.	10¾	12¼	23	690	Continued green and growing after all others except No. 1, were dead.
14	20 lbs. Floats, 53 lbs. green cotton seed	300 lbs. Floats, 795 lbs. green Cotton Seed.	9½	10½	20	600	

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 11.	Lbs. Cotton, 2d picking. Oct. 10.	Lbs Cotton, 3d picking. Nov. 18.	Total yield per plot.	Total yield per acre.	Remarks.
1	6 lbs. Sul. Ammonia ...	90 lbs. Sul. Ammonia...	5	22	4½	31½	945	**Experiment of Mr. W. H. Miller, Union, Greene County.** *Soil—Sandy with Clay Sub-Soil.* The land has been cleared for more than fifty years—has been "steadily brought up for past five years." Cultivated in oats in 1889, fertilized with 30 bushels cotton seed per acre. *Cultivation*—Shallow, with heel scrape. Seasons, good except "short windy spell first of August, lasting two weeks." The cotton grew steadily from the start, until frost killed the leaves first week in November. The production of the unmanured plots indicates great uniformity in fertility. The results from plots 2, 6, 7 and 9 indicate that phosphoric acid was needed more than nitrogen or potash Plots 1 and 5 indicate that nitrogen was needed, but could be only partially utilized without phosphoric acid. Potash seems to have been in good supply in the soil. The results from cotton seed and stable manure were more than satisfactory.
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black	9	22	10	41	1230	
3	10 lbs. Kainit	150 lbs. Kainit..........	4	19	6	29	870	
4	No Manure	No Manure	4	16	7	27	810	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit.	7	17	7	31	930	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	10	21	8	39	1170	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black.	150 lbs. Kainit, 195 lbs. Dis Bone Black	8	20	11	39	1170	
8	No Manure	No Manure	4½	17	6	27½	825	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black .	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	7	20	11	38	1140	
10	20 lbs. Floats	300 lbs. Floats.	3	22	4	29	870	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs. Floats ...	4	21	8	33	990	
12	No Manure	No Manure	3½	18	5	26½	795	
13	53 lbs. green Cotton Seed	795 lbs. green Cotton Seed	6	25	14	45	1350	
14	20 lbs. Floats, 53 lbs. green Cotton Seed	300 lbs. Floats, 795 lbs. green Cotton Seed	9	25	14	48	1440	
15	265 lbs. Stable Manure	3,975 lbs Stable Manure	10	27	17	54	1620	

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. Cotton, 1st picking. Sept. 15.	Lbs. Cotton, 2d picking. Nov. 5.	Total yield per plot.	Total yield per acre.
1	6 lbs. Sul. Ammonia.....	90 lbs. Sul. Ammonia....	50	16	66	990
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black	38	18	56	840
3	10 lbs. Kainit............	150 lbs Kainit	40	8	48	72
4	No Manure.	No Manure...	35	10	45	675
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit...........	90 lbs. Sul. Ammonia, 150 lbs. Kainit	55	16	71	1065
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	65	14	79	1185
7	10 lbs. Kainit, 13 lbs Dis. Bone Black ..	150 lbs. Kainit, 195 lbs. Dis. Bone Black	58	18	76	1140
8	No Manure.	No Manure.	45	10	55	825
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black...	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black..	75	10	85	1275
10	20 lbs. Floats............	300 lbs. Floats	95	22	117	1755
11	6 lbs. Sul. Ammonia, 20 lbs. Floats............	90 lbs. Sul. Ammonia, 300 lbs. Floats.....	75	12	87	1305
12	No Manure..............	No Manure....	47	8	55	825
13	53 lbs. green Cotton Seed	795 lbs. green Cotton Seed.	85	30	115	1725
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	60	22	82	1230
15	265 lbs. Stable Manure....	3,975 lbs. Stable Manure..	55	11	66	990

REMARKS.

EXPERIMENT OF MR. WM. MARTIN,
Greensboro, Hale county.

Soil.—Sandy loam with clay subsoil.

The results in this experiment indicate a need of nitrogen. Those in plots 2 and 10 are contradictory. Possibly some unobserved local cause affected the yield on No. 10.

While the results are very satisfactory as to yield of cotton, they present several very unsatisfactory answers, difficult of interpretation.

EXPERIMENT OF MR. W. H. NEWMAN, UNIONTOWN, PERRY COUNTY.

Soil—"Black Slough Bottom" Land.

The land, the previous season, had grown a crop of wheat, without manure, and then a crop of peas, which were cut for hay. The plots were "flushed" the first of December, 1889, and bedded in January, 1890, to four foot rows. The fertilizers were applied in the drill April 8th, and the seed were planted the same day with a planter.

The plots were cultivated with the hoe and heel scrape, being hoed only once after chopping. Each plot was chopped from eighteen to twenty inches. There was only a slight difference in yield by pickings. The plots were picked four times, and each picking weighed. The fertilizers did not have any effect in hastening the maturity or increasing the yield. There was no difference in the appearance of the plots; the unmanured plots producing as large and as vigorous plants as the manured. The increased yield did not pay for the fertilizers. The yield of each plot is given in the table. Sul. ammonia and dissolved bone black produced the largest yield, and floats the least. The Sul. ammonia seemed to increase the yield, except when applied with kainit. Kainit reduced the yield, except when applied with ammonium sulphate and dissolved bone black. The floats also reduced the yield.

COTTON EXPERIMENT WITH FERTILIZERS--RESULTS.

	FERTILIZERS.	Lbs. of Lint.	Lbs. of Seed.	Lbs. of Seed Cotton.
1	90 lbs. Sul. Ammonia	513¾	1278¾	1792½
2	195 lbs. Dis. Bone Black	510	1233¾	1743¾
3	150 lbs. Kainit	450	1068¾	1518¾
4	No Manure...	495	1207½	1702½
5	90 lbs. Sul. Ammonia and 150 lbs. Kainit...........	491¼	1185	1676¼
6	90 lbs. Sul. Ammonia and 195 lbs. Dis. Bone Black...	521¼	1237½	1758¾
7	150 lbs. Kainit and 195 lbs. Dis. Bone Black.	457½	1091¼	1548¾
8	No Manure	487½	1166¼	1653¾
9	60 lbs. Sul. Amo. x 150 lbs. Kainit x 195 lbs. Dis. B. B.	517½	1196¼	1713¾
10	300 lbs. Floats..	427½	963¾	1391¼
11	300 lbs. Floats and 90 lbs. Sul. Ammonia	472½	1136¼	1608¾

NOTE.—Supply of cotton seed and stable manure was exhausted before the fertilizers were received—hence omission of plots 12, 13, 14 and 15.

EXPERIMENT OF MR. C. L. NEWMAN, ATHENS, LIMESTONE COUNTY.

The ground selected for the experiment was nearly level, but the half acre upon which were planted plots 7–15, inclusive, had some advantage over the other half in fertility not discovered before planting. In the spring of 1889 the land was in oats, and in cotton in 1888. Early in April the slight growth of crab grass and rag weeds was turned under. The fertilizers were put down and bedded in the last week in April. On the first day of May the beds were harrowed twice (making them nearly level) and the seed (Peerless, from Mr. Jas. Clayton of Auburn) were put down with cotton planter. In a week there was a good stand. The plots were chopped the third week in May to two stalks two feet apart, and then plowed out with an 18-inch Terrell scrape. Three weeks later it was plowed again in the same way, and then hoed and thinned to one stalk in the hill. The stand was afterwards reduced to 94 stalks to the row, that being the number of stalks in the test row with the poorest stand. The plots were hoed three and plowed four times. Each plowing was done with the Terrell scrape set to run very shallow. The plants grew off rapidly and continued in vigorous growth until killed by frost. May and June were both dry months, but the cotton seemed to be more benefitted than injured by the drouth and shed very little. Plots 8–15 did not shed so much as did plots 1–7. The early frost killed about half the bolls, but more on some plots than on others. Some of the stalks on plot 15 measured seven (7) feet and lapped across the rows so that it was difficult to pass between them. Through the entire season the acre was kept clean of grass and weeds. There were no caterpillars and very little rust; no injury from storm.

The seed were planted late and coming from a lower latitude made the crop very late. Had there been sufficient time for the full crop to mature, several of the plots would have produced at the rate of a bale to the acre, if not more.

NOTE.—Attention is invited to the correspondence between these results and those reported by Mr. Bishop of Madison county, both on typical red soil of the Tennessee Valley, badly worn.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2nd picking.	Lbs. Cotton, 3rd picking.	Total yield per plot.	Total yield per acre.	Remarks.
			Oct. 10.	Nov. 4-5	Dec.			
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia	1	1	2½	4½	135	
2	13 lbs. Dis. Bone Black	195 lbs. Dis. Bone Black	1½	1½	7½	10½	315	
3	10 lbs. Kainit	150 lbs. Kainit	½	1	4	5½	165	
4	No Manure	No Manure	½	1	3½	5	150	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit	1	1	2½	4½	135	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	3	2½	8½	14	420	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black	150 lbs. Kainit, 195 lbs. Dis. Bone Black	2	3	8	13	390	
8	No Manure	No Manure	1	1½	6½	9	270	
9	6 lbs. Sul Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	4	4	13	21	630	
10	20 lbs. Floats	300 lbs. Floats	1	2	10	13	390	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs. Floats	2½	4	14	20½	615	
12	No Manure	No Manure	2	3	9½	14½	435	
13	53 lbs. Green Cotton Seed	795 lbs. Green Cotton Seed	3	4	11½	18½	555	
14	20 lbs. Floats, 53 lbs. Green Cotton Seed	300 lbs. Floats, 795 lbs. Green Cotton Seed	5	7	17	29	870	
15	265 lbs. Stable Maure	3,975 lbs. Stable Manure	2½	6	20	28½	855	

EXPERIMENT OF MR. J. P. OLIVER, DADEVILLE, TALLAPOOSA CO.

Soil—Sandy loam, with clay subsoil.

Mr. Oliver unfortunately used the same acre upon which the experiment of 1889 was conducted, and the arrangement of plots being different in 1890, created some confusion in the results.

It will be interesting to those who have bulletin No. 12, of February, 1890—"Co-operative Soil Tests"—to compare results upon some of the plots, showing the cumulative effects of the manures. This is specially observable in plots 6, 7, 9, 11, 13, 14 and 15. Attention is invited also to plot No. 16. The experimenters of 1889 were requested to plant peas on one plot to compare the fertilizing effects of the vines left upon the soil with those of chemicals containing nitrogen. Three thousand lbs. stable manure applied in 1889, produced 1020 lbs. seed cotton. A similar additional application in 1890 on the same soil raised the production to 2100 lbs.

COTTON EXPERIMENTS WITH FERTILIZERS.—RESULTS.

Plot Number.	Lbs. Fertiliizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking.	Lbs. Cotton, 2d picking.	Lbs. Cotton, 3rd picking.	Lbs. Cotton, Lint.	Total yield per Plot, seed cot.	Total yield per Acre, seed cot.	REMARKS.
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia ..	4	13	5	239	22	660	Broke up deep and close with 3 inch scooter March 14. Put in fertilizer deep, and bedded up April 10. Planted in Parkman big boll cotton (Texas storm proof) April 11. Harrowed with Scarbrough harrow May 9. May 19, hoed to 18 inches apart; good stand. Plowed with scrape and scootered, May 19 and 27, June 1, 14, 28 and July 7. Hoed again and put to stand June 28. Good seasons all the year; too much rain part of time; no rust or worms. When frost came in November, full of bolls nearly grown—lost. Plotts 1, 2, 3, 4, 7, 10 and 12 average from 3½ to four feet in height. 5, 6, 8, 9, 11, 13, 14 and 15, from 4 to six feet. Shallow cultivation all the way through, laying by on nearly a level as possible. Planting on same area as used last year accounts for results of some of the plots.
2	13 lbs. Dis. Bone Black	195 lbs. Dis. Bone Black..	12	20	8	430	40	1200	
3	10 lbs. Kainit..........	150 lbs. Kainit	12½	22	7½	451	42	1260	
4	No Manure.........	No Manure.........	2	12	10	258	24	720	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit........	90 lbs. Sul. Ammonia, 150 lbs. Kainit	5	16	8	312	29	870	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black..	22	21	12	591	55	1650	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	13	21	11	484	45	1350	
8	No Manure	No Manure.........	8	19	7	365	34	1020	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Bis. Bone Black..	25½	20	15½	656	61	1830	
10	20 lbs. Floats	300 lbs. Floats	14	21	9	481	44	1320	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats...........	90 lbs. Sul. Ammonia 300 lbs. Floats	20½	21	12½	580	54	1620	
12	No Manure......	No Manure.	6	16	9	333	31	930	
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed.	11	21	13	484	45	1350	
14	20 lbs. Floats, 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	26½	24	12	672	62½	1875	
15	265 lbs. Stable Manure...	3,975 lbs. Stable Manure..	30	22	18	760	70	2100	
16	Pea vines year before, 13 lbs. superphos ..	....	12½	22	15	505	49½	1485	

EXPERIMENT OF MR. Z. T. STROUD, ABERFOIL, BULLOCK COUNTY.

Mr. Stroud writes as follows: "The land selected is thin sandy soil, four feet to clay—has been planted in corn three years without fertilizer, except last year, when I put 100 lbs. cotton-seed meal per acre.

"The plows used in cultivating the crop were sweeps and scrapes, except the first plowing, when it was barred with turning plow."

(The barring with turn-plow was not according to directions from this station.)

"Weather unfavorable throughout the spring—too much rain for cotton—excessive rain from middle of May to first of June. Cotton turned red and rusty looking; shedded its bottom leaves, but afterwards came out and did well until July 4th. It then began raining again and rained frequently until the 20th of August. Cotton continued green and growing until the rains stopped and then shedded its fruit. The weather was very hot after the rains ceased."

The results of this experiment indicate a greater need of nitrogen and potash than of phosphoric acid. The former leach very promptly through such deep sandy soils.

The yield from plot nine, with the complete manure, however, compared with those upon which the chemicals were used either singly or in pairs, indicates that the soil was deficient in all three of the principal elements—nitrogen, phosphoric acid and potash. The extreme sensitiveness of the plant to changing meteorological conditions, indicate that the soil was deficient in humus. Soils are incapable of utilizing to the best advantage chemical manures without a supply of humus.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 15.	Lbs. Cotton, 2nd picking. Oct. 7.	Lbs. Cotton, 3rd picking. Nov. 3.	Total yield per plot.	Total yield per acre.	Remarks.
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia	5	9	1	15	450	Land prepared according to directions in Bulletin No. 12. Cotton planted April 15; barred off May 2; sided up May 15; chopped out May 28; sided up May 29; split middles June 4; sided up June 14; sided up June 26; laid by July 8. Number of stalks to the row 103, making 206 to the test rows.
2	13 lbs. Dis. Bone Black	195 lbs. Dis. Bone Black.	2	6	½	8½	255	
3	10 lbs. Kainit	150 lbs. Kainit	½	7	3	10½	315	
4	No Manure	No Manure	....	2½	¼	2¾	82½	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit	4¾	11½	1¾	18	540	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black.	90 lbs Sul. Ammonia, 195 lbs Dis. Bone Black.	5	4	¼	9¼	277½	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black	2	9	2	13	390	
8	No Manure	No Manure	...	3	½	3½	105	
9	6 lbs. Sul Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	13	10½	2	25½	768	
10	20 lbs. Floats	300 lbs. Floats	½	6½	1¾	8¾	262½	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs. Floats	3	8½	1	12½	375	
12	No Manure	No Manure	¼	3	¾	4	120	
13	53 lbs green Cotton Seed	795 lbs. green Cotton Seed	5¾	8½	1½	15¾	472½	
14	20 lbs. Floats, 53 lbs. green Cotton Seed	300 lbs. Floats, 795 lbs. green Cotton Seed	5¾	9	1¼	16	480	
15	265 lbs. Stable Manure	3,975 lbs. Stable Manure	9¼	6½	1	16¾	502½	

Experiment of Mr. A. B. Stephens, Keener, Etowah County.

Soil—Sandy, with mixed Sand and Clay Sub-soil.

Mr. Stephens accompanies his report with the following account of the cultivation of the experiment plots:

Land prepared as per directions—
May 2. Seed planted.
" 3. Rain, good season.
" 7. Fall in temperature; frost May 8th.
" 10. Warm.
" 13. Fall in temperature; rain, with some hail, which injured the stand.
" 22. Sided off and worked.
" 25. Chopped to two stalks in place.
" 26. Plowed, throwing dirt to stalk.
June 12. Thinned to one stalk.
" 16. Plowed second time.
July 4. " third time and hoed.
" 16. " fourth time and laid by.

Heavy rain June 17, damaging the land and otherwise destroying the stand, reducing the number of stalks to 72 per row.

The results indicate that the soil needs phosphoric acid especially, and that the addition of nitrogen and potash to the soil fails to increase the production without the addition of phosphoric acid also. Phosphate alone, however, finds enough nitrogen and potash to unite with it in effecting an increased production.

The effects of chemical manures upon this soil corresponds quite accurately with those observed upon the soils of this station.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot Number.	Lbs. Fertilizers per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Oct. 15.	Lbs. Cotton, 2nd picking. Nov. 25.	Total yield per 2 rows.	Total yield per Acre.	REMARKS.
1	6 lbs. Sul. Ammonia ..	90 lbs. Sul. Ammonia ...	6	9½	15½	465	Bolls large, but late in maturing.
2	13 lbs. Dis. Boue Black..	195 lbs. Dis. Bone Black.	10	10½	20½	615	Slow growth; good staple.
3	10 lbs. Kainit	150 lbs. Kainit	4	8	12	360	Large stalk, but few bolls.
4	No Manure	No Manure..........	6	10½	16½	495	Small stalk, few bolls; fruit opened well.
5	6 lbs. Sul. Ammonia 10 lbs. Kainit	90 lbs. Sul. Ammonia 150 lbs. Kainit	6	10½	16½	495	Good stalk, poorly bolled.
6	6 lbs. Sul. Ammonia 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia 195 lbs. Dis. Bone Black..	22	10	32	960	Good weed; opened fairly well.
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black..	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	19	8	27	810	Good weed, but opened poorly.
8	No Manure..........	No Manure. ...	7	8½	15½	465	Small stalk, but opened well.
9	6 lbs. Sul. Ammonia 10 lbs. Kainit, 13 lbs. Dis. Bone Black..	90 lbs. Sul. Ammonia 150 lbs. Kainit, 195 lbs. Dis. Bone Black..	26	13¾	39¾	1192½	Good weed and well fruited; good opening.
10	20 lbs. Floats	300 lbs. Floats	9	10	19	570	Large weed, but poorly opened.
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia 300 lbs. Floats	12	9	21	630	Large weed, but few bolls.
12	No Manure...........	No Manure..........	7	8	15	450	Good weed, but late.
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed.	9	7	16	480	Small weed, well bolled and opened.
14	20 lbs. Floats .... 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	10	7	17	510	Very slow in growth; late.
15	265 lbs. Stable Manure ...	3,975 lbs. Stable Manure..	15	9½	24½	735	Good weed, but injured by drought.

EXPERIMENT OF MR. T. M. WATLINGTON, ABBEVILLE, HENRY COUNTY.

In order to inquire into the needs of the sandy and clay soils of southeast Alabama in close juxtaposition, two sets of chemicals were furnished Mr. Watlington for experiment. Experiment No. 1 was made upon sandy soil with clay at varying distances from the surface, but no where in reach of the plow.

Experiment No. 2 was made upon what is known as clay soil with such mixture of sand at the surface as to justify the name of clay loam. The subsoil is red clay with a very slight mixture of sand. Both soils have been under cultivation for many years.

In 1889 both acres were cultivated in corn and fertilized with green cotton seed. The sandy land was remarkably uniform in quality, as indicated by the yield on the unmanured plots. The clay land of experiment No. 2 was not uniform, as shown by the fact that the yield on plots 4 and 8 is double that on 12.

The indications point to the need of all three of the elements, nitrogen, phosphoric acid and potash.

COTTON EXPERIMENT WITH FERTILIZERS—RESULTS.

Plot Number.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 5th.	Lbs. Cotton, 2nd picking. Sept. 30th.	Lbs. Cotton, 3rd picking. Oct. 16th.	Total yield per Plot.	Total yield per Acre.	REMARKS.
1	6 lbs. Sul Ammonia	90 lbs. Sul. Ammonia	12	8	4	24	720	Acre No. 1 sandy land.
2	13 lbs. Dis. Bone Black	195 lbs. Dis. Bone Black	10	6	3¾	19¾	592½	Commenced to rust Aug 6.
3	10 lbs. Kainit	150 lbs Kainit	5	8½	3¾	17¼	517½	
4	No Manure	No Manure	4	5	½	9½	285½	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia 150 lbs. Kainit	10	8¼	1¼	19½	585	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	13¾	5	4	22¾	682½	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black	150 lbs Kainit, 195 lbs. Dis. Bone Black	5	8½	2	15½	465	
8	No Manure	No Manure	3	7	¾	10¾	322½	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis. Bone Black	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	14½	10	2½	27	810	
10	20 lbs. Floats	300 lbs. Floats	5	7	3	15	450	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul. Ammonia, 300 lbs Floats	4	12	1½	17½	525	
12	No Manure	No Manure	1½	9	......	10½	315	
13	53 lbs. green Cotton Seed.	795 lbs. green Cotton Seed.	8	10¼	5	23¼	697½	
14	20 lbs Floats 53 lbs. green Cotton Seed.	300 lbs. Floats, 795 lbs. green Cotton Seed.	10¼	14	4	28¼	847½	
15	265 lbs Stable Manure	3,975 lbs. Stable Manure	13	13¾	6¼	33	990	

COTTON EXPERIMENT WITH FERTILIZERS - RESULTS.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 12.	Lbs. Cotton, 2nd picking Oct. 10.	Lbs. Cotton, 3rd picking. Nov. 3d.	Total yield per plot.	Total yield per acre.	Remarks.
1	6 lbs. Sul. Ammonia	90 lbs. Sul. Ammonia.	11	14	6¼	31¼	937½	
2	13 lbs. Dis. Bone Black..	195 lbs. Dis. Bone Black.	13½	16	7	36½	1095	Acre No. 2, clay land.
3	10 lbs. Kainit	150 lbs. Kainit..........	9	15½	5¼	29¾	892½	
4	No Manure.............	No Manure ...	8	14	2	24	720	
5	6 lbs. Sul. Ammonia, 10 lbs. Kainit	90 lbs. Sul. Ammonia, 150 lbs. Kainit....... ..	10	15	4	29	870	
6	6 lbs. Sul. Ammonia, 13 lbs. Dis. Bone Black.	90 lbs. Sul. Ammonia, 195 lbs. Dis. Bone Black	21¼	18¼	8	37½	1125	
7	10 lbs. Kainit, 13 lbs. Dis. Bone Black.	150 lbs. Kainit, 195 lbs. Dis. Bone Black..	9	16	7½	32½	975	
8	No Manure	No Manure	5	12	5	22	660	
9	6 lbs. Sul. Ammonia, 10 lbs. Kainit, 13 lbs. Dis Bone Black	90 lbs. Sul. Ammonia, 150 lbs. Kainit, 195 lbs. Dis. Bone Black	18	18½	6	42½	1275	
10	20 lbs. Floats	300 lbs. Floats.	5	13	4½	22½	675	
11	6 lbs. Sul. Ammonia, 20 lbs. Floats	90 lbs. Sul Ammonia, 300 lbs. Floats....... ..	6	10	3	19	570	
12	No Manure	No Manure	2¾	6¾	1	10½	315	
13	18 lbs. Cotton Seed Meal.	270 lbs. Cotton Seed Meal	9	12¾	3	24¾	742½	
14	20 lbs. Floats, 18 lbs. Cotton Seed Meal	300 lbs. Floats, 270 lbs. Cotton Seed Meal	14	15½	3¼	32¾	982½	
15	265 lbs. Stable Manure ..	3,975 lbs. Stable Manure.	14	16	3¾	33¾	1012½	Commenced to rust August 10.

EXPERIMENT OF THE STATE STATION, AUBURN, ALA.

For the purpose of convenient comparison, the following report of the co-operative experiment conducted at this Station is re-printed from Bulletin No. 22, recently issued:

Soil Test of Fertilizers with Cotton.

For the purpose of learning the *chemical needs* of the various soils of the State, chemicals already prepared and weighed, ready for application, were furnished thirty *volunteer experimenters* cultivating typical soils of as many sections of the State, with the request that they be applied, as far as practicable, to soil upon which no commercial or other fertilizer had ever been used.

In order to compare the soil of this station with those in the different parts of the State, the same chemicals in character and quantity were applied upon an old field which had been lying out for many years, and for the last seven closely pastured. No commercial fertilizers was ever applied to this soil previous to 1890. It had been cleared so long that even the long-leaf pine stumps had disappeared.

The plots were arranged as shown in the diagram on page 16 of this bulletin, and the experiment was the same in every respect as those already reported as conducted by local experimenters.

The manures were applied with the utmost care, and almost a perfect stand secured. The cultivation throughout was shallow and perfectly satisfactory. When the cotton was large enough to be exempt from attack by the cut worm, the stalks in the two test rows in each plot were counted and reduced to the same number in each by pulling out from those having the largest number, down to the least number found in any plot. This is the only practicable plan by which an absolutely uniform stand can be secured.

Observations were made, as shown in the table, upon the height, condition and appearance of the plants on the different plots, June 14th, July 8th, August 11th, and September 11th. The quantity gathered at the different pickings was recorded and is printed to show the effects of the different manures in hastening the growth and maturity of the crop. It will be observed, that while from some plots more than *ninety* per cent. of the crop was gathered by the 15th of October, from others less than *sixty* per cent. was gathered. This is often a very important effect of manures, since the price is usually better during September and October than later, and a laborer can gather fully one-third more per day in September than in November or December. Besides, by reference to the table giving the average rainfall it will be observed that September and October are generally comparatively dry months, and hence favorable for maturing and gathering cotton. In order to have a check upon the accuracy of the field weights, the seed cotton from each plot was kept separate, tied up in sacks and suspended from the joist of the gin house, where it was exempt from liability to be disturbed by either men or mice. At the time of ginning, the cotton from all the plots was re-weighed under like conditions. The columns in the table headed "field weights" and gin-house weights" show the loss of each plot up to December 17th, when it was ginned. The results indicate that the soil upon which the experiment was conducted was especially deficient in phosphoric acid, since a marked increase in production results from its application in every instance, whether used alone or in combination with potash or nitrogen, The results from kainit and sulphate of ammonia used either singly or together, indicate that the plant was unable to utilize these without phosphoric acid. That the soil needed both potash and nitrogen is shown by the increased yield where these are combined with phosphoric acid.

That these, potash and nitrogen, were to some extent available in the soil is shown by the fact that phosphoric acid alone gave good results. The *indications* from the results of this experiment are, therefore, that the soil needs all three of the principal ingredients, nitrogen, potash and phosphoric acid, but is most deficient in the latter.

Attention is invited to the *per centages* of increase from the use of the different manures, as shown in the table.

It is interesting also to note the cost of fertilizers applied per acre, the actual profit and the per cent. of profit. As the profit and per cent. are calculated upon and due to the increase resulting from the fertilizers, and as all other expenses are the same on the unfertilized land as upon the fertilized, the effect of the fertilizers alone are considered.

While the stable manure produced the largest increase and the largest profit per acre, attention is called to the fact that it was applied at the rate of nearly *two tons* per acre or half a ton more than the amount annually saved from each mule kept. There is no question about the efficacy of good stable manure properly used, but the available supply is too small.

The late fall was favorable to the plots which produced little since a larger per cent. of the fruit on these was produced late in the season than upon the plots upon which the plants grew off more promptly in early summer.

COTTON EXPERIMENTS WITH FERTILIZERS—RESULTS.

Plot No.	Pounds.	Fertilizers used per Acre.	Yield in Pound Seed Cotton per Acre. Field Weight.						Ginhouse weights. Total.	Per ct. of increase over no manure.	Cost of fertilizers per acre.	Profit per acre.	Per cent. of profit.	Loss.	Per cent. of loss.	Per cent. gathered to Oct. 15th.
		Names.	1st Picking, Sept. 1.	2nd Picking, Sept. 17.	3rd Picking, Oct. 15.	4th Picking, Nov. 8.	5th Picking, Nov. 25.	Field weights. Total.								
1	90	Sulphate Ammonia	9	33	108	75	39	264	255	.....	$ 3 30	......	...	5 70	1 23	57
2	195	Dissolved Bone Black	183	270	141	36	18	648	624	88.4	2 53	6 59	64	....	....	92
3	150	Kainit	6	27	174	135	72	414	390	20.3	1 37	73	7	....	..	50
4	....	No Manure	9	45	138	108	51	351	330	....	.....	......	...		....	55
5	240	150 lbs. Kainit, 90 lbs. Sul. Ammonia	6	30	123	144	75	378	369	9.9	4 67	.....	...	3 65	55	42
6	285	195 lbs. Dis. Bone Black, 90 lbs. Sul. Ammonia	180	345	186	66	36	813	765	136 3	5 83	8 24	80	...	.	88
7	345	195 lbs. Dis. Bone Black, 150 lbs. Kainit	198	411	222	69	39	939	900	173.0	3 90	13 95	135	....	...	88
8	....	No Manure	12	42	129	105	36	324	309	....	....	....		...	..	55
9	435	195 lbs. Dis. Bone Black, 90 lbs. Sul. Am., 150 lbs. Kainit	198	450	303	63	33	1047	963	204 4	7 20	13 86	134	....	..	91
10	300	Floats	81	225	162	45	24	537	510	56.1	2 36	3 43	33	..	..	87
11	390	300 lbs. Floats, 90 lbs. Sul. Ammonia	105	255	258	105	36	759	732	120 6	5 66	6 79	66		....	81
12	....	No Manure	9	66	159	93	30	357	342	....	....	..		..	....	66
13	795	Green Cotton Seed	48	228	222	69	21	588	570	71.0	3 57	3 75	36	.	...	85
14	1095	795 lbs. green Cotton Seed, 300 lbs. Floats	156	420	249	63	30	918	882	167.2	5 93	11 29	109	..	..	90
15	3975	Stable Manure	345	585	162	33	21	1146	1119	233.1	3 97	20 09	194	...	..	95

OBSERVATIONS UPON THE APPEARANCE AND CONDITION OF THE PLANTS UPON THE DIFFERENT PLOTS.

Plot Number.	Fertilized used per Acre.		June 14th.		July 8th		August 11th.			September 11th.	
	Pounds.	Names.	Condition of Plant.	Height in inches.	Condition of Plant.	Height in Inches.	Condition of Plant.	Height in Inches.	Leaf Blight.	Condition of Plant.	Leaf blight.
1	90	Sulphate Ammo.	Yellow.........	2 to 5	Yellow, not vig.	4 to 11½	Green, vigor's and fruiting rapidly...	7 to 16	Free ...	Mak'g small and vig	V'y slight
2	195	Dis. Bone Black.	D'k green & vig.	5 to 10	Col. g'd and vig.	11 to 24	Green and fruiting ended	15 to 30	Badly ..	Matured	V'y badly
3	150	Kainit	Green.........	2 to 6	" "	6½ to 14	Green, vigorous & making rapidly...	10 to 18	Free ...	Vigorous and mak'g	Free.
4	....	No manure. ..	Yellow.........	2 to 5	Yellow, not vig.	4½ to 9	"	7 to 13	"	Vigorous and mak'g.	Slight.
5	240	150 k't, 90 sul. am	Yellow.........	2 to 5	Col. g'd and vig.	4½ to 9	"	9 to 20	"	Vigorous and mak'g.	Free.
6	285	195 dis. B. Bl. 90 Sul. Ammn.	D'k gr'n and vig	4 to 8	" "	7 to 22	Vigorous and fruiting slightly	11 to 30	Slight..	Matured	Badly.
7	345	195 dis. B. B'k 150 Kainit....	" "	5 to 10	Vig., col. little	8 to 24	"	11 to 30	Free . .	Matured.	Slight.
8	....	No manure....	Yellow	2 to 5	Yel. and not vi	4½ to 9	Vigor'us and making rapidly......	6 to 13	Free ...	Small, vig. and mak.	V'y slight
9	435	195 dis. B. B'k. 90 sulpha. am. 150 Kainit.	Green	4 to 8	Col. g'd and vig.	1 to 22	Vigor'us and fruiting slightly......	14 to 30	Slight. .	Matured...........	Badly.
10	300	Floats	Light Green....	2 to 6	" "	7 to 12	Vigor'us and making rapidly	11 to 24	"	Matured and small..	Badly.
11	390	300 Floats, 90 sul. ammo.	Light Green....	2 to 6	" "	8 to 15	Vigor'us and making moderately..	12 to 26	"	Matured.	Badly.
12	....	No manure.....	Yellow.........	2 to 5	Yellow not vig.	4½ to 9	Vigor'us and making rapidly......	7 to 13	Free ...	Making	Slight.
13	795	Green cot'n seed	Yellow.........	2 to 5	Very yellow....	9 to 15	"	12 to 28	Slight..	Matured	Badly.
14	1095	795 green cot. seed, 300 floats	Light Green ...	2 to 6	Col. g'd and vig.	9 to 20	"	11 to 30	Slight ..	Matured.	Badly.
15	3975	Stable manure..	v'y vig. & d'k g'n	5 to 10	Col. little off & vig.	12 to 26	Fruiting ended	18 to 30	v'y sl'ht	Matured.	Badly.

LIST OF CO-OPERATIVE EXPERIMENTERS FOR 1891.

	NAMES.	COUNTY.	POST-OFFICE.	SOIL.	SUB-SOIL.
1	Aday, L. C., Rev	Franklin	Newberg, Ala	Red cedar loam	Red clay.
2	Beasley, E. J	Covington	Red Level, Ala	Red	Clay.
3	Brown, D. L	Bibb	Randolph, Ala	Sandy	Clay.
4	Bishop, M. A	Madison	Madison, Ala	Clay loam	Stiff clay.
5	Bradley, F. W	Clarke	Walker Springs, Ala	Sandy	Clay.
6	Brannon, J. M	Russell	Seale, Ala	Sandy loam	Clay.
7	Compton, G. W	Marengo	Dixon's Mills, Ala	Sandy loam	Clay.
8	Cross, R. H	Lowndes	Letohatchie, Ala	Sandy loam	Yellow clay.
9	Davis, E. M., Maj	Autauga	Prattville, Ala	Sandy loam	Red clay.
10	Davison, J. A	Choctaw	Yantley Creek, Ala	Sandy, with some lime	Clay.
11	Dick, R. M	Etowah	Attalla, Ala	Red loam	Red clay.
12	Deer, John F	Monroe	Monroeville, Ala	Gray sandy	Clay
13	Ewing, R. T	Cherokee	Centre, Ala	Black sandy	Stiff clay.
14	Ellison, J. M	Macon	Creek Stand, Ala	Sandy	Sandy.
15	Gordon, John, Dr	Washington	Healing Springs, Ala	Gray sandy loam	Sandy clay.
16	Goodwyn, A. T	Elmore	Robinson Springs, Ala	Gray sandy	Red clay.
17	Hobdy, J. M	Barbour	Louisville, Ala	Sandy loam	Red clay.
18	Hall, S. M	Marion	Hackleberg, Ala	Dark gray	Red clay.
19	Hall, Wm. B	Lowndes	Lowndesboro, Ala	Lime prairie	Black clayey.
20	Inzer, J. T	St. Clair	Eden, Ala	Sandy loam	Red clay.
21	Johnson, Uriah	Morgan	Trinity Station, Ala	Red sandy loam	Red clay.
22	Killebrew, J. C	Dale	Newton, Ala	Sandy loam	Clay.
23	Kennedy, J. M	Clay	Oak Lone, Ala	Red	Red, stiff clay.
24	Logan, J. A	Chilton	Clanton, Ala	Mulatto and sandy	Red clay.
25	Miller, W. H	Greene	Union, Ala	Sandy	Clay.
26	Martin, Wm	Hale	Greensboro, Ala	Sandy loam	Clay.
27	Mize, J. W	Blount	Remlap, Ala	Red and sandy	Sticky clay.
28	Melton, W. B	Fayette	Davis' Creek, Ala	Gray sandy	Clay.
29	Manning, W. S	Calhoun	Oxford, Ala	Mulatto	Red clay.
30	Newman, W. H	Perry	Uniontown, Ala	Black prairie	Black clay.
31	Newman, C. L	Limestone	Athens, Ala	Clay loam	Red clay.

LIST OF CO-OPERATIVE EXPERIMENTERS FOR 1891—CONTINUED.

	NAMES.	COUNTY.	POST-OFFICE.	SOIL.	SUB-SOIL.
32	Oliver, J. P	Tallapoosa	Dadeville, Ala	Gray sandy	Clay.
33	Ott, J. C	Lauderdale	Florence, Ala	Gray, little gravelly,	Clay.
34	Pitts, J. W	Shelby	Cresswell Station, Ala.	Red clay loam	Stiff red clay.
35	Porter, T. M. J	Butler	Georgiana, Ala	Pine, light sandy	Yellow clay mixed with sand.
36	Pruitt, S. A	Pike	Chesser, Ala	Sandy	Clay.
37	Radney, J. H	Randolph	Roanoke, Ala	Sandy loam	Stiff red clay.
38	Stroud, Z. T	Bullock	Aberfoil, Ala	Light, gray	Clay.
39	Snuggs, T. A	Cullman	Holly Pond, Ala	Sandy and gravelly	Yellow, sandy.
40	Sellers, W. H	Geneva	Geneva, Ala	Sandy	Red clay and sand mixed.
41	Watlington, T M	Henry	Abbeville, Ala	Sandy	Sand and clay mixed.
42	White, W. S	Lawrence	Hattan. Ala	Clay loam	Red clay.

DIRECTIONS FOR CONDUCTING SOIL TESTS WITH FERTILIZERS FOR 1891.

Selection of Land.

The area upon which the experiment is made should be level, or nearly so; should represent, in character of soil and subsoil, the section in which the experimenter lives, should not have been fertilized for several years, or better still, never at all, but should not be new or fresh land; the object being to learn what fertilizer the ordinary cultivated lands of the section need.

Arrangement of Plots.

The accompanying diagram shows the arrangement of the plots. There will be 19 plots of 1-16 of an acre each. Each plot will be 172¼ feet long and 16 feet wide, admitting of four rows of cotton four feet apart:

1	1...... 172¼ FEET 2 3 (16 feet) 4	6 lbs. Nitrate Soda.
2	1 2 3 4	15 lbs. Acid Phosphate.
3	1 2 3 4	4 lbs. Muriate Potash.
4	1 2 3 4	No. Manure.
5	1 2 3 4	6 lbs. Nitrate Soda. 4 lbs. Muriate Potash.
6	1 2 3 4	6 lbs. Nitrate Soda. 15 lbs. Acid Phosphate.
7	1 2 3 4	4 lbs. Muriate Potash. 15 lbs. Acid Phosphate.
8	1 2 3 4	No Manure.
9	1 2 3 4	6 lbs. Nitrate Soda. 4 lbs. Muriate Potash. 15 lbs. Acid Phosphate.
10	1 2 3 4	15 lbs. Floats.

	1	
11	2 3 4	6 lbs. Nitrate Soda. 15 lbs. Floats.
	1	
12	2 3 4	No Manure.
	1	
13	2 3 4	53 lbs. Green Cotton Seed.
	1	
14	2 3 4	53 lbs. Green Cotton Seed. 15 lbs. Floats.
	1	
15	2 3 4	265 lbs. Stable Manure.
	1	
16	2 3 4	15 lbs. Acid Phosphate. 15 lbs. Cotton Seed Meal.
17	To be planted in peas and vines turned turned in green.	
18	To be planted in peas—vines cut for hay.	
19	To be planted in peas—vines left to rot.	

The fertilizers are sent, freight prepaid, to the depot designated by each experimenter. Each package bears two labels—one showing its contents, the other the plot to which it is to be applied. As shown in the diagram, each fertilizer is to be applied to four rows. To secure an accurate distribution, divide each parcel into four equal parts, by weight, and apply one-fourth to each row. Numbers 4, 8 and 12 are to receive no fertilizer. The experimenter is expected to furnish the cotton seed for plots 13 and 14, and the stable manure for No. 15. Apply the green cotton seed in a deep furrow and distribute the floats over the seed, in plot 14. In plots 13 and 15, distribute the cotton seed and stable manure, respectively, and bed upon them as upon the fertilizers in the other plots.

Preparation.

First break the land "flush," deeply and thoroughly, after accurately measuring the area to be occupied by the experiment, viz.: 172¼ feet by 304 feet. Lay off nineteen plots 16 feet wide and 172¼ long, and then open four furrows 4 feet apart in each of these plots. In these furrows distribute the fertilizers and bed with a good turn plow, making a high bed. Then draw a harrow or heavy brush across the beds to reduce and smooth them and prepare them for the planter. It is important to secure a perfectly uniform stand of plants, and hence the seed-beds should be thoroughly prepared.

Planting.

Use the *same kind of seed upon* the whole area, and plant all the plots the *same day*. If a part of the plots were planted before and the rest after a rain, the results of the experiment would be impaired in value. Use every precaution necessary to secure a full stand. If a uniform stand is not secured at the first planting, plow it up promptly and plant again.

Cultivation.

As soon as the plants are large enough, "side" with a scrape or sweep, and after several days, chop to "*two stalks* every *two feet*." As soon as danger of loss by cold or cut worms has passed, reduce the stand to *one stalk* in every hill. Rows 2 and 3 of each plot are to be gathered to determine the yield from each fertilizer. This reduces the "test area" of each plot to 1–32 of an acre. One missing stalk on this area would, therefore, represent 32 to the acre. To make the experiment reliable, therefore, there must be the same number of stalks upon each such "test area." To insure this, when the plants are eight to ten inches high, count carefully the stalks in rows 2 and 3 of each plot. A perfect stand would give 86 stalks to the row, or 172 to the "test area," rows 2 and 3. Suppose, for instance, the count shows that the number of stalks range from 172, a perfect stand down to 160 to the test areas. *Reduce the number of plants to 160 in all of the test areas* (rows 2 and 3 of each plot) by pulling from each the number of stalks it was found to contain *above* 160. This is the only *reliable* way to secure uniformity of stand, without which the experiments *cannot be accurate.* Neither calculating the yield on the basis of a perfect stand, nor replanting is reliable, but both are misleading. Let all the plots be cultivated on the same day and in exactly the same manner throughout the season. See that no tree stands within 100 feet of any of the plots.

The Pia-Vine Plots.

On plots 17, 18 and 19 plant some variety of peas which produces most vine. As soon as a few pods begin to ripen turn under the vines on plot No. 17, and cut them from No. 18, and cure them for hay, weighing the hay and reporting its weignt and value with other results. When the peas ripen, gather them from No. 19, weigh accurately, and report weight and value with the cotton results. Leave the vines upon this plot until the land is prepared for cotton in 1892. The object of these three plots is to compare effects upon the crop of next year of turning under the vines, cutting them for hay, and allowing them to rot upon the land.

Since the size of the plots for 1891 is different from that of 1890, those who conducted the experiment in 1890 will select a different area from that used in 1890.

The area used in 1891 will be used again in 1892, and plots 17, 18 and 19 planted in cotton or corn.

MEMORANDA.

Record in a book, kept exclusively for that purpose, the time and manner of performing every operation connected with the experiment, from the preparation of the land to gathering the crop. Make weekly or bi-weekly notes of the appearance of the cotton on the different plots.

Record all changes in the weather likely to affect the growth or fruitfulness of the cotton plant, such as unusually high or low temperature, excessive rainfall or continued drouth; and note the difference, if any, in the effects upon the different plots. Keep a careful record of the "seasons" and their apparent effects upon soil and plants.

GATHERING.

Before the crop matures, printed blanks upon which to record results will be furnished each experimenter.

The slightest mistake in gathering or weighing the products will destroy the value of the experiment, and the utmost care and watchfulness should be exercised to prevent such mistakes. The gathering and weighing of the product of the different plots must be done under uniform conditions.

Pickings should not be commenced until the morning dew has disappeared from the cotton. If some plots are gathered and weighed in the early morning and others in the afternoon, accuracy will be sacrificed.

Each experimenter must exercise a sound judgment in these matters of detail, looking constantly to securing perfect accuracy in the comparison of the effects of the fertilizers.

Experiments, like statistics, unless full and accurate, are misleading.

No account need be kept of the rows one and two, since they being only four feet from the adjacent plots to which different manures were applied, receive by the spread of their roots the benefit of both fertilizers. The products of the rows two and three will be used to compare the effects of the different fertilizers. The plants in these rows being eight feet from those to which a different fertilizer was applied, only the extremeties of their longest roots will reach it, and hence, will not be materially affected by it.

Pickings should be made with sufficient frequency to avoid the risk of having the experiment vitiated by storm.

Record the weight and date of each picking. Record the average height of the stalks upon each "test area." Note the character and extent of injury to the plants by any casualty, such as storms, boll-worm, caterpiller, rust or blight.

When the plants are sufficiently advanced in growth to show plainly the effects of the fertilizers, invite the farmers of the neighborhood to inspect the plots at intervals during the season. This is important, since the object of the experiment is to benefit the farmers who cultivate lands similar in character to that upon which the experiment is made.

Cost of Fertilizers Applied per Acre.

In order that the experimenters and other farmers may better understand the inquiry made upon the different plots, the cost of the different materials used is given in the statement which follows. The calculations are made upon the cost laid down at Auburn for all of them, since the local freights upon the packages re-shipped to the depots of the experimenters would produce a false impression, since the average local rate of freight charged upon the amount sent to each experimenter from Auburn to their depots exceeds five dollars per ton. Shipped in quantity, the freight to the various depots of the experimenters would average little more than that from the factories to Auburn. Again, in estimating profits resulting from the use of the different fertilizers, it will be more convenient to have a common standard of comparison.

Quantity and Cost per Acre of Fertilizers used by Co-operative Soil Test Experimenters, 1891.

Plot	1.	96 lbs. Nitrate Soda		$ 2 13
	2.	240 lbs. Acid Phosphate		1 98
	3.	64 lbs. Muriate Potash		1 44
	4.	No manure.		
	5.	96 lbs. Nitrate Soda	$2 13	
		64 lbs. Muriate Potash	1 44	3 57

Plot 6.	96 lbs. Nitrate Soda	2 13	
	240 lbs. Acid Phosphate	1 98	4 11
7.	64 lbs. Muriate Potash	1 44	
	240 lbs. Acid Phosphate	1 98	3 42
8.	No manure.		
9.	96 lbs. Nitrate Soda	2 13	
	240 lbs. Acid Phosphate	1 98	
	64 lbs. Muriate Potash	1 44	5 55
10.	240 lbs. Floats		1 88
11.	240 lbs. Floats	1 88	
	96 lbs. Nitrate Soda	2 13	4 01
12.	No manure.		
13.	848 lbs. Green Cotton seed, @ 45c. per cwt.		3 81
14.	848 lbs. Green Cotton seed, " "	3 81	
	240 lbs Floats	1 88	5 70
15.	4,240 lbs. Stable manure, @ $1 per 1,000 lbs.		4 24
16.	240 lbs. Acid Phosphate	1 98	
	240 lbs. Cotton Seed Meal	2 60	4 58
17.	To be planted in peas and vines turned-in green.		
18.	To be planted in peas and vines cut for hay.		
19.	To be planted in peas and vines left to rot.		

Pounds of Fertilizing Elements per Acre.

When a farmer purchases acid phosphate he pays his money for the available phosphoric acid it contains. No value is placed upon the sulphate of lime, the water or the sulphuric acid it may contain. By available phosphoric acid is meant that which is in condition to be promptly utilized by the plant. The fertilizer laws of Alabama require the vendor to guarantee the per cent. of water soluble phosphoric acid, the citrate soluble phosphoric acid and the acid soluble phosphoric acid. The corresponding terms used in other States are "soluble phosphoric acid," "reduced phosphoric acid," and "insoluble phosphoric acid." The water soluble means that which is soluble in distilled or pure water; the citrate soluble means that which is soluble in citrate of ammonia, which is supposed to have solvent power equivalent to soil water. The insoluble or acid soluble means that which is not soluble in either pure water or the water of the soil impregnated with acids and alkalies extracted from the soil and the vegetable matter it contains. Experiment, often repeated, has demonstrated that the citrate soluble and the water soluble are both promptly available to the plant, and hence are together called "available phosphoric acid," and in calculating commercial values are given the same valuation.

In the statement following the number of pounds of "available" phosphoric acid is given in one column and the insoluble in another. While the insoluble or "acid soluble" phosphoric acid has a very low valuation, when finely powdered insoluble phosphates are used in connection with organic matter containing nitrogen, a portion of the phosphoric acid becomes promptly available. The valuable ingredient of the nitrate of soda is nitrogen, and in muriate is potash. The nitrate of soda used in these experiments contains 15.19 per cent. of nitrogen, which is equivalent to 18.44 per cent. of ammonia. The cotton seed meal contains 7.17 per cent. of nitrogen, equivalent to 8.71 per cent. of ammonia. The cotton seed meal contains, also, 2.78 per cent. of acid sol. phos. acid, and 1.43 per cent. of potash. The acid phosphate used contains 12.88 water soluble phosphoric acid, 2.02 citrate soluble and 2.53 acid soluble. The muriate of potash contains 52.31 per cent. of potash. These percentages are as reported by Dr. Lupton, chemist of the college and station. All fertilizing material intended for experiment is submitted to him for analysis before being used.

The following table shows quantity of potash, phosphoric acid, nitrogen (and its equivalent of ammonia) contained in the different fertilizers used per acre :

Plot No.	NAMES OF FERTILIZERS.	Lbs. Potash.	Lbs. phosphoric Acid Available	Lbs. Phosphoric Acid Insoluble.	Lbs. Nitrogen.	Lbs. equivalent to Ammonia.
1	96 lbs. Nitrate Soda	.....	....	....	14 58	17.70
2	240 lbs. Acid Phosphate	...	35.96	6.07	..	.....
3	64 lbs. Muriate Potash	33.47	.....	.....	....	.....
4	No Manure	.....	.....	.....	....	.....
5	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash	33.47	....	.....	14 58	17.70
6	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate	....	35.96	6.07	14 58	17.70
7	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	33.47	35.96	6.07	.....	.....
8	No Manure	.....	.....	.....	....	.....
9	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate, 64 lbs. Muriate Potash	33 47	35 96	6 07	14 58	17.70
10	240 lbs. Floats	...	20 08	46 84	....	......
11	240 lbs. Floats, 96 lbs. Nitrate Soda	.....	20.08	46.84	14.58	17.70
12	No Manure	.	.....		.....	.....
13	848 lbs. Green Cotton Seed	10 6	.....	10.17	21.2	25.74
14	848 lbs. Green Cotton Seed, 240 lbs. Floats	10 6	20 08	57 01	21.2	25.74
15	4,240 lbs. Stable Manure	28.40	....	13 14	26 71	32.43
16	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal	4 2	35 96	13 27	16 80	20.35

Nitrogen, Potash and Intercultural Experiments.

In addition to the co-operative experiments already mentioned, Mr. A. F. Cory, Mulberry, Autauga county, an Alumnus of the

A. & M. College, will conduct some special nitrogen, potash and intercultural experiments during the present year. He and others will also co-operate with this station in comparing varieties of cotton, which will be furnished from this station. In addition to the experiments with fertilizers to learn what the different soils of the State need, plants of a few standard varieties of grapes, strawberries and raspberries have been presented to each experimenter in order that the adaptation of these varieties which have proved especially successful on the grounds of this station, are adapted to cultivation on the various typical soils of this State.

In order to supply information as to the cultivation and other treatment of these plants and to secure uniformity of treatment in all cases, a bulletin of information upon grapes, strawberries and raspberries will be issued during the next month.

REPORT

OF THE

ALABAMA WEATHER SERVICE.

Co-operating with the U. S. Signal Service.

January, 1891.

STATE POLYTECHNIC INSTITUTE,
Auburn, Ala., February 15th, 1891.

The precipitation for the month was well distributed, and was above the average at all the stations. The continued rains have placed the roads in bad condition, and in some of the counties are rendered, in places, almost impassable. The average rainfall for the State was 0.67 inches above the normal.

The temperature has ranged rather high and the weather has been generally mild. With the exception of a few days the atmosphere was sufficiently warm to cause the buds of the forest plants to swell, and in some instances delicate flowers came forth. The average temperature was 2.°2 above the normal.

The farmers, however, have been delayed in the preparation of the land by the damp condition of the soil.

J. M. QUARLES, P. H. MELL,
Assistant. Director.

MONTHLY SUMMARY.

Atmospheric pressure (in inches), monthly mean, 30.181; maximum observed, 30.556, at Auburn on 7th; minimum observed, 29,519, at Chattanooga, on 1st; range, 1.037

Temperature (degrees F.), monthly mean 45.1; highest monthly mean 51.2, at Uniontown; lowest monthly mean, 39.4, at Valley Head; maximum observed, 80, at Citronelle on 30th; minimum observed, 18, at Jasper on 4th; range for State, 62°; greatest local monthly range 53, at Citronelle; lowest local monthly range 38, at Mobile.

Precipitation, including melting snow, in inches.—Average for State, 6.03; greatest, 8.11, at Jasper; least, 2.96 at Citronelle.

Mean relative humidity, 77.7 at Auburn; 87.3 at Valley Head; 74.5 at Uniontown.

Wind—Prevailing direction, N. W. Miles traveled, at Chattanooga, 4596; at Montgomery, 4109; at Mobile, 5829; at Auburn, 3227.

NOTES FROM OBSERVERS.

Greensborough, (M. H. Yerby).—This month has been unusually wet, raining eleven days, and rainfall amounting to 6.75 inches; in consequence of which farm work is very backward; scarcely any plowing has been done in this section. The roads are almost impassable for any kind of vehicle.

Livingston (J. W. A. Wright). Our normal temperature for January being 45°, the average for this January was 1° colder than usual. The total rainfall for this month (7.46 inches) nearly two inches above the normal. Our first wild flowers for early spring began blooming; the star chick weed (*Stellaria media*) and Bluets or Innocence (*Housatonia cœrulia*). On 31st temperature rose to 74°, almost summer heat.

TABLE OF SOIL TEMPERATURES—JANUARY, 1891.

(The observations for this table were taken at Auburn, Ala.)

A. M. LLOYD, Observer.

NOTE.—There are three sets of thermometers. On the 1st of January they were arranged as follows: One set ranging from 1 inch to 96 inches was placed in clay soil on the college campus for the purpose of determining the "frost line" among other problems that will require several years of continued observations. The other two sets were left in their former position, viz.;—One on the hill and the other in the bottom. They were left their to determine the effect produced upon the temperature of the roots of plants by stirring the soil over one set, and permitting the soil to cake over the other.

DEPTH IN INCHES.	SET NO. 1, On Hill.	SET NO. 2, On Hill.	SET NO. 3, In Bottom.
1	45.5°	This set has been removed to College campus for another experiment.	46.3°
3	45.5		45.6
6	45.3		45.8
9	44.9		45.3
12	45.2		45.5
24	48.6		49 1
36	50.6		50.5
48	52.7		52.4
60	53.8		54.1
72			
84			
96			

Monthly Summary of Meteorological Reports of the Alabama Weather Service. January, 1891.

STATIONS.	COUNTIES.	Altitude.	Latitude.	Longitude.	BAROMETER.					TEMPERATURE.									Total Precipitation.	Clear Days.	Fair Days.	Cloudy Days.	Days of Rain.	Prevailing Wind.	OBSERVERS.
					Monthly Mean.	MAX.		MIN.		Monthly Mean.	Mean of Max.	Mean of Min.	MAX.		MIN.		Monthly Range.	Me'n Daily Range							
						Height.	Date.	Height.	Date.				Height.	Date.	Height.	Date.									
Valley Head	DeKalb	1031	34.34	85.37						39.4	49.1	2.98	69	31	20	4	49	19.3	7.34	10	6	15	9	N E	E. P. Nicholson.
Florence	Lauderdale		34.48	87 37																					C. W. Ashcroft.
Chattanooga	Tennessee.	783	35.03	85.30	30 154	30 519	8	29 519	1	42	50.4	34.3	69	31	26	5	43	16.1	6.31	15	11	15	15	N E	Sgt. L. M. Pindell
Montgomery	Montgomery	219	32 22	86.23	30 196	30.412	19	29.623	21	46.9	55.7	38.1	76	30	28	19	48	17.6	3.57	15	8	8	13	W..	Sgt. L. Dunne.
Union Springs.	Bullock	516	32 12	85 39																					R. J. Grady.
Bermuda	Monroe		31.43	87 12						45 7			73	30	21	14	52		5 00				10		Wm. Fowler.
Mobile	Mobile.	30	30 41	88.20	30.148	30.431	19	29 710	1	49	56 3	41.6	68	31	30	19	38	14 7	6.50	5	12	14	13	N...	Sgt. A. Pritchard
Carrollton	Pickens			88.03																					M. L. Stansel.
Auburn	Lee	826	32 40	85 30	30.318	30 556	7	29 764	1	46 2	53.9	38.4	71	31	26	19	45	20.9	4.98	13	8	10	8	N w	J M. Quarles.
Livingston	Sumter.	150	32 34	88 08	30 150	30 440	19	29 650	1	43 6			72	31	26	4, 25-26	46		7.46				11	N w	J W. A. Wright
Greensboro	Hale	220	32 41	87.36						44 8			68	1–29–[31	26	4–19	42		6 75				11	N..	W. H. Yerby.
Mt. Willing	Lowndes		32 07	86 45																					Wm. Garrett.
Uniontown	Perry	273	32.28	86 44	30 12	30 480	28	29.530	1	51 2	54.6	37.1	74	30	24	19	50	17.5	6.81	11	4	16	12	N w	W. H. Newman.
Citronelle	Mobile	352	31 03	87 30						51.1	61.5	40.6	80	30	27	13	53	20.9	2.96	15	4	12	8		J. G. Michael.
Fayette	Fayette		33.42	83 12																					Dan Collier.
Guntersville.	Marshall	655	34 24	86.18																					A. J. Baker.
Chepultepec	Blount	890	33 58	86 20																					W. B. Allgood.
Columbiana	Shelby	560	33 15	86 38						42 5	53.5	31.4	72	31	20	4	52	24.1	6.37				9		W. D. Lovette.
Centre.	Cherokee	728	34 10	85.42																					Thos. Bradford.
Double Spri'gs	Winston.		34 08	85 35						45 9		38.4	65	29	22	18	43		6.18				7		A. M. Weiler.
Butler.	Choctaw.		32.05	87 24																					B. F. Gilder.
Jasper	Walker	310	33.49	88 12						40 8	49.7	32	70 5	31	18	4	52.5	17.7	8.11	6	10	15	13	N...	Howard Lamar.
Tuscumbia	Colbert		34.42	87 38						40 9			70	31	24	25	46		5.74			18	9	N w	L. B. Thornton.
Bessemer.	Jefferson									41.9	49 4	34.4	70	31	24	4–5	46	15	7.52				13		Wm. H. Swann.
Bewton.	Escambia.									49.1	60.9	37.2	75	30	25	19	50	23.7	5 80				9	N w	W. J. Holland.
Mount'n Home	Lawrence.																								A. J. Weaver.
Edwardsville	Cleburne.																								Dodson Bears.
Talladega.	Talladega.																								J. O. Huey.
Means.					30.181					45.1	54.1	36.1					47.3	18.9	6.03	10	8	13	11	N w	
*Jasper										53.4	68.7	38.1	79	8	28	29	51	30.6	.20	22	4	4	3	S...	Howard Lamar.
†Jasper.										48.5	58.9	38.2	69	5	25	12	44	20 1	3.53	12	1	18	3	N...	Howard Lamar
†Union Spri'gs										50.3			71	7	32	28	39		.77	6	13	12	1	S w	R. J. Grady.

* Delayed Reports. November, 1890. † December.

BULLETIN NO. 2~~3~~1. FEBRUARY, 1891.

AGRICULTURAL EXPERIMENT STATION,

OF THE

Agricultural and Mechanical College,

AUBURN, ALA.

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DAIRYING and BREEDING.

Report of Alabama Weather Service.

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☞The Bulletins of this Station will be sent Free to any citizen of the State on application to the Director.

R. J. Rice, Job Printer and Stationer, Auburn, Ala.

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Dairying and Breeding.

[Isaac Ross, In charge of live stock and dairy.]

This Bulletin is not intended to make every land owner and cotton raiser an exclusive dairyman, nor is it presumed in its presentation to attempt to cover the wide and important field of dairying. Its object is mainly to throw out a few suggestions for the careful consideration of the farmers of the State, as well as to give some practical thoughts and demonstration of facts from our experience as a breeder of dairy cattle. It is exceedingly unfortunate that the masses of our farmers are so ill informed on this matter, but few of them read a dairy or stock paper of any sort, hence have no knowledge of many important facts with reference to stock breeding and its management. It is with the hope of instructing this class of farmers that we propose to send out this bulletin.

Let me beg you not to conclude because you do not own a fine herd of Jersey or other pure bred dairy cattle, that this is of no interest to you. If you own only one cow it will pay to inform yourself as how best to manage and feed her, and if together with securing this information you will procure at reasonable cost recently improved appliances for butter making, your wife, who generally has the bulk of the work to do in this department, will rise up and call you blessed. So then subscribe at once for some good stock and dairy paper and learn from the practical experience of others how to feed and manage your cows, and the best process of making butter with the least cost and labor.

The great majority of farmers of Alabama own from six to eight milch cows, others own many more, and a few none. It is frequently the case that a man milking five cows does not make a pound of butter for sale, The first trouble is, the most of cotton producers own too many cattle. Sell off all of your non-paying and worthless cows and reinvest this money in more feed, if you have not already a sufficient quantity on hand, a good comfortable stable for the cow, and a few at least of the many important dairy implements. An important step for the farmer who decides to improve his cattle is

THE PURCHASE OF A BULL.

Grading up your herd in the right way is of the first importance, and do not cherish for one moment the thought that you own in one of your native cows one that is superior to all others for milk, butter and beef, "a general purpose cow," and propose to raise and use in your herd a bull calf from her. You do not own such a cow nor ever will.

If you want butter, buy a Jersey or Guernsey; if milk, Holstein or Ayrshire; beef, Shorthorn or Hereford. There are other breeds worhty of note. These are used by way of illustration, as they have been bred for a specific purpose for a long time, and the buyer when he gets a represenative animal of either breed, knows what he is getting before he pays his money. Once in awhile there will appear a phenomonal butter cow of the milk and beef breeds, a phenomenal milker of the butter breeds. Pay no attention to this, it is the breed you are after, backed by indisputable performance both at the pail and the churn.

There are plenty of reliable breeders of the diffierent breeds that will sell you a bull at a reasonable figure. Fifty dollars will buy a very good bull, one hundred dollars a much better one. It may be that you cannot afford this outlay as you have but few cows; in this case your neighbors can join you. Co-operate, use your order, the Alliance. First, decide on the breed; next buy as near home as you can, thus avoiding acclimating fever. If you cannot find what you want in your own State then go out of it. Get the best. The bull is half the herd, and under no circumstances use a grade.

TEST YOUR COWS.

Get your natives in good condition and test each cow by the churn. The cow giving the largest flow of milk does not always make the most butter—quite often the very reverse is true. Continue along to weed out, keeping the best until you breed a model dairy cow.

WHAT IS A MODEL DAIRY COW?

One of medium size, small head, full and placed eyes, neck long, thin and clean, broad hips, and back of great breadth at the loins, large, roomy stomack, short legs, large udder, medium sized well placed teats, tortuous milk veins. The escutcheon, like the solid cloor, is thought to be desirable by some, but many good dairy cows have first-class escutcheons and others equally as good have very poor ones.

The cow when well fed should, of coures, give a large quantity of good rich milk.

COLOR.

Do not be a "stickler" on color or size, or decide to let a cow remain in your herd beause she has a good escutcheon and pretty horns. If she only weighs 600lbs., is as black as a crow, and has neither escutcheon nor horns but yields the butter, keep her. You want the cow that will produce the most butter at the least cost.

IN AND IN BREEDING.

Beware of it, perhaps you have already paid dearly for it. With perfect animals on both sides and in the hands of a skillful breeder it may do, but as now practiced it is ruinous, and why should you in-breed so much? There is no necessity for it. Breed to the winner, and it is not out of place to say that this Experiment Station has been practicing in-and-in breeding for a number of years with a small herd of Jersey cattle, the ill effects of which can be seen by any practical breeder. The old cows are still the best, and one of the last heifers that came in milk young and which is intensely in-bred, had no fore udder at all. The foundation stock is deficient here. The experiment has proven conclusively, both in form and at the churn, that unless you have perfect animals on both sides to start with and you are skilled, it is best not to undertake it.

THE BARN.

If you have no barn, and the means to build one, make a shed, plank up the north and west sides, have separate stalls or fastenings for each cow, either stanchion or halter, and do not allow them to run all over your "cow-pen" as practiced by most farmers. Take your calves away from the cows at four to six weeks old. Feed your cows well. The most costly thing on a dairy farm is a poor cow. Milk and feed regularly, make them comfortable (this word implies a great deal) and with kind treatment they are certain to respond.

Feed-tables are sometimes given to show you how much feed to use. Remember that it requires more than a maintenance ration, and that you cannot get good results from raw cotton seed and shucks for instance.

RAISING THE CLAF.

Many farmers have asked, "how do you raise your calves?" We practice here the following plan: The first milk from the cow's udder acts as a physic and the calf should be allowed to take it. When the calf is four days old, separate from its mother; after 12 hours of fasting, take a couple of quarts of its mother's milk, warm from the cow, dip the fore and middle fingers into the milk and insert into the calf's mouth. If it is very unruly, back into corner of the stable and get straddle of the calf's neck. Repeat this uutil the calf sucks the fingers and do not lose your patience. As it is certain to throw up its head, lower it until the mouth comes in contact with the milk in the pail, and when it begins to drink the milk, gradually withdraw the fingers from the mouth. The calf will continue to throw up its head many times, but with patience repeat the process until the calf continues to drink the milk after the fingers are withdrawn. It will generally do this at the third or fourth trial. Two quarts of milk three or four times a day is all that it will take for the first three weeks. At the end of this time add a gill of sweet skimmed milk heated to blood heat (98°) to each feed twice per day and 12 hours apart until the quantity is incrased to 3 quarts. Continue this for 10 days then decrease the new milk one gill at a feed until no new milk is given; at the same time increase the warm skimmed milk half a pint at a feed until it reaches a gallon. Skim the milk after it sets 12 hours, and always feed it blood warm and while it is perfectly sweet. The great object in thus changing so gradually from new to skimmed milk is to avoid the"scours " Bright hay or fodder should always be accessible after a few weeks old. Corn and oats mixed, may be put in the feed trough; the calf will soon learn to eat and chew its cud. Keep the calves in a dry, clean stable with plenty of pure water and salt when a few months old. At seven months, take the milk entirely away and continue to feed and let them run on good pastures. Breed at 18 months old. We use linseed meal here with the milk to raise our calves, knowing how few cotton raisers would put themselves to the trouble of procuring the meal we have omitted it here.

MILKING AT THE STATION.

At present the cows are fed at 5:30 a. m. and 4:30 p. m. The first thing in the morning is to clean and sweep the stables; the cows are then fed and groomed, udders brushed carefully, and with a clean rag and bucket of tepid water, washed and wiped dry with a clean towel. The milker is now ready for business and with clean hands and short finger nails, he goes at his job with both hands quickly and quietly. The milk is weighed from each cow and a record kept; it is then strained through a wire and cloth strainer into a ten gallon can and carted to the dairy. The details of our method have been given in order to show that good butter making *must* begin at the barn.

When no experiments are being carried on, we feed on ensilage and one third each of corn meal, ground oats and bran, giving what the cows will eat clean.

BUTTER MAKING.

It may be of interest to many farmers that we give in a short, plain and simple way how we make butter. We have the facilities for making good butter,viz,a good dairy hand-power separator, cooling creamer, ripening vat, butter worker, print, etc., besides John Boyd's automatic fermenting can and automatic ripening vat, and a good well of pure water, though not cold.

After the milk is carried to the dairy it is run through a hand power DeLaval separator. The cream is at once cooled down to 55°, placed in a Cooley creamer and kept sweet until enough cream is gathered for a churning. It is then poured into a cream vat to ripen, kept at a temperature of 70°, and well stirred durning the ripening period. As soon as it is slightly acid, it is ready for churning. Cool down to 62°, scald out the churn well and pour in the cream. When the granules of butter are the size of wheat grains, the churn is stopped and rinsed down with a gallon of cold water (56°). A few swings of the churn and the butter-milk is ready to be drawn off. Wash the butter with about the same quantity of cold water as you have butter-milk; in two washings the water is clear. Tilt the churn to one side and let the butter drain thoroughly. It is then taken up and placed on a butter tray, weighed and salted, one ounce to the pound, put on the worker and worked only enough to distribute the salt, printed into one pound prints, wrapped with paraffin paper and forwarded to the consumer. When making butter in this way, we stir the cream; when using Boyd's method (which we like better)stiring is unnecessary,

Never mix sweet and sour cream.

Ice is necessary in summer.

WHAT TO DO WITH THE MILK.

This is an important question, and one you must decide for yourself. There is more money lost by the farmers of Alabama between the milk pail and the churn through ignorance and carelessness than they are aware of. You fail to get money out of your cows by improper feeding and handling, then after you get the milk,a large per cent.is lost by bad manipulation,by having only few if any of the improved dairy implements and no dairy proper. This is to be expected. Stop and reflect whether you can afford to do this any longer. You say that a dairy is costly, and it generally is, but this not the kind that most cotton raisers need. Buy the right sort of dairy goods and a cheap structure will answer your purposes. Boyd's automatic fermenting can and cream ripening vat is what you need. We have tried them both to churn the cream and the milk. Is not your milk carried now from the "cow-pen" to the house cold and the cream on top strain ed into jars and set away to turn, the weather continues cold and the jars are transferred from your faulty cellar or shed room to the family room or kitchen, there to remain two, three, and some times four days? Your wife turns the jar to the fire often during the day and the milk will not turn, all the while it is getting spoiled. She gets disgusted and attempts to churn it, and with a dash churn begins. Generally she knows what to expect. Not having a thermometer, the boiling water is poured in, and something that you call butter is taken out. The fermenting can and cream ripening vat will do away with this,and if you wili visit this Station, as you should, we will convence you on this point. A little money expended for dairy goods will furnish you the means for making agood article of butter and will be a great relief to your over-worked wife.

The actual cost of feeding will vary in different portions of the State. Each farmer knows what he can grow in the section in which he lives.Barley,rye,corn,millet,sorghum, peas, cotton seed and in many sections of our State, the clovers and grasses grow to perfection. Those farmers who intend to increase the number of dairy cattle to 20 to 25 milch cows should by all means build a silo. Corn and pea-vine ensilage is the most nutritous and cheapest feed we have. Try it.

The attention of farmers is called to the following maxims, derived from my own experience and that of other practical dairymen:

Feed your cows twice per day at regular intervals, and have pure water and salt always accessible.

You do not need a dog to drive up dairy cattle.

A dairy cow does not need as much exercise as a trotting horse.

A cow with a good escutcheon and nothing else should be butchered.

A yellow skin we like to see, but it is not always a true index to the color of the butter. The butter from a pale-skin cow is very often yellow.

Your "scrub" cows are averaging you not more that 100 to 125lbs. of butter per year. You should try to double this yield.

The cow likes a variety of food; gratify her taste as often as you can.

The winter dairy pays best, therefore breed the most of your cows in December and January and they will be fresh in September and October following.

Decide on the breed and stick to it.

There are many worthless cows in every breed.

The cow is a machine for the manufacture of milk and butter, and the stomach is the best laboratory in the world for this purpose.

There are many ways to test the richness of a cow's milk besides the churn; and every dairyman should have Dr. Babcock's or some other milk test. The farmer can use the churn if he prefers to do so.

In ordering your dairy goods, the first thing to be put on your list is a thermometer. It is more reliable than your wife's forefinger.

One ounce of salt to the pound of butter is our rule, but always try to salt to please your customers.

It is much better to wash the milk out of the butter while in the churn than to work it out on the worker.

It is impossible for you to be too clean either at the barn or dairy.

Keep your milk out of the kitchen, it absorbs all the bad odors and your customers will complain of the flavor.

Set aside your old dash churn and buy a barrel, swing, or box churn.

Churn your cream when slightly acid, and do not put it off to suit your conveniencc. Here is where you lose money.

Churning temperature 62° in summer, 64° in winter. If you feed much cotton seed in winter you can go to 68° or 70° and it will do no harm. The lower the better.

You cannot make a first-class article of butter by feeding cotton seed alone. They spoil the flavor.

Cotton seed meal, or well steamed cotton seeds, fed in limited quantities in connection with other feed, will do no harm.

The farmers of Alabama can have a succession of green crops almost from one end of the year to the other. Add to this, cotton seed meal, raw cotton seed, and hulls, with good ensilage, they can make butter very cheap.

Raw cotton seed is like the sweet potato, it can be served in many ways. Place a high value on it and learn to feed it the right way, but never to excess.

When the patent butter maker comes around do not let his persuasive tongue induce you to buy a county right to manufacture his butter. He is a fraud, let him alone.

Milk your cows ten months in the year.

Rich food will decrease the quantity of milk, but will increase the amount of butter.

The dairy business is a renovater, a restorer of worn out lands, and an educator of those who engage in it.

BOYD METHOD.

Mr. John Boyd, 199, Lake st., Chicago, Ill., patentee of Boyd process of ripening cream or milk, says: "It consists of making a lactic ferment from sweet skimmed milk taken from a fresh cow or cows, the milk divested of its butter fat, is treated to a warm water bath and brought to a certain required temperature when it is placed in the fermenting can and the vessel closed tightly. In a given time the lactic ferment is ready for use. A small per centage of this ferment is placed in the cream at a required temperature and the cream vat is closed in the same manner as the fermenting can. In so many hours the result is ripe cream, that is, cream of one chemical condition, the operation is uniform, as also is the result. If the rules are strictly obeyed, the operator is at all seasons master of the situation, he has perfect control over the conditions, consequently his work is all done to rule, nothing being left to chance or good luck." I am in no wise interested in the sale of Mr. Boyd's goods. Come to the Station and see them tried before buying.

REPORT
—OF THE—
ALABAMA WEATHER SERVICE,

Co-operating with the U. S. Signal Service.

February, 1891.

STATE POLYTECHNIC INSTITUTE,
Auburn, Ala., March 15th, 1891.

Rain was of frequent occurence during the month of February and very few days were even fair. The weather was very damp and disagreeable and the farming operations were much retarded by the unfavorable condition of the soil for planting.

The average rainfall for the State was 3 .91 inches above the normal.

The lowest range of the temperature recorded by the observers was 17°, at Valley Head, and this cool snap passed over the State on the 26th and 27th. There were a number of warm days, the thermometer recording as high as 80° at several stations, and under the warming influence of the air on those days many trees and other plants put forth flowers and the buds on many more were greatly swollen ready to break forth into leaves and flowers when the cool spell of the 27th stopped their growth and seriously injured some. The average temperature was unusually high, and was 5°.3 above the normal. A light fall of snow occurred on the 26th but melted as fast as it came in contact with the ground.

A low pressure hung over the State most of the month and the atmosphere was often in a condition favorable for violent storms, but the storm tendencies were dissipated as fast as they formed and no violent winds were reported from any quarter of the State,

J. M. QUARLES, P. H. MELL,
Assistant. Director.

MONTHLY SUMMARY.

ATMOSPHERIC PRESSURE (*in inches*).—Monthly mean, 30 .122; maximum observed, 30 .528, at Chattanooga on the 5th; minimum observed, 29 .586, at Montgomery on the 25th; range for the State .942.

TEMPERATURE (*Degrees F.*)—Monthly mean, 54 .5; highest monthly mean, 61 .7 at Citronelle; lowest monthly mean, 47.8, at Valley Head; maximum observed, 83, at Montgomery on the 19th; minimum observed, 17, at Valley Head on the 26th and 27th; range for the State, 66; greatest local monthly range; 60.5, at Jasper; least local monthly range, 48, at Chepultepec.

PRECIPITATION—INCLUDING MELTING SNOW (*in inches*).—Average for the State, 8 .58; greatest, 11 .20, at Auburn; least, 4 .54, at Mobile.

WIND.—Prevailing directon, south; miles traveled, 6530, at Mobile; 5004, at Montgomery; 5374, at Chattanooga; 2990, for 18 days, at Auburn. Mean relative humidity, 77, at Auburn; 84, at Valley Head; 75, at Uniontown.

NOTES FROM OBSERVERS.

Bessemer. (W. H. Swan).—We had some snow to fall on the 26th, but it melted as fast as it fell. The first snowfall during the winter.

Greensboro, (M. H. Yerby).—The great amount of rainy, disagreeable weather was the prevailing feature of the month. There has been no weather for the past two months suitable for farming operations. No plowing of any consequence has been done up to date, or any garden vegetables planted. All out door work has been practically at a standstill.

Jasper. (Howard Lamar).—Plum blossoms on February 16th. February 26th snow fell from 7 a. m. until noon — 0 01 inches melted snow fell.

Livingston. (J. W. A. Wright). The amount of rain this

February, 6 .68 inches, is greater than any February since 1873, when we had in this part of Alabama, 7 .87 inches. In 1884 we had within .20 inches of the rainfall of this February. Added to the rainfall for January, (7 .46 inches) this makes a total of 14 .14 inches since January 1st. This is the heaviest rainfall for January and February for 22 years past, except in 1886, 1884, 1883, and 1869. In each of these years we had about 15 inches of rain in January and February, except in 1884, when the amount was 14 .24 inches.

Though a comparatively warm month, being 5° above the normal, yet it gave us the coldest hour of the winter, 23½° on the 27th. We had ice one-fourth of an inch thick on the 27th as well as on the 4th, the temperature on the latter date falling to 28°.

The cold on the 27th nipped tender vegetation that was beginning to appear, but did nothing like the damage to fruit trees that was done by the extreme cold on March the 2nd, 1890.

A light snow on the 26th, melting as fast as it fell.

Tuscumbia. (L. B. Thornton).—On the 2nd about 11 o'clock at night a thunder cloud with lightning and heavy rain; 1 .78 inches fell. On the 4th the ground was frozen hard and there was plenty of ice. Commenced raining on the 12th at 9 p..m. and discontinued at 9:40 a. m.; rainfall, 1 .35 inches. Thunder cloud at night on the 20th; 26th snow fell but melted as fast as it fell; 28th hailed at 7 a. m.; heavy rain during the day.

TABLE OF SOIL TEMPERATURES—FEBRUARY, 1891.

(The observations for this table were taken at Auburn, Ala.)

A. M. LLOYD, Observer.

NOTE.—There are three sets of themometers. On the 1st of January they were arranged as sollows: One set ranging fron 1 inch to 96 inches was placed in clay soil on the College campus for the purpose of determining the "frost line" among other problems that will require several years of continued observations. The other two sets were left in their former positions, viz.;—One on the hill and the other in the bottom. They were left there to determine the effect produced upon the temperature of the roots of plants by stirring the soil over one set, and permitting the soil to cake over the other.

DEPTH IN INCHES.	SET NO. 1 ON HILL.	SET NO. 2 ON CAMPUS.	SET NO.3 IN BOTTOM.
I	57 .0°	57 .7°	57 .7°
3	56 .5	57 .1	*
6	56 .4	57 .1	*
9	55 .7	56 .2	54 .9
12	55 .6	55 .9	56 .1
24	56 ,3	56 .2	56 .3
36	55 .5	55 ,9	55 .8
48	55 .5	56 .3	56 .6
60	55 .1	*	55 ·9
72		56 .2	
84		56 ,7	
96		57 .5	

* Instruments were broken.

Monthly Summary of Meteorological Reports of the Alabama Weather Service, February, 1891.

Stations.	Counties,	Altitudes	Latitude N	Longitude W.	BAROMETER.					TEMPERATURE.									TotalPreci'tation	Clear Days	Fair Days	Cloudy Days	Days of Rain	Prevailing wind	Names of Observers.
					Monthly Mean	MAX.		MIN.		Monthly Mean	Mean of Max,	Mean of Min.	MAX.		MIN.		Monthly Range	Me'nDaily R'nge							
						Height	Date	Height	Date				Degrees	Date	Degrees	Date									
Valley Head..	DeKalb.......	1031	34 34	85 37			..	......	....	47 8	56 5	39	76	19	17	26—27	59	17 5	9 58	11	9	8	9	S E	E.P.Nicholson
Florence......	Lauderdale...	....	34 48	87 37			..	......	....	....	....	....	....	......	....	......	....	....	....	.	....	....	....	....	C. W. Ashcraft
Chattanooga..	Tennessee....	783	35 03	85 30	30 127	30 528	5	29 653	25	50	58 3	41 2	76	17	21	27	55	17 1	1030	5	14	9	19	S	* L. M. Pindell
Montgomery..	Montgomery .	219	32 22	86 23	30 192	30 432	27	29 586	25	58 5	66 2	50 7	83	19	27	27	56	15 6	8 43	3	5	20	16	E	* L. Dunne
Union Spr'gs	Bullock	516	32 12	85 39	......	......		......	....	....	....	....	....	......	....	......	....	....	....	..	....	....	....	....	R. J. Grady
Bermuda.....	Monroe ,......	....	31 43	87 12	......	......		......	....	58 6	....	....	80	19	25	27	55	....	8 20	..	....	....	13	....	Wm. Fowler
Mobile	Mobile	30	30 41	88 20	30 090	30 433	27	29 662	25	59	65 6	52 4	76	25	30	27	56	13 2	4 54	3	10	15	19	S	* A. Pritchard
Carrollton....	Pickens.......	....	....	....	......	......		......	....	....	....	....	....	......	....	......	....	....	....	..	....	....	....	....	M. L.Stansel.
Auburn	Lee...........	826	32 40	85 30	30 131	30 525	5	29 644	25	56	64 2	47 8	77	19	25	27	52	16 4	1120	6	7	15	13	E	J. M. Quarles
Livingston, ...	Sumter	150	32 34	88 08	30 140	30 430	4	29 770	7-25	56 6	64 6	47 7	80 5	19	23 5	27	57	16 9	6 68	4	6	18	19	N w	J.W A,Wright
Greensboro ...	Hale	220	32 41	87 36	......	......	..	......	....	57	....	....	78	19	24	27	54	....	8 15	.	7	21	13	....	M. H. Yerby
Mt. Willing ..	Lowndes......	....	32 07	86 45	......	......	..	......	....	....	....	....	....	......	....	......	....	....	9 05	..	....	....	....	....	W. M. Garrett
Uniontown ...	Perry	273	32 28	86 48	30 050	30 480	4	29 630	25	55 6	66 2	45 1	79	19	24	27	55	21 1	9 91	..	....	....	13	S	W. H. Newman
Citronelle	Mobile	352	31 03	87 30	......	......	..	......	....	61 7	71 5	52	82	18	24	27	58	19	8 20	9	4	15	16	....	J G Michael
Fayette C H..	Fayette	....	33 42	83 12	......	......	..	......	....	....	....	....	....	......	....	......	....	....	....	..	....	....	....	....	Daniel Collier
Guntersville.,.	Marshall.....	655	34 24	86 18	......	......	..	......	....	....	....	....	....	......	....	......	....	....	....	..	....	....	....	....	A. J. Baker
Chepultepec ..	Blount	890	33 58	86 20	......	......	..	......	....	49 6	50 5	48 6	80	17	32	11	48	2	7 78	..	....	....	7	....	W. B. Allgood
Columbiana ..	Shelby.	560	33 15	86 38	......	......	..	......	....	53 8	63 8	43 8	80	19—20	18	27	62	20	8 31	..	....	....	12	....	W. D,Lovett
Centre	Cherokee,....	728	34 10	85 42	......	......	..	......	....	....	....	....	....	......	....	......	....	....	....	..	....	....	....	....	Thos. Bradford
Double Spr'gs	Winston	....	34 08	85 35	......	......	..	......	....	52	....	44 9	70	17—20	19	27	51	....	1033	9	....	19	14	....	A, M. Weiler
Butler	Choctaw.....	....	32 05	87 24	......	......	..	......	....	....	....	....	....	......	....	......	....	....	....	..	....	....	....	....	B. F. Gilder
Jasper	Walker	310	33 49	88 12	......	......	..	......	....	50 9	60 6	41 2	78 5	19	18	27	60 5	19 4	8 72	5	11	12	14	S	Howard Lamar
Brewton.......	Escambia....	....	.....	87 38	......	......	..	......	....	56 5	62 5	51	81	18	25	27	56	11 1	5 61	..	....	.. .	11	S w	W. J. Holland
Tuscumbia....	Colbert	....	34 42	.....	......	......	..	......	....	50 2	....	....	77	19	22	27	55	....	9 30	6	....	19	11	S w	L. B. Thornton
Bessemer......	Jefferson	....	....	.....	......	......	..	......	....	53 6	61 3	46	80	19	22	27	58	15 3	1010	..	...	....	16	....	W· H. Swan
Mt. Home	Lawrence...	....	.....	.....	......	......	..	......	...	....	....	....	....	......	....	......	....	....	....	..	....	....	....	....	A. J. Weaver
Wiggins.......	Covington...	....	.....	.....	......	......	..	......	...	....	....	....	....	......	....	......	....	..	....	..	....	....	....	....	M. D. Jones
	Averages	....	....	....	30 122	......	..	......	....	54 5	62 4	46 5	....	......	....	......	55 7	15 7	8 58	6	7	15	14	S	

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*Sergeants of the United States Signal Corps.

BULLETIN No. 25. NEW SERIES.

REPORT

—OF—

AGRICULTURAL EXPERIMENT STATION,

Agricultural and Mechanical College,

AUBURN, ALA. - - APRIL, 1891.

Effects on Butter by feeding Cotton Seed and Cotton Seed Meal.

☞The Bulletins of this Station will be sent Free to any citizen of the State, on application to the Director.

Smith, Allred & Co., State Printers and Binders, 24 Commerce St., Montgomery, Ala.

BULLETIN NO. 25.

AGRICULTURAL EXPERIMENT STATION,

Agricultural and Mechanical College,

AUBURN, ALA. - - APRIL, 1891.

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EFFECTS ON BUTTER BY FEEDING COTTON SEED AND COTTON SEED MEAL.

N. T. LUPTON.

THE COMPOSITION OF MILK.

The constituents of milk, as usually stated, are water, butter-fat, casein, milk-sugar, and mineral matter, or ash. The proportions of these constituents, and the quality of the milk, vary with the breed of cattle; the quantity, with the materials upon which they are fed and the treatment to which they are subjected. The average results of the analysis of *seventy* samples of Jersey milk, made in the State Laboratory by Dr. Anderson during the months of February, March, and April, 1889, are as follows:

Water	84.96	Per cent.
Butter Fat	4.95	"
Casein	3.50	"
Sugar	5.84	"
Mineral matter, or Ash	0.75	"
Total	100.00	

The average of *twenty-seven* samples, analyzed during the months of November, December, and January, 1890-91, gave:

Water	84.97
Butter-Fat	4.97
Casein	3.58
Sugar	5 74
Mineral Matter, or Ash	0.74
Total	100.00

These samples from the same herd of registered Jerseys, show in the two series an average composition of remarkable uniformity. The feed-stuffs used were different during the two periods, the latter samples being those analyzed during an investigation of some of the effects produced by feeding on cotton seed and cotton seed meal, to be discussed in a subsequent part of thisBulletin. Johnston and Cameron, in a late edition of their elements of Agricultural Chemistry, give, in the following table, what may be regarded as a fair average composition of milk of different animals, without reference to breed. Jersey milk contains less water than the average here given, and is especially rich in butter-fat:

	Water	Butter-fat	Casein	Sugar	Min'l matter
Cow	87.00	3.80	4.00	4.57	0.72
Goat	86.49	5.69	3.51	3 69	0.62
Ewe	83 03	5.33	6.98	3.94	0.72
Mare	90.36	1.05	1.95	6.24	0.40
Ass	89.01	1.85	3.57	5 05	0.52
Sow	81.76	5.83	6.18	5.33	0.90

CHANGES WHICH MILK NATURALLY UNDERGOES.

The butter-fat consists of small globules, somewhat lighter than water, which rise to the top when milk is allowed to stand, and with a little water and casein, constitute the cream. The agitation of this cream, in the process of churning, causes the fat-globules to cohere and form butter.

The casein is a nitrogenous substance which undergoes spontaneous decomposition on exposure to the air. This decomposition develops a growth, or organism, called a ferment, which changes the milk-sugar into lactic acid and renders the milk sour. The germs of these organisms which cause milk to ferment, are known as bacteria, or microbes and are found abundantly in the air, in water, and also on plants and animals. The casein held naturally in solution, is rendered insoluble by the lactic acid and separates as curd.

THE COMPOSITION OF BUTTER.

Butter consists mainly of the fat found in milk, and, as just stated, is formed by the fat globules which are made to cohere by agitation, as in the operation of churning. More or less water, casein or curd, and salts, are mixed with the butter-fat. The average composition of the best Jersey butter as determined in this laboratory, is as follows:

Fat	86.06
Casein or Curd	1.87
Water	9.61
Salts (chiefly, common salt)	2.46
Total	100.00

When prepared for the market, a small percentage of sodium chloride; or common salt, about one ounce to the pound, is added to impart a desirable taste. Dairymen have long known that consumers of butter prefer that which has a bright yellow or golden color, such as results from feeding on the rich pastures of spring and early summer. To impart this color to butter of lighter shades, a coloring matter known as annatto, is sometimes used. It is gotton from the fruit of a tree that grows in South America, and is said to be harmless.

THE EFFECT OF COTTON SEED AND COTTON SEED MEAL.

An investigation was undertaken in this laboratory, a few months ago, to determine the effect of cotton seed and cotton seed meal on the composition of the butter fat, especially on the volatile acids, the melting point, and the specific gravity of the butter produced.

Several chemists of late years, have called attention to changes produced by the use of the feed-stuffs mentioned, especially Prof. Harrington of the Texas Experiment Station and Dr. Wiley of the Department of Agriculture, Washington D. C. This subject was thought to be of sufficient scientific and practical importance to justify an extended investigation. For this purpose, a herd of registered Jerseys at the Experiment Station, was divided into two groups, one consisting of ten cattle and the other of a single cow. The cattle of group No. 1 were fed for a preparatory period of ten days on the customary ration used at the station, excluding cotton seed meal and hulls, the single cow was fed on the same ration. At the end of the preparatory period, samples of milk and butter were taken for one week, on Monday, Wednesday, and Friday, and carefully analyzed. The milk of the ten cattle composing group No. 1, was mixed and churned as a whole; that of the single cow was kept separate and churned by itself. The first preparatory period was for ten days; after that, the preparatory and experimental periods extended over seven days each.

The daily rations for the different periods which represent the kind and quality of food actually consumed, were as follows:

1st period, preparatory and experimental:

Ground Oats	5 lbs.
Ground Corn	5 "
Bran	5 "
Nutritive Ratio	1:5.8

2d period:

Cotton Seed Meal	3 lbs.
Ground Oats	4 "
Bran	5 "
Ensilage	11 "
Nutritive Ratio	1:3.75

3d period:

Cotton Seed Meal	4 lbs.
Cotton Seed Hulls	9 "
Ensilage	4½ "
Nutritive Ratio	1:5.08

During the fourth period, the cattle were confined exclusively to raw cotton seed and cotton seed hulls; and during the fifth period to cooked cotton seed and cotton seed hulls. They were allowed as much as they would eat. The nutritive ratios mentioned above, are calculated from the following analyses of feed-stuffs used.

In compounding the rations, the object was not so much to conform with strictness to the German standard, as to bring the cows gradually under the influence of cotton seed, cotton seed meal, and hulls without injury to their health.

COMPOSITION OF FEED STUFFS USED AT THE EXPERIMENT STATION.

	Corn.	Oats.	Bran.	C. S. Meal.	Cotton Seed.	Ensilage.	C S. Hulls.
Water....................	14.15	10.55	12.81	8.48	10.11	60.93	12.76
Ash......................	1.20	3.12	5.49	6.47	3 90	2.43	2 94
Crude Protein (albuminoid)	10.36	14.41	17.28	47.72	7.40	3.22	2.78
Ether Extract (Fats & oils.)	3.79	4.67	4.17	8.22	20.77	1.82	2.17
Crude Fibre..............	1.68	10.45	8.02	7.28	24.61	13.76	44.84
Nitrog'n free ext (starch etc)	68.82	56 80	52.23	21.83	33 21	17.84	34.51
	100.00	100.00	100 00	100.00	100.00	100 00	100.00

The results of the analyses of samples of milk and butter, taken immediately after each milking and churning, are given below. The first two tables give the composition of each sample of milk analyzed, also, the volatile acids, melting point, and specific gravity of the butter from the same milk; the third table gives the average composition for each experimental period.

THE COMPOSITION OF JERSEY MILK.

BUTTER FROM THE SAME MILK.

DATE Group I.		WATER Per Cent	BUTTER FAT PerCent	CASEIN Per Cent	SUGAR Per Cent	ASH Per Cent	VOLATILE ACIDS. Expressed in cc one-tenth normal alkali for 5 grains of fat.	MELTING POINT C°	SPECIFIC GRAVITY at 100 °c	RATION
Nov.	19	85.76	5.53	3 95	3.96	0 80	30 0	35°.9	0.90257	Period I. Ground Oats....5lbs " Corn ..5 " " Bran ... 5 "
"	21	84.95	5.20	4 05	5.09	0 81	29.6	35°.3	0.90311	
Dec.	1	84.15	5.73	4.06	5.24	0.82	29.7	36°.0	0.90411	Period II. Cotton Seed Meal.3lbs Ground Oats... 4 " Bran ....5 " Ensilage ....11 "
"	3	83.62	5.51	3 88	6.19	0 80	30.5	36°.3	0 90165	
"	5	84 26	5.16	3 90	5.98	0.80	31.4	36°.1	0.90265	
"	15	84.53	5 96	3.64	5.12	0 75	28.4	36° 6	0 90081	Period III. Cotton Seed Meal.4lbs C. S. Hulls.....9 " Ensilage 4½
"	17	83.35	6.07	3.60	6 03	0 75	26.9	37°.6	0.90194	
"	19	84 71	5.79	3.57	5.19	0.74	27 1	38°.1	0.90306	
Jan.	5	84 27	6.41	3.58	5 01	0 73	22 0	43° 6	0.90021	Period IV. Raw Cotton Seed. Cotton Seed Hulls.
"	7	84.59	6.11	3.34	5 22	0.74	21 9	43°.9	0.89721	
"	9	84.51	5.84	3.56	5.37	0 72	22.4	43°.4	0 89955	
"	19	85 84	4.87	3 39	5.16	0 74	23.1	42° 7	0.90462	Period V. Cooked Cotton Seed. Cotton Seed Hulls.
"	21	84.89	5.95	3.31	5 08	0.77	22.2	42°.3	0 90057	
"	23	85.38	5.53	3 31	5 04	0 74	22.1	43°.0	0 90266	

THE COMPOSITION OF JERSEY MILK. ‖ BUTTER FROM THE SAME MILK.

DATE Group II.		WATER Per Cent	BUTTER FAT Per Cent	CASEIN Per Cent	SUGAR Per Cent	ASH Per Cent	VOLATILE ACIDS Expressed in cc one-tenth normal alkali for 5 grains of fat.	MELTING POINT C°	SPECIFIC GRAVITY at 100°c	RATION
Nov.	24	85.53	4 67	3.84	5.23	0 73	31.4	35°.1	0.90188	Period I. Ground Oats....5 lb " Corn....5 " " Bran....5 "
"	28	84.03	5.93	3.93	5.30	0.81	31.5	33°.4	0.90458	
Dec.	8	85.71	4.75	3.56	5.30	0.68	....	....	....	Period II. CottonSeed Meal.3lbs Ground Oats....4 " Bran ....5 " Ensilage........11 "
"	10	85.68	4 53	3.84	5.24	0 71	31.7	36°.5	0.90282	
"	12	85.63	3.94	3.66	6.02	0.75	30.6	36°.2	0.90022	
"	22	85.26	4.74	3.42	5.86	0.72	25.5	37°.5	0.90192	Period III. CottonSeed Meal.4lbs C. S. Hulls.....9 " Ensilage 4½
Jan.	2	84.31	5.85	3.69	5.42	0.73	25 4	41°.3	0.89798	
"	12	85.17	5 12	3.40	5.60	0.71	20 5	43°.5	0.89751	
"	14	85.10	4 76	3.47	5.98	0.69	19.2	41°.0	0.89929	Period IV. Raw Cotton Seed. Cotton Seed Hulls.
"	16	85.54	4.80	3 34	5.64	0.68	21.4	43°.0	0.89883	
"	26	86.21	4.87	3.13	5.09	0.70	22,0	43°.3	0.89775	Period V. Cooked Cotton Seed. Cotton Seed Hulls.
"	28	86.00	4.88	3.12	5.28	0.72	22.1	43°.3	0.89994	
"	30	85.39	6.00	3.18	4.72	0.71	21.7	44°.0	0.89803	

THE AVERAGE COMPOSITION OF JERSEY MILK. || BUTTER FROM SAME MILK.

PERIOD	WATER Per Cent	BUTTER FAT Per Cent	CASEIN Per Cent	SUGAR Per Cent	ASH Per Cent	VOLATILE ACIDS Expressed in cc one-tenth normal alkali for 5 grains of fat.	MELTING POINT C°	SPECIFIC GRAVITY. At 100°c.
Group I								
I	85.35	5.36	4.00	4.52	0.81	29.8	35°.6	0.90284
II	84.01	5.47	3.95	5.80	0 81	30.5	36°.1	0 90280
III	84.20	5.91	3.60	5.45	0.75	27.5	37°.4	0.90194
IV	84.46	6.12	3.49	5.20	0 73	22.1	43°.6	0.89899
V	85.37	5.45	3.36	5.09	0.75	22 5	42°.7	0.90262
Group II								
I	84.78	5.30	3.89	5.26	0 77	31.4	34°.2	0.90323
II	85.67	4.41	3.69	5.52	0.71	31.1	36° 3	0.90152
III	84.79	5.30	3.37	5.64	0.72	25.45	39°.4	0 89995
IV	85.27	4 89	3.40	5.74	0.69	20.4	42°.5	0.89854
V	85.87	4.92	3.14	5.03	0.71	21.9	43°.5	0 89857

The following table, taken from a record carefully kept at the dairy, gives the aggregate amount of milk and butter produced by group No. 1, consisting of ten cows, for each experimental period of seven days.

	Milk in Pounds.	Butter Pounds.	Pounds of milk for 1 lb. butter.
Period I	1414½	82	17.2
“ II	1275	85½	14.9
“ III	975	91	10.7
“ IV	896	75	11.9
“ V	716	58	12.3

As will be observed, there is a marked falling off in the quantity of milk and a corresponding increase in the amount of butter, produced during the first three periods as the cattle were getting more and more under the influence of cotton seed meal.

During the remaining periods, the quantities of both milk and butter diminished, the ration being confined to cotton seed and cotton seed hulls, without reference to having it well-balanced as a milk ration.

The general effects of these valuable feed stuffs when used in carefully prepared rations will be hereafter investigated; at present, we are concerned only, as previously stated, with their effects on the volatile acids, melting point, and specific gravity of the butter-fat produced under their influence. For these effects, attention is called to the above tabular statements, from which the following conclusions are drawn.

1. The quantity and, to some extent, the quality of milk and butter vary with the feeding.

2. The milk increases in richness, or yield of butter, by the use of cotton seed and cotton seed meal, but diminshes in quantity.

The opinion of some that the quality of butter and milk is not affected by the feed stuff, is not sustained by these experiments.

3. Cotton seed and cotton seed meal increase in a marked degree the melting point of butter, the increase in these experiments, amounting to eight or nine degrees centigrade, and diminish to a corresponding extent, the volatile acids, while the specific gravity remains virtually the same.

The richness of cotton seed meal in albuminoids, or crude protein, renders it of prime importance to mix it with one or more feed stuffs poor in this nitrogenous compound, such as ensilage, hay, or cotton seed hulls.

It may be stated in this connection, that no change was observable in the color of the butter from feeding cotton seed and cotton seed meal. The samples, still in the laboratory, are all of a beautiful golden yellow.

It is proper to state that the analytical work represented in the above tables, was done by Dr. J. T. Anderson, first assistant in the chemical laboratory.

BULLETIN No. 26. NEW SERIES.

REPORT

—OF—

AGRICULTURAL EXPERIMENT STATION,

Agricultural and Mechanical College,

AUBURN, ALA. - - APRIL, 1891.

COMMERCIAL FERTILIZERS.

☞The Bulletins of this Station will be sent Free to any farmer in the State, on application to the Director.

Smith, Allred & Co., State Printers and Binders, 24 Commerce St., Montgomery, Ala.

BULLETIN NO. 26.

AGRICULTURAL EXPERIMENT STATION,

Agricultural and Mechanical College,

AUBURN, ALA. - - APRIL, 1891.

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STATE LABORATORY,
AGRICULTURAL AND MECHANICAL COLLEGE,
AUBURN, ALA., April 1st, 1891.

HON. R. F. KOLB, Com., of Agriculture,
Montgomery, Ala.

DEAR SIR: The following report of analyses of commercial fertilizers and other substances made in the State Laboratory for the Department of Agriculture during the year, from April 1st, 1890 to April 1st, 1891, is respectfully submitted.

Very truly, N. T. LUPTON,
Official chemist,
Department of Agriculture.

Analyses Reported by Dr. N. T. Lupton from April 1890 to October 1, 1890.

PHOSPHATES CONTAINING NITROGEN AND POTASH.

Station No.	NAME OF FFRTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
1596	Troy Perfect Guano	J. M. L. Sansbury, Daleville, Ala.	9.21	0.31	1.32	2 10	1.55	$24 02
1597	Troy Perfect Guano	W. F. Collins, Daleville, Ala	8.98	0.59	1.31	2.24	1.82	24 90
1599	Soluble Sea Island	Howle Bros , Edwardsville, Ala	6.27	2.11	2.79	1.96	1.41	21 62
1600	Southern Ammoniated Dissolved Bone	Howle Bros., Edwardsville, Ala	9.15	1.39	1.88	1.54	2.07	23 83
1603	Rock City Guano	W. R. Hagood, Gurly's Creek, Ala.	6.73	2.36	1.12	1.68	1.35	21 53
1604	Ammoniated Dissolved Bone	Howle Bros., Edwardsville, Ala	7.66	1.16	3.56	1.82	1.75	21 07
1605	Kennesaw High Grade Guano	Howle Bros., Edwardsville, Ala	7.27	2.65	2 25	2.62	2.38	27 47
1606	Georgia State Grange	Howle Bros., Edwardsville, Ala	8.66	1.27	2.73	1.61	2.38	23 63
1608	Fertilizer	W. M. Grey, Kincheon, Ala	7.52	2.08	1.95	2.66	1.84	26 61
1609	Fertilizer	R. N. L. Watson, Fatama, Ala	8.10	1.53	1.81	2.59	1.28	25 72
1612	Alabama Fertilizer	J. M. Brown, Chulafinne, Ala.	6.93	1.67	2.93	2.52	1,32	24 04

1613	Rock City Guano	D. H. Vaughan, Geneva, Ala	7.24	2 52	1.93	2.10	2 26	25 09
1621	Troy Perfect Guano	T. F. Windham, Daleville, Ala	8.79	0.65	1.28	2.24	1.89	24 48
1622	Standard of Columbus, Miss., Oil Mills	Perry C. Guin, Tallulah, Ala	3.68	3.50	1.84	2 59	3.08	23 95
1623	Webb Fertilizer	A. L. West, Gregory, Ala	2.30	0.75	0 34	4.34	1.27	22 76
1625	Southern Ammoniated Dissolved Bone	W. E. Barnett, Germania, Ala	8.40	1.68	1.61	1.68	1.75	23 42
1626	Adair's Guano	O. P. Ford, McFall, Ala	3.24	4.52	5.18	2.17	1.12	21 22
1627	Alabama Fertilizer	J. T. Morgan, Sneed, Ala	8.27	1.77	1.63	2.38	1.63	25 97
1628	Fertilizer No. 1	J. C. Cheney, Montgomery, Ala	7.87	1.82	2.48	2.10	1.60	24 47
1629	Fertilizer No. 2	J. C. Cheney, Montgomery, Ala	6.31	2.76	2.16	1.82	1.50	22 16
1632	Fertilizer No. 1	Albert Elmore, Gordo, Ala	6.33	1.83	1.63	2.52	2.06	26 12
1633	Furman's Fertilizer	W. A. Brown, Cave Springs, Ala	9.00	3.50	3.55	0.21	1.05	21 61
1634	Fertilizer	A. L. Williamson, Chulafinne, Ala	7.26	2.22	2.59	2.52	1.61	25 62
1638	Fertilizer	F. R. King & Co., Leighton, Ala	2.95	3.65	3.59	1.40	1.58	16 96
1639	Standard Fertilizer	F. W. McClure, Fayette C. H., Ala.	2.80	4.55	1.50	3.36	3.49	24 12
1640	Webb Fertilizer No. 1	J. L. Harrison, Bevill's Store, Ala	1.82	0.76	0.37	4.83	0.93	23 60
1641	Webb Fertilizer No. 2	J. L. Harrison, Bevill's Store, Ala	0.93	1.52	2.73	4.90	1.11	23 89
1643	Merriman's Guano	S. A. Flemming, Peak's Hill, Ala	9.67	2.56	1.19	2.38	2.36	30 02

Analyses Reported by Dr. N. T. Lupton from April 1890 to October 1, 1890.

PHOSPHATES CONTAINING NITROGEN AND POTASH.—CONTINUED.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
1644	Fertilizer	Thomas Gilley, Wicksburgh, Ala.	7.66	2.81	2.12	2.10	3.22	$27 11
1645	Furman's Dissolved Bone	J. F. Kelley, Chulafinne, Ala.	7.79	1.51	1.89	1.61	1.54	21 67
1646	Gossypium Guano	G. W. Pitts, Pitt, Ala.	8.22	1.09	1.82	2.66	1.53	25 86
1647	Fertilizer	W. P. Hill, Hillsboro, Ala	8.47	0.84	1.63	2.31	2.14	25 10
1648	Fertilizer	W. W. Griffin, Ragland, Ala.	7.41	2.14	3.39	1.82	1.48	22 91
1649	Fertilizer	J. M. Wester, Ragland, Ala	7.06	2.35	1.86	1.26	1.54	20 66
1650	Alabama Fertilizer	J. T. Adams	6.83	0.88	2.33	2.66	1.48	23 41
1651	Georgia State Standard Guano	E. B. Hollis	8.25	0.82	2.54	1.96	2.63	23 87
1652	Rainbow Soluble Phosphate	W. H. Farr, Wilsonville, Ala	8.14	2.39	2.31	1.68	1.32	23 66
1653	Ammoniated Dissolved Bone	J. H. Crumpton, Hightower, Ala.	9.38	2.42	1.90	1.26	1.17	23 83
1654	Excelsior Guano	J. A. Seymore, Gregory, Ala.	2.86	2.93	0.33	4.34	1.78	27 38

1655	Standard Fertilizer	Perry C. Guin, Tallulah, Ala	3.80	4.02	2.43	2.94	3.14	26 33
1656	Fertilizer	S. C. Cook, Camden, Ala	4.01	4.24	6.32	1.89	1.39	21 12
1657	Rock City Guano	W. H. Guthrie, Logan, Ala	6.96	2.68	1.89	1.05	1.27	19 82
1658	Ammoniated Dissolved Bone	W. H. Guthrie, Logan, Ala	7.35	2.86	2.67	1.12	1.26	20 93
1660	Georgia State Standard	J. R. Davies, Chulafinne, Ala	8.17	1.43	2.97	1.89	2.42	24 21
1661	Alabama State Standard	J. R. Davies, Chulafinne, Ala	7.06	0.43	1.93	2.59	1.59	22 82
1662	Kennesaw High Grade	W. J. Beverly, Rosewood, Ala	6.72	2.61	3.84	1.96	1.79	23 42
1663	Furman's High Grade Guano	W. J. Beverly, Rosewood, Ala	7.70	1.74	2.82	2.45	2.81	26 52
1668	"Guano"	J. W. Hunnicutt, Asheville, Ala	5.93	4.91	1.88	1.54	1.23	23 49
1669	Fertilizer	J. W. Davis, Ragland, Ala	8.29	1.18	1.49	1.33	0.89	20 27
1671	Gossypium Phospho	G. W. Pitts, Pitt, Ala	8.33	1.24	1.77	2.52	1.77	25 94
1672	Standard Fertilizer	Perry C. Guin, Tallulah, Ala	3.39	4.14	2.18	2.38	2.47	23 04
1675	"Guano"	G. Outlaw, Post Oak, Ala	8.00	1.37	2.41	1.19	1.22	19 91
1676	"Georgia Farmer"	J K. Wesson, Peak's Hill, Ala	8.58	0.71	1.38	1.33	1.52	20 63
1679	Standard Fertilizer	B. C. Walker, Barley, Ala	5.26	2.48	2.03	3.92	2.92	29 81
1680	"Merryman"	R. Nation, Blountsville, Ala	7.44	1.29	2.06	2.10	1.40	22 68
1681	Patapsco	R. Nation, Blountsville, Ala	7.23	1.96	2.88	1.82	1.85	22 72

Analyses Reported by Dr. N. T. Lupton from April 1890 to October 1, 1890.

Phosphates Containing Nitrogen and Potash.—continued.

Station No.	Name of Fertilizer.	By Whom Sent.	Phosohoric Acid.			Nitrogen.	Potash.	*Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
1682	Guano No. 1 (dark)	A. J. Brightwell, Preston, Ga	1.26	3.92	4.36	2.20	1.65	$18 00
1683	Guano No. 2 (light)	A. J. Brightwell, Preston, Ga	1.21	3.89	4.42	2.03	1.56	17 12
1685	Old Dominion	A. J. Norton, Edwardsville, Ala	7.48	2.56	1.51	2.03	2 22	25 19
1686	Soluble Sea Island	E. Caffey, Edwardsville, Ala	7.89	1.58	4 12	1.68	2 12	22 87
1688	Alabama Fertilizer	Marks & Gayle, Montgomery, Ala	4.01	4.12	0.87	3.92	2.09	29 56
1692	John M. Greene's Formula	F. M. Meritt, Abbeville, Ala	5.51	2.90	6.96	1.89	2.09	22 07
1693	Fertilizer	F. E. Ashford, Courtland, Ala	5.56	2.75	2.02	2.24	0.66	21 85
1694	Alabama Fertilizer	J. T. Adams, Chulafinne, Ala	6.08	2.29	2.57	2.52	2.05	24 42
1696	Complete Cotton Fertilizer	J. C. Lee, Strickland, Ala	6.45	1.57	3.98	1.26	2.08	19 02
1697	Cherokee Ammoniated Dissolved Bone	J. C. Lee, Strickland, Ala	8.98	1.02	1.21	1.61	1.67	22 94

Analyses Reported by Dr. N. T. Lupton from April 1, 1890, to October 1, 1890.

ACID PHOSPHATES.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Commercial Value.
			Water Soluble	Citrate Soluble.	Acid Soluble.	
1598	High Grade Acid Phosphate	Howle Bros., Edwardsville, Ala	12.36	2.15	1.63	$21 76
1610	Phosphate	J. M. Smith, Key, Ala	11.21	3.97	2.56	22 72
1611	Phosphate	N. A. Dobbs, Pincheon, Ala	11.42	3.60	2.47	22 53
1620	Phosphate	E. Willingham, Buffalo, Ala	10.32	2.21	1.31	18 79
1624	Fertilizer	A. Wilson, Prattville, Ala	11.21	3.02	4.29	21 34
1630	Phosphate	J. S. Pearson, Dixon's Mills, Ala	10.98	1.97	0.66	19 42
1631	Fertilizer No. 2	Albert Elmore, Gordo, Ala	9.69	3.52	4.16	19 81
1636	Phosphate	James H. Cash, Millport, Ala	9.90	2.78	0.77	19 02
1659	Acid Phosphate	W. H. Guthrie, Logan, Ala	11.65	2.81	2.58	21 69
1664	Phosphate No. 1	J. C. Hillburn, Temple, Ala	12.00	2.26	0 90	21 39
1665	Fertilizer	J. C. Hillburn, Temple, Ala	5.95	4.13	1.72	15 12

Analyses Reported by Dr. N. T. Lupton From April 1, 1890, to October 1, 1890.

ACID PHOSPHATES.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID. Water Soluble.	PHOSPHORIC ACID. Citrate Soluble.	PHOSPHORIC ACID. Acid Soluble.	Commercial Value.
1666	Guano	L. C. V. Harrison, Kingsville, Ala	7.20	1.51	1.85	$ 13 06
1667	Acid Phosphate	G. W. Hunnicutt, Ashville, Ala	9.44	3.75	4.24	19 93
1670	Pomona Acid Phosphate	J. S. Newman, Auburn, Ala	13.20	1.87	1.50	22 59
1674	Phosphate	W. H. Richardson, Knoxville, Ala	8.71	4.03	2.44	19 11
1677	Acid Phosphate	J. K. Wesson, Peek's Hill, Ala	9.75	3.15	0.15	19 35
1678	Phosphate	L. P. Chapman, Grove Hill, Ala	12.65	3.15	1.97	23 70
1701	Phosphate	Montgomery Fert. Co., Montgomery, Ala	0.38	0.17	0.02	00 82

Analyses Reported by Dr. N. T. Lupton From April 1, 1890, to October 1, 1890.

MISCELLANEOUS FERTILIZERS.

Sta. No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrog'n	Potash.
			Water Soluble.	Citrate Soluble.	Acid Soluble.		
1601	Swann Island Guano	A. Adams, Mobile, Ala	0 30	4.21	14.77	.....	.....
1602	Cotton Seed Hull Ashes	Columbus Fertilizer Co., Columbus, Ga	....	....	.....	....	28 85
1618	Carib Guano	Ingle & Long, Ark, Ala	....	2 71	23 78	.....	.....
1619	"Fertilizer"	J. C. Webb, Demopolis, Ala	....	1 63	28.56	.....	.....
1635	Carib Phosphate	W. J. Hudson, Mobile, Ala	....	1.31	23.34	.....	.....
1637	Carib Guano	George F. Ellis, Shiloh, Ala	....	2.09	30.18	.....	.....
1642	Swann Island Guano	A. Adams, Mobile, Ala	0 27	4.83	16.48	.....	.....
1673	"Guano No. 3"	McMillan & Harrison, Mobile, Ala	0 09	7.56	14.59	.....	.....
1687	Tankage	Montgomery Fert. Co., Montgomery, Ala	....	....	12.51	7.56	.....
1691	Blood and Tankage	J. H. and J. C. Haas, Montgomery, Ala	....	....	8.98	8.19	.....
1695	Bat Manure	R. P. Glenn, Afton, Ark	....	....	6.72	2.31	.....
1699	Cotton Seed Hull Ashes	Montgomery Fert. Co., Montgomery, Ala	....	....	8 85	.....	23.60
1700	Phosphate Rock	Montgomery Fert. Co., Montgomery, Ala	....	....	1.09	.....	.....
1702	Tankage	McMillan & Harrison, Mobile, Ala	....	....	15 36	6 23	.....

Analyses Reported by Dr. N. T. Lupton From October 1, 1890, to April 1, 1891.

PHOSPHATES CONTAINING NITROGEN AND POTASH.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID. Water Soluble.	PHOSPHORIC ACID. Citrate Soluble.	PHOSPHORIC ACID. Acid Soluble.	Nitrogen.	Potash.	Commercial Value.
1709	Furman High Grade Guano..........	Adair Bros. & Co., Atlanta, Ga	7 14	3 44	1.45	3.15	3.87	$31 52
1711	Adair's Ammoniated Dissolved Bone.	Adair Bros. & Co., Atlanta, Ga..........	7.60	2.85	1.74	3 08	2 74	30 42
1714	Buffalo Bone Guano.................	Adair Bros. & Co., Atlanta, Ga.........	8.23	3 50	0.75	1.75	1.93	26 34
1715	Planters's Soluble Guano	Adair Bros. & Co., Atlanta, Ga.........	5.74	2 86	3.57	2 80	2.63	26 47
1616	Furman Soluble Bone	Adair Bros. & Co., Atlanta, Ga	3.93	3.37	1.58	1 05	1.38	20 92
1717	Troy Perfect Guano	Troy Fertilizer Co., Troy, Ala	7.91	2 31	0 83	2.31	2.60	26 93
1718	Alliance Guano	Troy Fertilizer Co., Troy, Ala......... .	7 14	2.09	1 06	2 24	1.23	23 80
1722	Sea Island Guano...................	Clay Rogers, Talladega, Ala............	3 87	4.24	1.42	1.89	1 38	20 91
1723	Bradley's Ammoniated Dissolved Bone	Bradley Fertilizer Co., Boston, Mass......	6.26	4.01	1 90	1.82	2 69	25 18
1724	Eagle Ammoniated Dissolved Bone..	Bradley Fertilizer Co., Boston, Mass	6.97	3 78	1.51	1 89	2.74	26 23
1725	B. D. Sea Fowl Guano	Bradley Fertilizer Co., Boston, Mass......	8.16	2.39	2 50	1.89	1.34	26 03

1726	Carolina Fertilizer..................	Bradley Fertilizer Co,. Boston, Mass.....	8.56	2.83	1.85	1.96	3.00	27 72
1728	Bradley's Patent Super-phosphate...	Bradley Fertilizer Co., Boston, Mass.....	7 71	2.32	1 49	2.59	1.99	26 85
1730	Ammoniated Guano................	Rasin Fertilizer Co., Baltimore, Md......	7.32	1.88	1.64	2 27	1.80	24 45
1732	Planters's Soluble Bone Guano.......	E. A. Hammett, White Plains, Ala.......	7.68	2.50	2 01	1.85	1.13	23 61
1737	Farmer' Alliance Guano.	Troy Fertilizer Co., Troy, Ala..........	8.04	2 39	0.87	2 24	2.24	26 61
1741	Buffalo Bone Guano.....	Adair Bros. & Co., Atlanta, Ga	8 04	2.60	0.94	2.66	2 74	29 07
1743	Fertilizer..........................	Montgomery Fert. Co., Montgomery, Ala	8 90	1.36	2.29	1.96	2.14	25 17
1746	Complete Cotton Fertilizer.	Commercial Guano Co., Savannah, Ga....	6 91	1.89	2.93	2 10	1.81	23 20
1750	Gossypium Phosphate..............	James Owens, Simpkinsville, Ala........	7.18	1.62	1.45	2.66	2.00	25 52
1751	Ammoniated Dissolved Bone	John Merryman & Co., Maltimore, Md...	7.85	1.96	2.67	1.82	2.13	23 43
1754	Fertilizer..........................	Lister's Agri'l & Chemical Works, N.J...	8.62	3.10	1 64	1 89	0 98	25 93
1755	Ammoniated Dissolved Bone	Patapsco Guano Co., Augusta, Ga........	8.60	2 13	1.02	1.68	2 09	24 66
1756	Patapco Ammoniated Sol. Phosphate	Patapsco Guano Co., Augusta, Ga........	8.06	2 22	0 93	1.89	1.58	24 37
1861	Fertilizer	Montgomery Fert. Co., Montgomery, Ala.	7.75	2.90	2.48	2.20	2 43	26 98
1762	Eufaula Fertilizer	Eufaula Oil & Fertilizer Co., Eufaula, Ala	7.15	1.77	0.98	1.96	1.88	22 90
1769	Samson Guano	Wight, Weslosky & Brown, Albany, Ga..	6.66	2 84	0.38	2.41	1.54	25 18
1770	B. & B. Guano.....................	Wight, Weslosky & Brown, Albany, Ga...	7.00	0.40	1.05	1 57	1.05	18 27

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.—Cont'd.

PHOSPHATES CONTAINING NITROGEN AND POTASH.—CONTINUED.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.	Commercial value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
1771	Southern Am. Bone Super-phosphate	Crocker Fert. Co., Buffalo, N. Y.........	10.06	1.15	1.52	1 47	2.54	$25 08
1772	Southern Dis. Bone Super-phosphate	Crocker Fert. Co., Buffalo, N. Y........	8 90	1.56	1.33	1.89	2.45	25 54
1774	Complete Cotton Fertilizer..........	J. W. Cassady, Midland City, Ala	8 49	0 92	1.82	1 82	1.32	22 62
1775	Etowah Super-phosphate	Maddox, Rucker & Co., Atlanta, Ga......	8 46	2.46	0.15	1.54	1.28	23 66
1776	Southern Ammoniated Dissolved Bone	Maddox, Rucker & Co., Atlanta, Ga.....	7.83	1 56	0.26	2.03	1.60	23 59
1778	Old Dominion Guano	Maddox, Rucker & Co., Atlanta, Ga......	7 21	1.85	0 15	2 52	2 25	25 66
1786	Elephant Guano	Albany Fert. Farm Imp. Co., Albany, Ga	7 14	2.12	0 51	1 96	1.91	23 44
1787	Standard Fertilizer.................	Albany Fert. Co., Albany, Ga.........	7.08	2 15	0.60	1.89	2.29	23 50
1790	Americus Am. Bone Super-phosphate	Williams & Clark Fert. Co., Augusta, Ga	7.75	3 19	2.11	1 82	0 51	24 01
1791	Vandiver's Am. Dis. Bone..........	Montgomery Fert. Co., Montgomery, Ala	10.17	2.37	1.72	1.21	1 26	24 78
1792	Fertilizer	Montgomery Fert. Co., Montgomery, Ala.	8.40	1.56	1.38	2.20	2 76	26 28

1795	Ammoniated Dissolved Bone	Baldwin Fertilizer Co., Savannah, Ga.	7.58	2 11	2.11	1.82	2.45	24 07
1797	Georgia State Grange	Baldwin Fertilizer Co., Savannah. Ga	7.83	3.03	1.65	1.75	2.00	25 11
1798	Edisto Ammoniated Dissolved Bone	Edisto Phosphate Co., Charleston, S. C	7 37	1.98	2.07	2.17	1.77	24 25
1801	Edisto Ammoniated Fertilizer	Edisto Phosphate Co., Charleston, S. C.	6.60	2.32	1.52	2.52	1.38	24 58
1806	Fertilizer	East Alabama Fert. Co., Clayton, Ala	8.64	2.13	0.76	2.45	1 85	27 55
1807	Golden Rod Guano No. 3	South Ala. Oil & Fert. Co., Ozark, Ala.	8.62	2.18	0 62	2 24	2 08	27 01
1808	Golden Rod Guano No. 4	South Ala. Oil & Fert. Co., Ozark, Ala.	8.42	2 34	0 45	2 24	2.35	27 22
1809	Fertilizer	Eufaula Oil & Fert. Co., Eufaula, Ala	9 50	0 58	0 57	2.24	2 33	23 18
1816	Kennesaw B. & B. Compound	Kennesaw Guano Co , Atlanta, Ga.	7 44	4.65	1.71	2.17	1 17	28 26
1819	Kennesaw High Grade Guano	Kennesaw Guano Co , Atlanta, Ga.	6.62	1.84	1.94	2.59	1.87	24 66
1820	Kennesaw Am. Dis. Bone	Kennesaw Guano Co., Atlanta, Ga.	6.81	3.17	0.96	2.66	1.73	27 07
1822	Patapsco Am. Soluble Phosphate	Patapsco Guano Co., Augusta, Ga	8.83	1.87	1.01	1.82	1.85	24 99
1827	B. & B. Guano	Wight, Weslosky & Brown, Albany, Ga	7.85	2.44	1.46	2.24	1.61	25 77
1833	Cotton Seed Meal Fertilizer	Montgomery Fert. Co., Montgomery, Ala	6.24	2.59	1.34	1.68	1.91	21 70
1841	Perfection Guano	McMillan & Harrison, Mobile, Ala	4.99	3.45	0.48	1.96	2.02	22 32
1842	Perfection Guano, "A A"	McMillan & Harrison, Mobile, Ala.	7.48	1.16	0.96	1.47	2.14	20 83
1846	Merryman's Dissolved Bone	East Alabama Fertilizer Co., Clayton, Ala	8.39	1.64	3.14	2.10	1.82	25 05

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.—Cont'd.

PHOSPHATES CONTAINING NITROGEN AND POTASH.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
1848	Home Mixture Guano..............	Columbus Fertilizer Co., Columbus, Ga..	7.68	1.44	0.68	2.12	1.57	$23 71
1850	Alabama Fertilizer................	Alabama Fertilizer Co., Montgomery, Ala	6.52	3.56	1.34	2.38	2.38	26 78
1854	Ashepoo & Eutaw Fertilizer	Ashepoo Phosphate Co., Charleston, S. C.	6.93	3.06	2.70	2.17	1.77	25 21
1855	Ammoniated Guano.................	Lorentz & Ritter, Baltimore, Md	6.91	0.92	2.05	2.10	2.84	22 77
1856	Dissolved Bone with Ammonia......	Lorentz & Ritter, Baltimore, Md..........	7.73	2.83	1.72	0.98	1.61	21 17
1859	Vandiver & Co.'s Am. Dis. Bone Guano	W. F. Vandiver & Co., Montgomery, Ala	5.70	5.90	3.53	2.24	2.31	28 44
1860	Imperial Fertilizer..................	Imperial Fertilizer Co., Charleston, S. C..	7.92	1.85	2.01	1.54	1.24	21 89
1863	Fertilizer..........................	Montgomery Fert. Co., Montgomery, Ala.	4.99	5.11	4.80	1.54	1.53	22 71
1864	Cotton Seed Meal Fertilizer.........	Montgomery Fert. Co., Montgomery, Ala.	4.64	5.34	1.63	2.00	1.45	24 22
1866	Fertilizer..........................	Columbus Oil Mills, Columbus, Miss	7.68	1.92	2.42	2.03	1.17	23 48
1867	Corn and Cotton Fertilizer..........	Cincinnati Desiccating Co., Cincinnati, O.	1.51	14.01	3.16	2.03	2.68	33 84

1869	Lee Fertilizer......................	Lee Fertilizer Works, Opelika, Ala.......	8.58	1.37	1.24	1.96	2.35	24 91
1870	Farmers' Club Fertilizer...........	Lee Fertilizer Works, Opelika, Ala.......	8.54	2.10	3.64	1.61	1.39	23 62
1874	Fertilizer...........................	Blanchard, Humbert & Co., Columbus, Ga	5.14	3.06	2.38	2.97	1.88	25 76
1875	Patapsco Am. Sol. Phosphate........	Patapsco Guano Co., Augusta, Ga........	9.35	1.21	0.67	2.10	1.50	25 53
1880	Fertilizer	J. C. Lee, Midland City, Ala.............	8.97	1.12	1.20	2.10	2.66	25 98
1882	Pure Blood Guano...................	H. C. Fisher, G. M., Newnan, Ga........	9.46	2.16	0.72	2.80	1.72	30 07
1884	Coweta High Grade Guano	H. C. Fisher, G. M., Newnan, Ga........	8.50	1.96	1.11	2.10	3.07	26 95
1885	Animal Bone Fertilizer..............	H. C. Fisher, G. M., Newnan, Ga........	6.20	2.67	3.85	2.10	1.96	23 25
1886	Aurora Ammoniated Phospho.......	H. C. Fisher, G. M., Newnan, Ga........	6.85	2.06	0.88	1.96	3.57	24 57
1888	Woodard's Soluble Guano..........	Coweta Fertilizer Co., Newnan, Ga.......	7.12	3.48	0.65	2.03	2.03	25 84
1889	Reese's Pacific Guano	John S. Reese & Co., Baltimore, Md......	4.56	5.42	1.30	1.89	1.06	23 40
1890	Eutaw Fertilizer	Weil Bros., Opelika, Ala..................	6.68	2.25	3.12	2.10	1.80	23 38
1896	Magnet Soluble Guano	Davis, Marshall & Co., Mobile, Ala	8.25	3.08	0.15	2.07	1.10	26 16
1901	Potato Guano........................	Mobile Phos.& Chem. M'f'g Co., Mobile, Ala	7.69	2.72	0.97	2.66	6.25	32 23
1902	Eclipse Soluble Guano.	Mobile Phos.& Chem. M'f'g Co., Mobile, Ala	11.24	1.74	0.61	1.12	1.32	25 27
1903	Mobile Standard Guano............	Mobile Phos.& Chem. M'f'g Co., Mobile, Ala	9.33	1.33	1.76	2.10	1.14	25 32
1904	Compost..............................	Col. J. S. Newman, Auburn, Ala........	0.42	0.36	11.76	2.32	0.58	.....

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.—Cont'd.

PHOSPHATES CONTAINING NITROGEN AND POTASH.—CONTINUED.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
1907	Excelsior S. Fertilizer	J. C. Webb, Demopolis, Ala	1.78	2.75	1.17	4.76	1.50	$26 85
1908	Fertilizer	J C. Webb, Demopolis, Ala	1.92	4.03	0.42	4.27	1.37	26 94
1909	Imperial Soluble Guano	Smith T. Meadows & Co., Opelika, Ala	8.42	1.95	2.07	1.78	1.03	23 52
1910	Globe Guano	Smith T. Meadows & Co., Opelika, Ala	1.78	6.07	2.74	2.03	1.17	20 87
1912	Pure Bird Guano	Falmar & Sons, Troy, Ala	.....	4.51	7.35	1.40	2.03	14 25
1913	M. G. C. Dissolved Bone	Marietta Guano Co., Atlanta. Ga	8.90	2.81	0.84	1.47	1.37	24 66
1914	P. P. Guano	Marietta Guano Co., Atlanta, Ga	8.04	2.91	0.55	2.10	2.20	26 81
1916	S. S. Guano	Marietta Guano Co., Atlanta, Ga	7.87	3.36	1.63	2.17	1.19	26 49
1919	Fertilizer	Josiah Snider, Little Oak, Ala	6.07	2.67	2.89	2.10	2.67	23 97
1923	Old Dominion Guano	Farmby & Stewart, Spring Garden, Ala	7.79	2.38	1.59	2.24	1.34	25 32
1927	King Cotton Guano	Chattahoochee Fert. Co., Eufaula, Ala	5.76	1.74	1.40	0.21	1.89	21 33

1930	Excelsior Guano....................	Mayfield, Pittman & Co., Roanoke, Ala...	6.04	3.08	2.16	1.54	1.34	20 52
1931	Adair's Ammoniated Dissolved Bone.	Mayfield, Pittman & Co., Roanoke, Ala...	9.61	2.68	0.72	0.70	0.88	22 14
1933	H.H.&Co's Pure Ani B High G Veg F't	Hammond, Hull & Co., Savannah, Ga...	7.48	1.35	1.63	3.50	3.33	30 22
1934	Farmers' Am. Dis. Bone............	Hammond, Hull & Co., Savannah, Ga...	7.68	1.35	2.01	1.68	1.41	21 50
1935	Ga. State Stand. Am. Super-phosphate	Hammond, Hull & Co., Savannah, Ga...	7.30	0.72	3.32	1.68	2.66	21 24
1936	"Old Reliable"...................	Hammond, Hull & Co., Savannah, Ga...	8.04	2.40	1.59	1.68	0.50	22 71
1942	Potent Pacific Guano..............	Southern Phos. Co., Atlanta, Ga.......	8.37	4.75	1.03	1.12	0.89	24 93
1943	Eclipse Soluble Guano..............	Mobile Phos. & Chem. M'f'g. Co., Mobile.	9.07	0.58	2.61	1.75	0.75	22 04
1944	Mobile Standard Guano	Mobile Phos. & Chem. M'f'g. Co., Mobile	8.35	3.69	1.95	1.75	0.95	25 83
1945	East Alabama Fertilizer............	George McDaniel, Cox's Mill, Ala.......	6.98	2.14	0.72	2.80	1.80	25 90
1946	East Alabama Fertilizer............	Daniel Feagin, Clayton, Ala.	8.31	3.12	2.16	1.68	1.40	25 09
1950	"Guano"........................	Crewsville Alliance, Crewsville, Ala	7.66	2.27	1.99	1.89	1.83	23 99
1954	Goulding's Bone Compound.........	W. B. Tucker, Opelika, Ala.............	5.03	2.98	1.59	1.85	1.22	20 44
1957	Home Made Fertilizer..............	L.C. Cooper, Hatchechubbee, Ala.......	6.81	1.11	0.72	1.61	3.30	21 55

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.

PHOSPHATES CONTAINING NITROGEN AND POTASH.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Potash.	Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.		
1703	Guano	W. S. Hilburn, Hightogy, Ala	5.70	2.64	1.65	1.38	$13 89
1710	Farish Furman Formula	Adair Bros. & Co., Atlanta, Ga	6.73	4.04	1.65	2.58	18 73
1740	Farish Furman Formula	Adair Bros. & Co., Atlanta, Ga	8.54	3.27	2.24	3.32	21 03
1757	Patapsco Acid Phosphate	Patapsco Guano Co., Augusta, Ga	10.57	2.85	0.13	0.91	20 92
1794	Acid Phosphate	Imperial Fertilizer Co., Charleston, S. C	11.40	1.90	1.77	1.24	21 19
1800	Edisto Acid Phosphate	Edisto Phosphate Co., Charleston, S. C	12.15	1.41	1.51	1.66	22 00
1921	Bone Ash	Imperial Fertilizer Co., Charleston, S. C	10.21	1.58	1.34	2.65	20 33
1853	Ashepoo Bone Ash	Ashepoo Phosphate Co., Charleston, S C	8.88	3.88	1.88	2.00	21 14
1876	Patapsco Acid Phosphate with Potash	Patapsco Guano Co., Augusta, Ga	9.86	2.98	0.36	1.00	20 26
1897	Acid Phosphate with Potash	Paul Hoffmann, Haverly, Ala	8.33	4.01	2.80	1.90	20 41
1924	Ashepoo Bone Ash	Farmby & Stewart, Spring Garden, Ala	7.44	3.22	1.49	1.33	17 32

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.

ACID PHOSPHATES.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID. Water Soluble.	Citrate Soluble.	Acid Soluble.	Commercial Value.
1712	Adair's Acid Phosphate	Adair Bros. & Co., Atlanta, Ga	12.05	3.66	0.62	$23 56
1713	Furman Acid Phosphate	Adair Bros. & Co , Atlanta, Ga	10.73	4.68	0.15	23 11
1720	Acid Phosphate	Troy Fertilizer Co., Troy, Ala	13.72	2.86	1.27	24 87
1727	Palmetto Acid Phosphate	Bradley Fertilizer Co., Boston, Mass	11.23	3.20	1.02	21 64
1731	Acid Phosphate	Rasin Fertilizer Co., Baltimore, Md	12.08	2.16	0.77	21 36
1739	Acid Phosphate	Rasin Fertilizer Co., Baltimore, Md	11.97	2.59	0.12	21.84
1742	Acid Phosphate	Montgomery Fertilizer Co., Montgomery, Ala	12.26	2.30	3.37	21 84
1752	Acid Phosphate	South Alabama Oil & Fertilizer Co., Ozark, Ala	13.13	2.01	0.56	22 71
1858	Acid Phosphate	Eufaula Oil & Fertilizer Co., Eufaula, Ala	10.04	4.41	1.42	21 67
1760	Acid Phosphate	Montgomery Fertilizer Co., Montgomery, Ala	14.38	1.68	3.69	24 09
1763	Acid Phosphate No. 2	Montgomery Fertilizer Co., Montgomery, Ala	13.84	1.24	5.09	22 62

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.—Cont'd.

ACID PHOSPHATES.—CONTINUED.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.	
1764	Acid Phosphate No. 3	Montgomery Fertilizer Co., Montgomery, Ala	12.53	1.32	7.40	$20 77
1765	Acid Phosphate No. 1	South Alabama Oil & Fertilizer Co., Ozark, Ala	13.13	1.94	0.94	22 60
1766	Acid Phosphate No. 2	South Alabama Oil & Fertilizer Co., Ozark, Ala	12.84	1.68	1.39	21 78
1773	Americus Acid Phosphate	Williams & Clark Fertilizer Co., Augusta, Ga	8.83	6.09	2.18	22 38
1777	Southern Acid Phosphate	Maddox, Rucker & Co., Atlanta, Ga	14.93	1.58	1.71	24 76
1782	Acid Phosphate	Schloss & Kahn, Montgomery, Ala	12.26	2.64	0.69	22 35
1783	Acid Phosphate	M. P. McCarley, Buffalo, Ala	8.02	4.14	3.00	18 24
1788	Acid Phosphate	Albany Fert. & Farm Imp. Co., Albany, Ga	8 73	4.61	0.67	20 00
1793	Dissolved Bone	Imperial Fertilizer Co., Charleston, S. C	12.65	1.42	2.09	21 10
1796	Acid Phosphate	Baldwin Fertilizer Co., Savannah, Ga	13.74	1.02	1.40	22 14
1799	High Grade Acid Phosphate	Edisto Phosphate Co., Charleston, S. C	8.54	5.86	1.24	21 60
1803	Acid Phosphate	East Alabama Fertilizer Co., Clayton, Ala	13.53	1.06	0.76	21 88

1813	Acid Phosphate	South Alabama Oil & Fertilizer Co., Ozark, Ala	12.55	2.28	0.69	22 24
1817	Kennesaw High Grade Acid Phosphate	Kennesaw Guano Co., Atlanta, Ga	9.96	2.33	2.57	18 43
1818	Patapsco Acid Phosphate	Patapsco Guano Co, Augusta, Ga	10.44	3.55	0.19	20 98
1845	Acid Phosphate	East Alabame Fertilizer Co., Clayton, Ala	12.90	1.73	1.51	21 91
1847	Magnet Acid Phosphate	Davis, Marshall & Co., Mobile, Ala	12.96	1.06	0.76	21 03
1849	Soluble Bone	Columbus Fertilizer Co., Columbus, Ga	11.80	1.36	0.76	19 74
1851	Acid Phosphate	Kennesaw Guano Co., Atlanta, Ga	12.57	3.02	0.61	23 38
1852	Ashepoo & Eutaw Acid Phosphate	Ashepoo Phosphate Co., Charleston, S. C	10.65	3.06	1.97	20 56
1857	Diamond Soluble Bone Phosphate	W. F. Vandiver & Co., Montgomery, Ala	10.21	6.07	2.78	24 22
1858	High Grade English Phosphate	W. F. Vandiver & Co., Montgomery, Ala	11.79	4.39	2.32	24 27
1861	Acid Phosphate	W. F. Vandiver & Co., Montgomery, Ala	8.94	5.39	1.66	21 49
1868	Acid Phosphate	Trawick & Jernigan, Opelika, Ala	12.07	2.40	1.40	21 70
1871	Acid Phosphate	Mobile Phos. & Chem. M'f'g Co., Mobile, Ala	12.67	1.50	0.15	21 25
1878	Woodard's High Grade Acid Phosphate	Coweta Fertilizer Co., Newnan, Ga	10.59	4.58	2.07	22 75
1881	Eutaw Acid Phosphate	S. L. Burdeshaw, West Point, Ga	8.07	3.90	3.48	17 95
1891	Eutaw Acid Phosphate	Weil Bros., Opelika, Ala	6.87	4.52	3.45	17 08
1893	Acid Phosphate	Col. J. S. Newman, Auburn, Ala	12.88	2.02	2.53	22 35

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ACID PHOSPHATES.

Sta. No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Commerc'l Value.
			Water Sol.	Citr'te Sol.	Acid Sol.	
1911	Woodard's Acid Phosphate............	J. T. Seay, Fernbank, Ala........................	12.44	1.57	2.07	$21 01
1915	Piedmont Acid Phosphate.............	Marietta Guano Co., Atlanta, Ga................	11.73	2.17	0.59	20 85
1920	Acid Phosphate.......................	Josiah Snider, Little Oak, Ala....................	10.04	2.13	6.62	18 25
1821	Ashepoo Phosphate	Farmby & Stewart, Spring Garden, Ala...........	6.88	7.80	1.44	22 02
1822	Southern Phosphate	Farmby & Stewart, Spring Garden, Ala...........	12.76	2.74	0.19	23 25
1926	Nation Guano (Phosphate)..............	H. E. Eddins, Tuscaloosa, Ala............	11.64	2.55	1.26	21 43
1928	Acid Phosphate.......................	Chattahoochee Fertilizer Co., Eufaula, Ala..	9.08	2.50	1.78	17 37
1937	Acid Phosphate.......................	Columbus Oil Mills, Columbus, Miss...............	12.57	3.08	1.09	23 47
1938	Georgia State Standard Acid Phosphate..	Hammond, Hull & Co., Savannah, Ga............	10.40	3.81	1.26	21 31
1948	Edisto Dissolved Bone.................	Edisto Phosphate Co., Charleston, S. C	10.33	3.48	2.60	20 71
1949	Acid Phosphate.......................	Crewsville Alliance, Crewsville, Ala..............	11.59	3.56	1.78	22 72
1952	Acid Phosphate "A"	Atkeison & Pearson, Atkeison, Ala..............	11.57	3.41	2.16	22 47
1953	Acid Phosphate "P"	Atkeison & Pearson, Atkeison, Ala...............	11.09	3.69	2.07	22 17

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.

MISCELLANEOUS FERTILIZERS.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.
			Water Soluble.	Citrate Soluble.	Acid Soluble.		
1719	Phosphate Rock	Troy Fertilizer Co., Troy, Ala	.....	.....	22.08	....	.....
1721	Tankage	Troy Fertilizer Co., Troy, Ala	....	....	0.76	9.94	.....
1729	Bone Meal	Crocker Fertilizer Co., Buffalo, N. Y	.....	..	27.64	2.38	.....
1733	Tankage	Montgomery Fertilizer Co., Montgomery, Ala	.....	....	12.19	6.23	.....
1734	Natural Phosphate	H. A. Phares, Yalaha, Fla	....	.....	35.20	.....	.....
1735	Natural Phosphate	H. A. Phares, Yalaha, Fla	....	.....	25.01	.....	.....
1736	Natural Phosphate	H. A. Phares, Yalaha, Fla	....	.....	31.77	.....	.....
1838	Con. Tankage	Troy Fertilizer Co., Troy, Ala	.....	....	1.52	10.22	.....
1744	Tankage	J. W. Humphrey, Mobile, Ala	....	....	15.36	9.19	.....
1745	Dried Blood	J. W. Humphrey, Mobile, Ala	....	....	0.76	13.40	.....
1747	Swan Island Guano	A. Adams, Mobile, Ala	....	16.77	11.88	....	.....

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.

MISCELLANEOUS FERTILIZERS.—CONTINUED.

Stat. No	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.
			Water Sol.	Citr'te Sol.	Acid Sol.		
1748	Crocker's Pure Bone Meal	C. L. Dean & J. J. Robinson, Lafayette, Ala	....	....	30 18	1 96	.....
1749	Cotton Seed Meal	Montgomery Fertilizer Co., Montgomery, Ala	....	....	3 25	7.42	1.38
1753	Cotton Seed Meal	South Alabama Oil & Fertilizer Co, Ozark, Ala	.....	....	3.03	7.42	1.79
1759	Muriate Potash	Eufaula Oil & Fertilizer Co., Eufaula, Ala	....	....	....	....	49.04
1767	Caribbean Phosphate	R. A. Finche, Mobile, Ala	.....	4 83	15.93	.....	.....
1768	Dried Blood	R. A. Finche, Mobile, Ala	.....	....	0 48	7.01	.....
1779	Muriate Potash "J. R."	East Alabama Fertilizer Co., Clayton, Ala	....	.....	...	.....	51.81
1780	Muriate Potash "J. S."	East Alabama Fertilizer Co., Clayton, Ala	....	....	.....	....	50 95
1781	Muriate Potash "C. C. B."	East Alabama Fertilizer Co., Clayton, Ala	....	....	......	.....	50.66
1784	Muriate Potash No. 1	South Alabama Oil & Fertilizer Co., Ozark, Ala	.....	.....	.....	....	50.69
1785	Muriate Potash No. 2	South Alabama Oil & Fertilizer Co., Ozark, Ala	.....	......	.....	.....	50.57
1789	Muriate Potash	Eufaula Oil & Fertilizer Co., Eufaula, Ala	......	.....	......	....	51.86
1801	Muriate Potash	East Alabama Fertilizer Co., Clayton, Ala	.....	......	......	....	49.99

1805	Cotton Seed Meal	East Alabama Fertilizer Co., Clayton, Ala	....	.....	3.23	7.56	1.99
1810	" Fertilizer "	Mountain & Son, Mobile, Ala	....	2.69	3.45	3.92	.....
1811	Cotton Seed Meal No. 6	South Alabama Oil & Fertilizer Co., Ozark, Ala	....	....	3.09	7 21	1.76
1812	Cotton Seed Meal No. 7	South Alabama Oil & Fertilizer Co., Ozark, Ala	....	......	3.03	7 35	1.87
1814	Muriate Potash	South Alabama Oil & Fertilizer Co., Ozark, Ala	......	......	....	.....	51 97
1815	Caribbean Guano	L. H. Davis, Biler, Ala	.....	4.41	28.01	.....	.....
1823	Tankage	J. H. & J. C. Haas, Montgomery, Ala	....	......	9 98	7.07	.....
1824	Muriate Potash " E. B. E."	East Alabama Fertilizer Co., Clayton, Ala	....	...	....	....	50.71
1825	Muriate Potash " U. B. E."	East Alabama Fertilizer Co., Clayton, Ala	....	....	......	....	50.83
1826	Muriate Potash " O. B. E."	East Alabama Fertilizer Co., Clayton, Ala	......	....	.....	......	51.37
1828	Tankage	Columbus Fertilizer Co., Columbus, Ga	......	......	19.37	5.60	......
1829	Tankage No. 1	Montgomery Fertilizer Co., Montgomery, Ala	......	.....	11.65	7.63	.....
1830	Tankage No. 2	Montgomery Fertilizer Co., Montgomery, Ala	......	.....	7.83	6 65	.. ...
1831	Tankage No. 3	Montgomery Fertilizer Co., Montgomery, Ala	......	.....	6.39	7 42	......
1832	Tankage No 4	Montgomery Fertilizer Co., Montgomery, Ala	....	......	9.73	6.72	......
1835	Cotton Seed Meal	East Alabama Fertilizer Co., Clayton, Ala	......	......	3 50	7.35	2.20
1836	Pure Bone Meal	F. D. Tinsley, Selma, Ala	......	......	23 98	2.31	......

Analyses Reported by Dr. N. T. Lupton from October 1, 1890, to April 1, 1891.

MISCELLANEOUS FERTILIZERS —CONTINUED.

Stat. No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrogen.	Potash.
			Water Sol.	Citr'te Sol.	Acid Sol.		
1837	Ground Bone	F. D. Tinsley, Selma, Ala	....	....	26.88	3.43	....
1838	Bone & Blood Fertilizer	F. D. Tinsley, Selma, Ala	....	....	16.87	5.39	.....
1839	Pure Dissolved Bone	F. D. Tinsley, Selma, Ala	0.74	14.62	7.37	2.38	.....
1840	Tankage	Columbus Fertilizer Co., Columbus, Ga	....	.....	18.12	5.95	.....
1843	Tankage No. 1 (St. Louis)	Columbus Fertilizer Co., Columbus, Ga	....	.....	9.96	7 21	.....
1844	Tankage (Kansas City)	Columbus Fertilizer Co., Columbus, Ga	....	......	14.67	6.86	.....
1862	Liverpool Tankage	J. H. & J. C. Haas, Montgomery, Ala	....	......	7.50	7 00	......
1865	Tankage No. 6	Montgomery Fertilizer Co., Montgomery, Ala	.....	......	14.40	5.95	......
1872	Cotton Seed Meal (prime)	Col. J. S. Newman, Auburn, Ala	......	.....	......	7 42	......
1873	Cotton Seed Meal "Off"	Col. J. S. Newman, Auburn, Ala	......	.....	......	5.53	......
1877	Natural Phosphate	J. T. Moses, Montgomery, Ala	......	......	19.35	....	......
1878	Tankage No. 1	Columbus Fertilizer Co., Columbus, Ga	......	.....	14.64	6.37	......
1879	Tankage No. 2	Columbus Fertilizer Co., Columbus, Ga	......	.....	18.58	5.18	.....

1883	Cotton Seed Meal	Huntsville Fertilizer & Milling Co., Huntsville, Ala	.....	.....	2.73	6.93	1.57
1892	"Guano"	Pauline & Warley, Mobile, Ala	.....	4 80	15.12	.....	.....
1894	Sodium Nitrate	Col. J. S. Newman, Auburn, Ala	.....	....	......	15.19	.....
1895	Muriate Potash	Col. J. S. Newman, Auburn, Ala	.....	.....	.....	.....	52.31
1898	Cotton Seed Meal	Paul Hoffman, Waverly, Ala	.....	.....	2.80	7.14	1 04
1899	Swan Island Guano	A. Adams & Co., Mobile, Ala	.....	6 82	15.22	.....	.....
1900	Swan Island Phosphate Rock	A. Adams & Co., Mobile, Ala	.....	....	22.03	.....	.....
1918	Concentrated Tankage	Troy Fertilizer Co., Troy, Ala	.....	.....	0 92	11.69	.....
1925	Desiccated Tankage (Kainite)	Col J. S. Newman, Auburn, Ala	.....	.....	.....	.....	21.50
1929	Cotton Seed Meal	Southern Cotton Oil Co.. Montgomery, Ala	.....	.....	2.99	7.21	1.42
1932	Tankage	J. Steiner & Sons, Greenville, Ala	.....	....	15 22	6.02	.....
1939	Cotton Seed Meal No 1	Marks & Gayle, Montgomery, Ala	.....	.....	3.64	7.21	1.84
1940	Cotton Seed Meal No. 2	Marks & Gayle, Montgomery, Ala	.....	.....	3 23	6.71	1 31
1941	Cotton Seed Meal No. 3	Marks & Gayle, Montgomery, Ala	.....	.....	3 20	7.00	1.59
1947	Ashes from Coke Furnace	S. W. Riddie, Gadsden, Ala	.....	.....	0.76	.....	22.07
1951	Phosphate Rock	J. T. Moses, Montgomery, Ala	.....	.....	30.72	.....	.....
1955	Tankage	Montgomery Fertilizer Co., Montgomery, Ala	.....	.....	19.00	4.90	.....
1956	Dried Blood	Montgomery Fertilizer Co., Montgomery, Ala	.....	.....	.....	12 39	.....

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTUR'D.	Weight of Package.	GUARANTEED ANALYSIS.					Commercial Value.
	NAME.	ADDRESS.					Phosphoric Acid.				
						Nitrog'n	Water Soluble.	Citrate Soluble.	Acid Soluble.	Potash.	
Rome C. & C. Guano	The Rome Chem. Co	Rome, Ga	Rome Chemical Co	Rome, Ga	200	2 %	6 %	2 %	1 %	1 %	$20 80
Dis. Bone with Am. and Potash	The Rome Chem. Co	Rome, Ga	Rome Chemical Co	Rome, Ga	200	1	6	2	1	1	16 90
Ammoniated Dissolved Bone	No Western Fert. Co	U. S. Y., Chicago	No-West'n Fert. Co	U. S. Y., Chicago	200	1.75	2.20	5.80	....	0.50	19 33
National Bone Dust	No-Western Fert. Co	U. S. Y., Chicago	No-West'n Fert. Co	U. S Y., Chicago	200	1.75	2.20	5.80	...	0.50	19 33
Standard Guano	Albany Fert.&F.I.Co	Albany, Ga.	Albany Ft & Im Co	Albany, Ga.	200	2.75	6	1.50	1.25	1.60	23 58
Standard Guano	Albany Fert.&F.I.Co	Albany, Ga	Albany Ft & Im Co	Albany, Ga.	200	2.75	6	1.50	1.25	1.60	23 58
Tinsley's Standard Fertilizer	Tinsley Fertilizer Co	Selma, Ala	Tinsley Fert. Co.	Selma, Ala	200	2	8	1	2	.....	21 30
Tinsley's Stand. Acid Phosphate	Tinsley Fertilizer Co	Selma, Ala	Tinsley Fert. Co	Selma, Ala.	200	...	10	3	2	....	19 50
Troy Perfect Guano	The Troy Fert. Co.	Troy, Ala	The Troy Fert. Co	Troy, Ala	200	1.75	7	1	..	1	19 83
Farmers' Alliance Guano	The Troy Fert. Co.	Troy, Ala	The Troy Fert. Co	Troy, Ala	200	1.75	7	1	....	1	19 83
Pike County Guano	The Troy Fert. Co.	Troy, Ala	The Troy Fert. Co	Troy, Ala	200	1.75	7	1	..	1	19 83
The Troy Acid Phosphate	The Troy Fert. Co.	Troy, Ala	The Troy Fert. Co	Troy, Ala	200	..	10	2	..	....	18 00
Farmers' High Grade Guano	Adair Bros. & Co.	Atlanta, Ga	Furman F'm Im Co	Atlanta, Ga	200	2.25	7.50	2.50	2	1.50	25 28
Buffalo Bone Guano	Adair Bros. & Co.	Atlanta, Ga	Furman F'm Im Co	Atlanta, Ga.	260	2	7.50	2.50	2	1	23 80
Farmers' Sol. B. with Am. & Pot	Adair Bros. & Co.	Atlanta, Ga	Furman F'm Im Co	Atlanta, Ga	200	0.85	8	3	2	1	20 82
Farnish Furman Formula	Adair Bros. & Co.	Atlanta, Ga	Furman F'm Im Co	Atlanta, Ga.	200	....	8	3	2	2.50	19 00
Furman's Acid Phosphate	Adair Bros. & Co.	Atlanta, Ga	Furman F'm Im Co	Atlanta, Ga	200	..	11	2	2	...	19 50
Adair's Am. Dis. Bone	Adair Bros. & Co.	Atlanta, Ga.	Adair Bros. & Co	Atlanta, Ga.	200	2	7	3	2	1	23 80
Planters' Soluble Guano	Adair Bros. & Co	Atlanta, Ga	Adair Bros. & Co	Atlanta, Ca	200	1.85	7	3	2	1	23 22
Adair's Acid Phosphate	Adair Bros. & Co.	Atlanta, Ga.	Adair Bros. & Co	Atlanta, Ga.	200		11	2	2	.....	19 50
Ammoniated Dissolved Bone	Baldwin Fertilizer Co	Savannah, Ga.	Baldwin Fert. Co.	Port Royal, S. C	200	1.75	8	2	1.50	2	23 83
Georgia State Grange Fertilizer	Baldwin Fertilizer Co	Savannah, Ga.	BaldwinFert. Co.	Port Royal, S. C	200	1.75	8	2	1.50	2	23 83
Georgia State Grange Acid Phos	Baldwin Fertilizer Co	Savannah, Ga.	Baldwin Fert. Co.	Port Royal, S. C	200	...	10	2	2	...	18 00
Bone and Potash	Baldwin Fertilizer Co	Savannah, Ga.	Baldwin Fert. Co.	Port Royal, S. C	200		9	2	1.50	4	20 50
Bone Compound	Baldwin Fertilizer Co	Savannah, Ga.	Baldwin Fert. Co.	Port Royal, S. C	200	1.75	8	2	1.50	.....	21 83

Ga. State Stand. Am. Supe-Phos	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	SavGa & Pt Ro'l	200	1.65	7	1	1	2	20 44
Ga. State Stand. Am. Super-Phos	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	167	1.35	7	1	1	2	20 44
Port Royal Cotton Fertilizer	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	1.65	7	1	1	2	20 44
Oglethorpe Am. Dis. Bone	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	1.65	7	1	1	2	20 44
Forest City Am. Dis. Bone	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	1.65	7	1	1	2	20 44
Hardee's Cot. Boll Am. Sup-phos	Hammond, Hull & Co	Savannah, Ga	Ga Ft Co&Pt R'l Ft	Sav Ga & Pt Ro'l	200	1.65	7	1	1	2	20 44
Crescent Bone Fertilizer	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	1.65	7	1	1	2	20 44
Farmers' Am. Dis. Bone	Hammond, Hull & Co	Savannah, Ga	Ga Ft Co&Pt R'l Ft	Sav Ga & Pt Ro'l	200	1.65	7	1	1	1	19 44
Alliance Am. Dis. Bone	Hammond, Hull & Co	Savannah, Ga	Ga Ft Co&Pt R'l Ft	Sav Ga & Pt Ro'l	200	1.65	7	1	1	1	19 44
So. Ca. Am. Dis. Bone	Hammond, Hull & Co	Savannah, Ga	Ga Ft Co&Pt R'l Ft	Sav Ga & Ft Ro'l	200	1.65	7	1	1	0.10	18 54
Old Reliable	Hammond, Hull & Co	Savannah, Ga	Ga Ft Co&Pt R'l Ft	Sav Ga & Ft Ro'l	200	1.65	7	1	1	0.10	18 54
H H & Co's P An B, H G Veg Fert	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	5	7	1	1	5	36 50
Georgia Stand. Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	....	10	2	1	.....	18 00
Crescent Bone Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	....	10	2	1	.....	18 00
Forest City Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	....	10	2	1	......	18 00
Ga. State Stand. Dis. Bone Phos	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	..	10	2	1	.....	18 00
Port Royal Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	..	10	2	1	....	18 00
Port Royal Dis. Bone Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	...	10	2	1	.....	18 00
Oglethorpe Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	..	10	2	1	....	18 00
Cotton Boll Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	...	10	2	1	....	18 00
Oglethorpe Dis. Bone Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	...	10	2	1	....	18 00
Genuine German Kainit	Hammond, Hull & Co	Savannah, Ga	Imported	Germany	200	..	.....		...	11	11 00
Georgia Fertilizer	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	1.65	7	1	1	2	20 44
Manley, Handley&Co's Am Dis B	Hammond, Hull & Co	Savannah, Ga	Georgia Fert. Co	Savannah, Ga	200	1.65	7	1	1	1	19 44
Manley, Handley&Co's XX Ac Ph	Hammond, Hull & Co	Savannah, Ga	Georgia Fert Co	Savannah, Ga	200	..	10	2	1	....	18 00
Georgia Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Sav Ga & Pt Ro'l	200	...	10	2	1	....	18 00
Tillis' English Acid Phosphate	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	....	200		10	2	1	....	18 00
Manley, Handley&Co's Am Dis B	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Savannah, Ga	200	1.65	7	1	1	1	19 44
Manley, Handley&Co's XX Ac Ph	Hammond, Hull & Co	Savannah, Ga	Ham'nd, Hull & Co	Savannah, Ga	200	..	10	2	1	......	18 00
Ammoniated Dissolved Bone	John Merryman & Co	Baltimore, Md	J. Merryman & Co	Barren Isla'd, N Y	167	1.65	6	2	3	1	19 44
Georgia Test Guano	John Merryman & Co	Baltimore, Md	J. Merryman & Co	Barren Isla'd, N Y	167	1.65	6	2	3	1	19 44
High Grade Acid Phosphate	John Merryman & Co	Baltimore, Md	Wappoo Mills	Charleston, S. C	200	..	10	1	1	.....	16 50
Walton Guano	Walton Guano Co	Social Circle, Ga	Walton Guano Co.	Social Circle, Ga	200	2	7	2	2	1	22 30
Walton Acid Phosphate	Walton Guano Co	Social Circle, Ga	Walton Guano Co.	Social Circle, Ga	200	..	10	3	2	.....	19 50

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers.—Cont'd

Name of Fertilizer or Chemical.	By Whom Reported.		By Whom Manufactured.	Where Manufactur'd	Weight of Package.	Guaranteed Analyses.					Commercial Value.
	Name.	Address.				Nitrog'n	Phosphoric Acid.			Potash.	
							Water Soluble.	Citrate Soluble.	Acid Soluble.		
Pride of Tennessee	Walton Guano Co.	Social Circle, Ga	Walton Guano Co	Social Circle, Ga	200	2	7	2	2	1	$22 30
Clover Leaf	Walton Guano Co.	Social Circle, Ga	Walton Guano Co	Social Circle, Ga	200	1	8	2	2	1	19 90
Pure Dissolved Bone	Walton Guano Co	Social Circle, Ga	Walton Guano Co	Social Circle, Ga	200	....	10	3	2	1	20 50
Americus Guano	Americus Guano Co	Americus Ga	Americ's Guano Co	Americus, Ga.	200	2	7	2	2	1	22 30
Eddystone Soluble Guano	Americus Guano Co	Americus, Ga	Americ's Guano Co	Americus, Ga	200	2	7	2	2	1	22 30
John M. Green's Formula	Americus Guano Co	Americus, Ga	Americ's Guano Co	Americus, Ga	200	2	7	2	2	1	22 30
Americus Dissolved Bone	Americus Guano Co	Americus, Ga	Americ's Guano Co	Americus, Ga	200	....	10	3	2	....	19 50
John M. Green's Soluable Guano	Atlanta Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga	200	2	7	2	2	1	22 30
Eddystone Soluble Guano	Atlanta Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga	200	2	7	2	2	1	22 30
Atlanta Am. Super-Phosphate	Atlanta Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga	200	2	7	2	2	1	22 30
Rainbow Soluble Phosphate	Atlanta Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga	200	1	8	2	2	1	19 90
Sunny South Acid Phosphate	Atlanta Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga	200	.....	10	3	2	.....	19 50
Atlanta Soluble Bone	Atlanta Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga.	200	....	10	3	2	....	19 50
Berkeley Acid Phosphate	Berkeley Phos Co	Charleston, S. C	Berkeley Phos Co.	Ashley Junct,S C	200	....	9	1	2	1.5	16 50
Berkeley Dissolved Bone	Berkeley Phos Co	Charleston, S. C	Berkeley Phos Co.	Ashley Junct,S C	200	.....	10.50	1.50	2	....	18 00
Berkeley Soluble Guano	Berkeley Phos Co	Charleston, S. C	Berkeley Phos Co.	Ashley Junct,S C	200	2.06	7	1	2	1.5	21 53
Berkeley Am. Dis. Bone	Berkeley Phos Co	Charleston, S. C	Berkeley Phos Co.	Ashley Junct,S C	200	1.05	7	1	2	1 5	17 60
Penn & Co's Alli. H. G. Ac. Phos	Berkeley Phos Co	Charleston, S. C	Berkeley Phos Co.	Ashley Junct.S C	200	......	10.50	1 50	..	....	18 00
Penn & Co's Dis. Bone Acid Phos	Berkeley Phos Co	Charleston, S. C	Berkeley Phos Co.	Ashley Junct,S C	200	....	9	1	...	1.50	16 50
Penn & Co's Am. Fertilizer	Berkeley Phos Co	harleston, S. C	Berkeley Phos Co.	Ashley Junct,S C	200	1.05	7	1	.	1	17 60
Gossypium Phospho	G W Scott M'f'g Co	Atlanta, Ga	G W Scott M'g Co	Atlanta, Ga	200	2	6	3	1	1.50	22 80
Scott's Animal Am. Guano	G W Scott M'f'g Co	Atlanta, Ga	G W Scott M'g Co	Atlanta, Ga	200	1 65	6	3	1	1	20 94
Hansell's State Standard	G W Scott M'f'g Co	Atlanta, Ga	G W Scott M'g Co	Atlanta, Ga	200	1.65	6	3	1	1	20 94
Scott's Potasso Phospho	G W Scott M'f'g Co	Atlanta, Ga	G W Scott M'g Co	Atlanta, Ga	200	....	7	5	1	2	20 00
Scott's High Grade Acid Phos	G W Scott M'f'g Co	Atlanta, Ga	G W Scott M'g Co	Atlanta, Ga	200	......	7.50	5.50	1	.....	19 50

Montgomery Blood & Bone Fert.	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	2	7	2	1	2	23 30
Sea Gull Soluble Guano	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	2	7	2	1	2	23 30
Alliance Am. Dis. Bone	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	1.75	6	2	1	1	19 83
High Grade Acid Phosphate	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	.....	11	2	1	....	19 50
High Grade Dis. Bone	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	....	11	2	1	..	19 50
Vandiver's Am. Dis. Bone	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	.8750	7	2	1	1	17 91
L. & L. High Grade Dis. Bone	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	......	11	2	1	....	19 50
Dowlings Alkaline Guano	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	1 23	6	2	1	3	19 80
Our Cotton King Guano	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	1	7	2	1	1	18 40
Alliance Soluble Guano	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	1.65	7	2	1	1	20 94
Ammoniated Dissolved Bone	Montgom'y Fert. Co	Montgomery, Ala	Mont. Fert. Co.	Montgomery, Ala	200	1	7	2	1	1	18 40
Our Dissolved Bone Phosphate	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	....	10	2	1.50	.....	18 00
Chatham Acid Phosphate	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	....	10	2	1 50	.....	18 00
Pomona Acid Phosphate	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	.....	10	2	1 50	..	18 00
Georgia Bone Compound	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co	Savannah, Ga	200	....	9	1	1 50	2	17 00
Cherokee Ammoniated Bone	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	1 65	7	1	1.50	1	19 44
Climax Guano	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	1 65	7	1	1.50	1	19 44
Old Time Guano	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	1 65	7	1	1.50	1	19 44
The Complete Cotton Fertilizer	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	1.65	7	1	1 50	1.50	19 44
Chatham Guano	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga	200	1 65	7	1	1.50	1.50	19 44
Pomona Guano	Comm'cial Guano Co	Savannah, Ga	Com. Guano Co.	Savannah, Ga.	200	1.65	7	1	1.50	1.50	19 44
Etiwan Guano	Etiwan Phosphate Co	Charleston, S. C	Etiwan Phos. Co.	Charleston, S. C	200	1.75	5	2	2	1.25	18 58
Etiwan Am. Super-Phosphate	Etiwan Phosphate Co	Charleston, S. C	Etiwan Phos Co.	Charleston, S. C	200	1.50	5	2	1	1	17 35
Etiwan Am. Dis. Bone	Etiwan Phosphate Co	Charleston, S. C	Etiwan Phos. Co.	Charleston, S. C	200	.8750	7	2	1	1	17 91
Etiwan Dissolved Bone	Etiwan Phosphate Co	Charleston, S. C	Etiwan Phos. Co.	Charleston, S. C	200	.....	10	1	1	....	16 50
Etiwan Acid Phosphate	Etiwan Phosphate Co	Charleston, S. C	Etiwan Phos. Co.	Charleston, S. C	200	.....	8	3	1	.....	16 50
Plow Brand Raw Bone Sup-Phos	Walton & Whann Co	Charleston, S. C	Walton & Whann	Charleston, S. C	200	2	6	2	2	2.25	22 05
Reliance Am. Super-Phosphate	Walton & Whann Co	Charleston, S. C	Walton & Whann	Charleston, S. C	200	1.50	5	2	1	1	17 35
W. & W. Co's Am. Dis. Bone	Walton & Whann Co	Charleston, S. C	Walton & Whann	Charleston, S. C	200	.8750	7	2	1	1	17 91
Diamond Soluble Bone	Walton & Whann Co	Charleston, S. C	Walton & Whann	Charleston, S. C	200	....	10	1	1	.....	16 50
X. X. Acid Phosphate	Walton & Whann Co	Charleston, S. C	Walton & Whann	Charleston, S. C	200	..	10	1	1	.....	16 50
Crocker's Pure Ground Bone Meal	Crocker Ft & Ch Co	Buffalo, N. Y.	Crocker Ft & Ch Co	Buffalo, N. Y.	200	2.90	.....	..	.25	.....	11 31
Crocker's Sol. Am. B. Sup-Phos	Crocker Ft & Ch Co	Buffalo, N. Y.	Crocker Ft & Ch Co	Buffalo, N. Y.	200	1.64	6	2	1	2	20 40
Crocker's Sol. Dis. B. Sup-Phos	Crocker Ft & Ch Co	Buffalo, N. Y.	Crocker Ft & Ch Co	Buffalo, N. Y.	200	1 23	6	2	1	1.50	18 30

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers.—Cont'd.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTUR'D	Weight of Package.	GUARANTEED ANALYSIS.					Commercial Value.
							Phosphoric Acid.				
	NAME.	ADDRESS.				Nitrog'n	Water Soluble	Citrate Soluble	Acid Soluble	Potash.	
B. D. Sea Fowl Guano	Bradley Fertilizer Co	Boston, Mass	Bradly Fertilizer Co	Boston, Mass	200	1.85	6 50	2.50	2	1	$21 72
Bradley's Patent Super-Phosphate	do	do	do	do	200	1 85	6.50	2.50	2	1	21 72
Bradley's Am. Dis. Bone	do	do	do	do	200	1 65	6	2	2	1	19 44
Eagle Am. Bone Super-Phosphate	do	do	do	do	200	1.65	6	2	2	1	19 44
Carolina Fertilizer	do	do	do	do	200	1.85	6.50	2.50	2	1	21 72
Palmetto Acid Phosphate	do	do	do	do	200	....	9	3	1	....	19 75
Soluble Sea Island Guano	The Rasin Fert. Co	Baltimore, Md	The Rasin Fert. Co	Baltimore, Md	200	2	6	3	2	1.75	23 05
Empire Guano	do	do	do	do	200	2	6	3	2	1.75	23 05
South American Guano	do	do	do	do	200	2	6	3	2	1.75	23 05
King Guano	do	do	do	do	200	2	6	3	2	1.75	23 05
Grant Guano	do	do	do	do	200	2	6	3	2	1.75	23 05
Rasins Acid Phosphate	do	do	do	do	200	0.20	12	2	1	....	21 78
Imperial Ammoniated Fertilizer	Imperial Fertilizer Co	Charleston, S. C	Imperial Fert. Co	Charleston, S. C	200	2 06	6	2	2	2	22 03
Imperial Soluble Guano	do	do	do	do	200	1.65	6	2	1 50	1	19 44
Imerial Am. Dis. Bone	do	do	do	do	200	.82	8	2	1 50	1	19 20
Imperial Dissolved Bone	do	do	do	do	200	....	10	2	2	....	18 00
Imperial Acid Phosphate	do	do	do	do	200	....	9	2	1 50	1	17 50
Double Anchor Am. Fertilizer	do	do	do	do	200	2 06	6	2	2	2	22 03
Double Anchor Sol. Guano	do	do	do	do	200	1 65	6	2	1 50	1	19 44
Double Anchor Am. Dis. Bone	do	do	do	do	200	82	8	2	1 50	1	19 20
Double Anchor Dis. Bone	do	do	do	do	200	....	10	2	2	....	18 00
Double Anchor Acid Phosphate	do	do	do	do	200	....	9	2	1 50	1	17 50
Bowker's Cotton Fertilizer	Bowker Fertilizer Co	Savannah, Ga	Bowker Fert. Co	Elizabethport, N J	200	1.75	7	2	2	1.25	21 58
Nassau Guano	do	do	do	do	200	1 75	7	2	2	1 25	21 58
Crown Guano	do	do	do	do	200	1 75	7	2	2	1.25	21 58

Bowker's Dis. Bone Phosphate	Bowker Fertilizer Co	Savannah, Ga.	Bowker Fert. Co	Elizabethport, N J	200	....	9	2	2	1.25	17 75
Nassau Dis. Bone Phosphate	do	do	do	do	200	.....	10	3	2	..	19 50
German-Kainit	do	do	Imported	Germany	200	....	.....	..	...	12	12 00
Crown Dis. Bone Phosphate	do	do	Bowker Fert. Co	Elizabethport, N J	200	.....	9	2	2	1.25	17 75
Nassau Dis. B. Phos. with Potash	do	do	do	do	200	.....	9	2	2	1.25	17 75
Plow Brand Bone Phosphate	W. F. Vandiver & Co	Montgomery, Ala	Walton & Whann co	Wilmington, Del	200	2	6	2	2	2 25	22 05
Reliance Am. Dis Bone	do	do	do	do	200	1.50	5	2	1	1	17 35
W. & W. Co's Am. Dis Bone	do	do	do	do	200	.8750	7	2	1	1	17 91
Diamond Soluble Bone	do	do	do	do	200	......	10	1	1	.. ..	16 50
X. X. Acid Phosphate	do	do	do	do	200	....	10	1	1	....	16 50
Wando Soluble Guano	Wando Phosphate Co	Charleston, S. C	Wando Phos. Co	Charleston, S. C	200	1.65	6.50	2	2	1	20 19
Wando Am Dis. Bone	do	do	do	do	200	.75	7	3	2	1	18 93
Wando Acid Phosphate	do	do	do	do	200	....	10	1	.50	......	16 50
Wando Acid Phosphate	do	do	do	do	200	.....	9	1	1	1	16 00
Wando Dissolved Bone	do	do	do	do	200	....	10	1	.50	.....	16 50
Zell's Am. Bone Super Phosphate	The Zell Guano Co	do	The Zell Guano Co	Baltimore, Md.	200	1.8750	7	2	2	1.25	22 06
Zell's Economizer	do	Baltimore, Md.	do	do	200	1.8750	7	2	2	1.25	22 06
Zell's Calvert Guano	do	do	do	do	200	1.8750	7	2	2	1.25	22 06
Patapsco Am. Sol. Phosphate	Patapsco Guano Co	do	Patapsco Guano Co	do	200	2	6.75	2.25	1.50	1	22 30
Ammoniated Dissolved Bone	do	do	do	do	200	1.75	6.75	2.25	1.50	1	21 33
Patapsco Acid Phosphate	do	do	do	do	200	....	9	3	1	1	19 00
Patapsco Acid Phosphate	do	do	do	do	200	.... .	10	3	1	......	19 50
Edisto Acid Phosphate	Edisto Phosphate Co	Charleston, S. C	Edisto Phos. Co.	Charleston, S. C	200	.....	8	2	1	1	17 50
Edisto Acidulated Rock	do	do	do	do	200	......	9	3	1.50	.....	18 00
Edisto Dissolved Bone	do	do	do	do	200	.....	9	3	1.50	.....	18 00
Edisto Ammoniated Fertilizer	do	do	do	do	200	2.06	7	2	1	1	22 53
Edisto Am. Dis. Bone	do	do	do	do	200	1.64	7	2	1	1	20 90
Edisto Soluble Guano	do	do	do	do	200	1.64	7	2	1	1	20 90
Genuine Leopoldshall Kainit	do	do	Imported	Germany	200	....	.....	....	.	12	12 00
Mastodon Am. Sol. Phos	Ga. Chemical Works	Augusta, Ga	Ga. Chem. Works	Augusta, Ga.	200	2	6.75	2.25	1.50	1	22 30
Georgia Formula	do	do	do	do	200	1.75	6.75	2.25	1.50	1	21 33
Planters' Soluble Guano	do	do	do	do	200	1.75	6.75	2.25	1.50	1	21 33
Acid Phosphate	do	do	da	do	200	.....	9	3	1	1	19 00
Acid Phosphate	do	do	do	do	200	....	10	3	1	...	19 50

Guarantee Analyes of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers.—Cont'd.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTUR'D	Weight of Package.	GUARANTEED ANALYSES. Phosphoric Acid.					Commercial Value.
	NAME.	ADDRESS.				Nitrog'n	Water Soluble	Citrate Soluble	Acid Soluble	Potash.	
Home Mixture	Columbus Fert. Co	Columbus, Ga	Columbus Fert. Co	Girard, Ala	200	2	6	2	2	1 50	$21 80
Soluble Bone	do	do	do	do	200	.....	10	3	1	......	19 50
Eufaula Fertilizer	Eufaula Oil & Ft. Co	Eufaula, Ala	Eufaula Oil & Ft Co	Eufaula, Ala	200	1 25	6 50	2 50	1.25	2	20 38
Am. Dis. Bone Phosphate	Lister's Ag.Ch. W'ks	Newark, N. J	Lister's Agr Ch W	Newark, N. J	167	1.65	6	2	...	1	19 44
Acid Phosphate	National Fertilizer Co	Nashville, Tenn	National Fert. Co	Nashville, Tenn	200	......	10	2	2	......	18 00
Ammoniated Dissolved Bone	do	do	do	do	200	1.02	8	2	1	1.25	20 23
Rock City Guano	do	do	do	do	200	1 85	6	2	1	1 25	20 47
Old Hickory Guano	do	do	do	do	200	1 85	6	2	1	1 25	20 47
Alliance Exchange Guano	do	do	do	do	200	1.85	6	2	1	1 25	20 47
King Cotton	Chattahoochee Ft. Co	Eufaula, Ala	ChattahoocheeFt co	Eufaula, Ala	200	2.10	4	3	1.75	1 50	20 19
King Cotton	do	Cuthbert, Ga	do	do	200	2.10	4	3	1.75	1	19 69
Excelsior Ammoniated Bone	Savannah Guano Co	Savannah, Ga	Savan'h Guano Co	Savannah, Ga	200	1 65	6	3	1	1.25	21 19
Our Own Ammoniated Bone	do	do	do	do	200	1.65	6	3	1	1.25	21 19
Standard Ammoniated Bone	do	do	do	do	200	1.65	6	3	1	1 25	21 19
Alliance Standard Am. Bone	do	do	do	do	200	1.65	6	3	1	1.25	21 19
Dissolved Bone Acid Phosphate	do	do	do	do	200	....	8	5	1	...	19 50
Southern Pacific	do	do	do	do	200	.8250	7	3	1	1.25	19 77
Standard of Alabama	do	do	do	do	200	.8250	7	3	1	1 25	19 77
Farmers' Favorite	do	do	do	do	200	8250	7	3	1	1.25	19 77
English Dis. Bone Acid Phos	do	do	do	do	200	.....	8	5	1	...	19 50
Southern States Standard	C. L. Montague & Co	do	C L Montague & co	do	200	1.65	6	3	1	1.25	21 19
State Alliance Favorite	do	do	do	do	200	.8250	7	3	1	1 25	19 77
Dissolved Bone Acid Phosphate	do	do	do	do	200	....	8	5	1	...	19 50
Southern Pacific	do	do	do	do	200	.8250	7	3	1	1 25	19 77
East Alabama Fertilizer	East Ala. Fert. Co	Clayton, Ala	East Ala. Fert. Co	Clayton, Ala	200	1 50	8	1 1/8	1	2	21 54

Golden Rod	So. Ala. Oil & Ft Co	Ozark, Ala	So Ala Oil & F't Co	Ozark, Ala	200	1.50	8	1 ⅛	1	2	21 54
Alabama Fertilizer	Alabama Fert. Co	Montgomery, Ala	Alabama Fert. Co	Montgomery, Ala	200	2	6	3	2	2	23 30
Acid Phosphate	do	do	Edisto Phos. Co	Charleston, S. C	200	....	9	3	1.50	...	18 00
Kainit	do	do	Imported	....	200	....	.....	..	....	13	13 00
Muriate Potash	do	do	do	....	167 250	....	.....	...	..	80	80 00
Pelican Guano	do	do	Alabama Fert. Co	Montgomery, Ala	200	2	6	2	1	1	20 80
Favorite Fertilizer	Marks & Gayle	do	do	do	200	2	6	2	1	1	20 80
Acid Phosphate	do	do	Edisto Phos. Co	Charleston, S. C	200		9	3	1.50	....	18 00
Kainit	do	do	Imported	....	200	....	....	..	..	13	13 00
Muriate Potash	do	do	do	....	167 250	....	.....	.	..	80	80 00
Pelican Guano	do	do	Alabama Fert. Co	Montgomery, Ala	200	2	6	2	1	1	20 80
Lockwood Cotton Grower	Clarence Angier	Atlanta, Ga	Ga. Chem. Works	Augusta, Ga	200	1.75	6.75	2.25	1.50	1	21 33
Sterling Guano	do	do	do	do	200	1.75	6 75	2.25	1 50	1	21 33
Lockwood Acid Phosphate	do	do	do	do	200	....	9	3	1	1	19 00
Sterling Acid Phosphate	do	do	do	do	200	.....	9	3	1	1	19 00
English Super-Phosphate	Mead Phosphate Co	Charleston, S. C	Mead Phos. Co	Charleston, S. C	200	.....	10	2	2	.....	18 00
English Acid Phosphate	do	do	do	do	200	...	10	2	2	.....	18 00
Baker's Standard Guano	Chem. Co. of Canton	Baltimore, Md	Ch. Co. of Canton	Baltimore, Md	200	1.70	5	3	2	2	20 63
Dissolved Ammoniated Bone	do	do	do	do	200	1.70	5	3	2	2	20 63
Resurgam Guano	do	do	do	do	200	1.25	5	3	2	2	18 88
Trucker's Delight	do	do	do	do	167	5	5	3	2	4	35 50
Baker's Standard Guano	do	do	do	do	200	1.75	5.80	3.20	3 10	2	22 33
Dissolved Ammoniated Bone	do	do	do	do	200	1 75	5.80	3 20	3.10	2	22 33
Old Dominion	Southern Phos. Co	Atlanta, Ga	Southern Phos. Co	Atlanta, Ga	200	2	8	1.50	1	1.50	23 55
Southern Am. Dis. Bone	do	do	do	do	200	2	7	1	1	1.50	21 30
Southern Acid Phosphate	do	do	do	do	200	....	9	2	1	.....	16 50
Etowah Super-Phosphate	do	do	do	do	200	0 85	8	2.	1	1	19 32
Potent Pacific	do	do	do	do	200	2	7	1	1	1.50	21 30
Goulding's Bone Compound	The Goulding F't. Co	Pensacola, Fla	W & H M Goulding	Dublin & Cork	200	1.75	7	2	1	1	21 33
Soluble Pacific Guano	W. J. Pollard, Agt	Augusta, Ga	....	....	....	1.85	6 50	2.50	2	1	21 72
Americus Am. Bone Super-Phos	W. J. Pollard, G. M	do	....	....	..	1.65	6	2	2	1	19 44
High Grade Acid Phosphate	Slingluff & Co	Baltimore, Md	Slingluff & Co	Baltimore, Md	200		9	5	1		21 00

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers.—Cont'd

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTUR'D	Weight of Package.	GUARANTEED ANALYSES					Commercial Value.
							Phosphoric Acid.				
	NAME.	ADDRESS.				Nitrog'n	Water Soluble	Citrate Soluble	Acid Soluble.	Potash.	
Baltimore Dissolved Bone	Slingluff & Co	Baltimore, Md	Slingluff & Co	Baltimore, Md	200	1.25	7	3	1.50	1.50	$21 38
Ammoniated Bone	do	do	do	do	200	2	7	1	2	1	20 80
Baltimore Standard Bone	do	do	do	do	200	1.75	7	2	1	1.50	21 83
Oskalium	do	do	do	do	200	...	9	3	1	2	20 00
H. & T. High Grade Acid Phos.	Hobbie & Teague	Montgomery, Ala	Hobbie & Teague	Montgomery, Ala	200	...	13	..	..	....	19 50
Cumberland Fertilizer	Charles Ellis	New York	Charles Ellis	New York	200	1.85	7.25	2	..	1.40	22 12
Chesapeake Guano	Chesapeake Guano Co	Baltimore, Md	Ches'p'ke Gu'no Co	Baltimore, Md	200	2.25	4	5.50	2	1	24 03
Alkaline Phosphate	do	do	do	do	200	2	4	4.50	2	1.50	22 05
Ammoniated Dissolved Bone	do	do	do	do	200	2	4	4.50	2	1.50	22 05
Koton Guano	Rome Oil mills &F Co	Rome, Ga	Rome Oil M&F Co	Rome, Ga	200	2	8	2	2	2	24 80
L. & C. Dis. B. with Am. & Potash	Langston & Woodson	Atlanta, Ga	Langs'n & Woods'n	New York	200	2	7	2	..	1	22 30
L & W, I X L Am B Super-Phos	do	do	do	do	200	2.50	7	2	..	1	24 25
L. & W. H. G. Acid Phosphate	do	do	do	Charleston, S. C	200	....	9	4	..	....	19 50
High Grade Eng. Acid Phos.	Curtis & Wright	Luverne, Ala.	Bradley Fert. Co.	Boston, Mass	200		9	3	1	...	18 00
Globe Guano	Globe Fertilizer Co.	Louisville, Ky	Globe Fert. Co	Louisville, Ky	200	1.65	5	3	2	1	19 44
Farmers' Friend	Read Fertilizer Co.	New York	Read Fertilizer Co	New York	200	2.058	6	2	2	1	21 03
Matchless Cotton Grower	do	do	do	do	200	1.647	6	2	2	1	19 42
New York Soluble Bone	do	do	do	do	200	..	7	3	2	....	15 00
Manley, Handley & Co's Am Dis B	do	do	do	do	200	1.647	6	2	2	1	19 42
Manley, Handly & Co's XX Ac Phs	do	do	do	do	200	....	9	4	2	....	19 50
Atlantic Am. Dis. Bone	Atlantic Phos. Co.	Charleston, S. C	Atlantic Phos. Co	Charleston, S. C	200	1.2	8	2	1.50	1	20 68
Atlantic Dissolved Bone	do	do	do	do	200	...	10	2	2.50	....	18 00
Atlantic Acid Phosphate	do	do	do	do	200	...	9	2	1.50	1	17 50
Atlantic Fertilizer	do	do	do	do	200	2	6	2	2	1	20 80
Atlantic Soluble Guano	do	do	do	do	200	1.2	6	2	1.50	1	17 68

Atlantic Acid Phosphate	Atlantic Phos Co	Charleston, S. C	Atlantic Phos Co	Charleston, S. C	200	....	10	2	2 50	...	18 00
High Grade Acid Pnosphate	do	do	do	do	200	....	10	2	2.50	....	18 00
Cherokee Dissolved Bone	do	do	do	do	200	.....	9	2	1.50	1	17 50
Ober's Dis Bone Phosphate Slea	G. Ober & Sons Co	Baltimore, Md	Ober & Sons Co	Baltimore, Md	200	....	10	1	1	...	16 50
Ober's Sol Am Sup-Phos of Lime	do	do	do	do	200	2	6.75	2	2	1.40	22 33
Ober's Farmers' Stand Am. Phos	do	do	do	do	200	1.80	6.75	1.75	2	1.50	21 27
Ober's Ga. Cotton Compound	do	do	do	do	200	2	6 75	2	2	1 40	22 33
English Acid Phosphate	Jos. Steiner & Sons	Greenville, Ala	Imported	England	200	...	8	3	1	...	16 50
Standard Home Mixture Guano	Meridian Fert. Fact	Meridian, Miss	Meridian Fert Fact	Meridian, Miss	200	2.25	8.50	1.75	1	2.25	26 41
Southern Soluble Guano	do	do	do	do	200	2.25	8.50	1.75	1	2.25	26 41
Lee Fertilizer	Trawick & Jernigan	Opelika, Ala	Lee Fert. Works	Opelika, Ala	200	2.25	8	1	1	2	24 28
Farmers's Club Guano	do	do	do	do	200	1.75	8	1	1	2	22 33
Trawick Dissolved Bone	do	do	do	do	200	....	11	2	2	....	19 50
Acid Phosphate	do	do	do	do	200	.....	8	2	1	....	15 00
Kainit	do	do	do	do	200	.....	.....	...	..	11	11 00
Corn and Cotton Fertilizer	Cin. Desiccating Co	Cincinnati, Ohio	Cin Desiccating Co	Cincinnati, Ohio	200	1.85	2	7	1	1	21 72
Perfection Guano	McMillan & Harrison	Mobile, Ala	McMil'n & Harris'n	Mobile, Ala	200	2 25	3.25	5.25	2.25	1	22 53
Perfection A. A. Guano	do	do	do	do	200	3	4	6	1 50	2.50	26 20
Kainit	do	do	Imported	Germany	200	....	.....	...	..	12.50	12 50
Acid Phosphate	do	do	Taggert Allen F co	Philadelphia, Pa	200	..	12		2	....	18 00
W. G. & Co's Manipulated Guano	Wilcox & Gibbs Co	Savannah, Ga	Wilcox & Gibbs Co	Savannah, Ga	200	2.10	6	2.75	2	2	23 32
Excellent Ga. Standard Guano	do	do	do	do	200	1.75	6	2 50	2	1	20 58
W. G. & Co's Super-Phosphate	do	do	do	do	200	....	6	4	2	2.50	17 50
High Grade Acid Phosphate	do	do	do	do	200		11	2	1	....	19 50
Globe Dissolved Bone	Lorentz & Rittler	Baltimore, Md	Lorentz & Rittler	Baltimore, Md	200	0.82⅓	7	3	2	1.50	19 71
Ammoniated Guano	do	do	do	do	200	1.64	6	2	2	1	19 40
Kennesaw H. G. Am. Guano	Kennesaw Guano Co	Atlanta, Ga	Kennesaw Gu'noCo	Clifton, Ga	200	2 50	6	3.50	1	1 75	25 75
Kennesaw Am. Dis. Bone	do	do	do	do	200	2	6	3 50	1	1.50	23 55
Blood and Bone Compound	do	do	do	do	200	1.50	6	3 50	1	1	21 10
High Grade Acid Phosphate	do	do	do	do	200		10	3.50	1	....	20 25
Ashepoo Fertilizer	Ashepoo Phos. Co	Charleston, S. C	Ashepoo Phos. Co	Charleston, S. C	200	1.85	6.25	2.25	2	1	20 97
Eutaw Fertilizer	do	do	do	do	200	1.85	6.25	2.25	2	1	20 97
Ashepoo Acid Phosphate	do	do	do	do	200	..	8 50	2	1	...	15 75
Eutaw Acid Phosphate	do	do	do	do	200		8.50	2	1		15 75

Guaranteed Analyses of Commercial Fertilizees, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers.—Cont'p

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTUR'D	Weight of Package.	GUARANTEED ANALYSES. Phosphoric Acid.					Commercial Value.
	NAME.	ADDRESS.				Nitrog'n	Water Soluble	Citrate Soluble	Acid Soluble	Potash.	
Ashepoo Bone Ash	Ashepoo Phos'ate Co	Charleston, S. C	Ashepoo Phos. Co	Charleston, S. C	200	....	8.50	2	1	1	$16 75
Soluble Guano	Ashley Phos. Co	do	Ashley Phos. Co	do	200	2	4	4	2	1	20 80
C. & C. Compound	do	do	do	do	200	1.75	4	4	2	1	19 83
S. G. Specific	do	do	do	do	200	1.75	4	4	2	1	19 83
Ammoniated Dissolved Bone	do	do	do	do	200	1	4	4	2	1	16 90
Soluble Fish Guano	do	do	do	do	200	2 50	4	4	2	1	22 75
Acid Phosphate	do	do	do	do	200	....	6	4	2	1	16 00
Dissolved Bone	do	do	do	do	200	....	7	5	2	....	18 00
Kainit	do	do	do	do	200	....	....	..	..	13	13 00
Stono Soluble Guano	E. H. Frost & Co	do	E H. Frost & Co	do	200	2	6	2	2	1	20 80
Stono Acid Phosphate	do	do	do	do	200	....	8	2	2	1	16 00
Stono Dissolved Bone	do	do	do	do	200	....	10	2	2	..	18 00
Kainit	do	do	do	do	200	....	....			11	11 00
W. O. C. Guano	Coweta Fert. Co	Newnan, Ga	Coweta Fert. Co	Newnan Ga	200	2.25	7.50	2 50	1	2	25 78
Coweta High Grade	do	do	do	do	200	2	7	2	1	2	23 30
Aurora Ammoniated Phosphate	do	do	do	do	200	1.75	6.50	1.50	1	2	20 83
Coweta Animal Bone Fertilizer	do	do	do	do	200	1.85	6.50	2.50	2	2	22 72
Woodward's Soluble Guano	do	do	do	do	200	1.75	6 50	1.50	1	2	20 83
Mobile Home Mixture	Mountain & Sons	Mobile, Ala	Mountain & Sons	Mobile, Ala	200	3.92	.....	2.69	3 45	.....	19 28
Woodward's H. G. Acid Phos	Edisto Phosphate Co	Charleston, S. C	Edisto Phos Co	Charleston, S. C	200	....	9	3	1.50	....	18 00
Mobile Stand. Acid Phosphate	Mobile Ph & Ch Co	Mobile, Ala	Mobile Ph & Ch Co	Mobile, Ala	200	.....	10	3	1	.	19 50
Mobile Standard Guano	do	do	do	do	200	1.86	4.50	5	1	1	22 50
Eclipse Soluble Guano	do	do	do	do	200	1.65	4	5	1	1	20 94
Potato Fertilizer	do	do	do	do	200	3.30	3	2	2	5	25 37
Cabbage Fertilizer	do	do	do	do	200	4 12	3	2	2	4	27 57

Kainit	Mobile Ph & Ch Co	Mobile, Ala	Mobile Ph &Ch Co	Mobile, Ala	200	......	......	....	....	12	12 00
Huntsville Fertilizer	Huntsville Fert. Co	Huntsville, Ala	Huntsville Ft. Co	Huntsville, Ala	200	2.25	6.75	3.25	.75	1	24 78
Slingluff's Dis. B. for Home Fert	Boykin, Carmer & Co	Baltimore, Md	Boykin, Carmer Co	Baltimore, Md	167	2.20	9	3	....	......	26 58
Home Fertilizer Chemicals	do	do	do	do	213	5 75	......	....	....	7	29 43
Brown's Cotton & Corn Fertilizer	R. B. Brown Oil Co	St. Louis, Mo	R B Brown Oil Co	St. Louis, Mo	200	2.50	8	1	9	2	25 25
Acid Phosphate	Euf. Oil & Fert. Co	Eufaula, Ala	Berkeley Phos Co	Charleston, S. C	200	.....	10.50	1.50	. ..	......	18 00
Standard Fertilizer	Columbus Oil Mills	Columbus, Miss.	Columbus Oil Mills	Columbus, Miss	100	2 94	7.86	1.92	2.47	2.92	29 06
Acid Phosphate	do	do	Scott M'f'g Co	Atlanta, Ga	100	......	..	..	...	......	......
Reese's Pacific Guano	John S. Reese & Co	Baltimore, Md	John S. Reese & Co	Carteret, N. J	200	1.85	4	4 50	1 20	1.20	21 17
Excellenza Soluble Guano	do	do	do	do	200	1.85	4	4.50	1.20	1.20	21 17
Clifton Acid Phosphate	Clifton Ch & Phs Co	Atlanta, Ga	Clifton Ch & Ps Co	Atlanta, Ga	200	....	10	2	2	......	18 00
Clifton Complete Fertilizer	do	do	do	do	200	2	7	2	1	1	22 30.
Ammoniated Dissolved Bone	Baugh & Sons Co	Baltimore, Md	Baugh & Sons Co	Baltimore, Md	200	1.70	7	2	12	......	20 13
Pure Raw Bone Meal	do	do	do	do	200	3.75	......	...	21	......	14 63
Solid South Guano	Marietta Guano Co	Atlanta, Ga	Marietta Guano Co	Atlanta, Ga	.	1.75	7	2	2	1.50	21 83
Planters's Pride Guano	do	do	do	do	..	1 75	7	2	2	1.50	21 83
Piedmont Acid Phosphate	do	do	do	do	..	.....	9	4	2	....	19 50
M. G. C. Dissolved Bone	do	do	do	do		1	7	3	2	1 25	20 15
Crown Guano	Treadwell, Abbott Co	do	Walton&WhannCo	Wilmington, Del	200	2	6	2	2	2	21 80
Crown Acid Phosphate	do	do	do	& Charleston, S C	200	....	8	3	1	1	17 50
Ammoniated Dissolved Bone	do	do	Berkeley Phos Co	Charleston, S. C	200	1.75	6	2	2	1	19 83
Ammoniated Dissolved Bone	do	do	The Rasin Fert Co	Baltimore, Md	200	1 75	6	2	2	1	19 83
Bone & Blood Fertilizer	F. D. Tinsley, Agt	Selma, Ala	Armour & Co	Chicago, Ill	150	6.25	......	5.50	6	....	32 63
Pure Dissolved Bone	do	do	do	do	200	2	......	13½	7	......	28 05
Pure Bone Meal	do	do	do	do	200	2.25	.....	8	17	.....	20 78
Pure Ground Bone	do	do	do	do	200	2	..	6.50	17	.....	17 55
Waverly Fertilizer	W. & P. Hoffman	Waverly, Ala	W. & P. Hoffman	Waverly, Ala	200	2.50	4 50	2.25	1.25	1	20 88
Webb's Excelsior S	John C. Webb	Demopolis, Ala	John C. Webb	Demopolis, Ala.	200	4.76	1.78	2 75	1.17	1.50	26 86
Complete Fertilizer	Scholze Bros	Chat'nooga, Tenn	Scholze Bros	Chat'nooga, Tenn	200	2	8	2	3	1.50	24 30
X. X. Acid Phosphate	do	do	Walton&WhannCo	Charleston, S. C	200	..	10	1	1	..	16 50
Tankage	Jos. Steiner & Sons	Greenville, Ala	ArmourPacking Co	Chicago, Ill	100	4	Equiv	to B.	Phs	25	15 60
Standard Fertilizer	Columbus Oil Mills	Columbus, Miss	Columbus Oil Mills	Columbus, Miss.	100	2 94	7 86	1.92	2.47	2.92	29 56
Acid Phosphate	do	do	Scott M'f'g Co	Atlanta, Ga.	100	.....	12.57	3.08	1.09	.	23 48
Pure Bird Guano	Folmar & Sons	Troy, Ala	....	Baltimore, Md	200	1	..	3.75	6	1.50	11 03
Vegetator	Miller, Lippincott Co	Baltimore, Md	Miller, Lip'ncott Co	do	167	2	6	4	2	1	23 80

BULLETIN NO. 27. MAY, 1891.

AGRICULTURAL EXPERIMENT STATION,

OF THE

Agricultural and Mechanical College,

AUBURN. ALA.

BLACK "RUST" of COTTON.

☞The Bulletins of this Station will be sent Free to any citizen of the State on application to the Director.

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*Deceased.

Black "Rust" of Cotton.*

By Geo. F. Atkinson, Biologist.

Early in the past year I began the study of the fungus diseases of the cotton plant with the special object to determine the disease called "black rust." The first of August, 1890, one hundred circular letters were sent to different farmers of Alabama requesting specimens of cotton affected with the disease variously termed "rust," "red rust," "black rust," "frenching," etc.

From twenty-five to thirty replies were received including specimens marked "black rust," "red rust," "frenching" and "root rot." †

The disease has been very prevalent and destructive during the season and excellent opportunities were offered for studying it in the vicinity of Auburn, not only upon the Station farm, but on neighboring plantations.

July 22d, on one of my visits to the cotton field, I found the disease had made its appearance in full force in several spots, where fully one-half of the leaves of the plants had fallen off, the remainder being curled, dried, and blackened by a profuse development of dark hyphæ and spores of several fungi, so that by jarring a leaf the spores would float off in clouds like the smut

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*The substance of this article was read in a paper by the author before the Botanical section of the American Association of Agricultural Colleges and Experiment Stations,Champaign,Ill., Nov. 1889. Later published in the *Botanical Gazette*, Vol. XVI., 3, Mar. 1891, pp. 61-65.

† An account of this disease was published in Bulletin No. 24, Dec. 1889. "A New Root-rot Disease of Cotton."

spores of some of the *Ustilagineæ*. Some of the plants showed still the earlier stages of the disease, and in other parts of the field were numerous opportunities to study the earlier stages. For two months my time was occupied in noting the external character, collecting material, examining the different fungi found and noting the relation of each species to the variety of external characters presented in the progress of the disease.

A Complex Disease.—The disease is a complex one, that is, it is not due to one organism, but to the combined effect of several microscopic plants called fungi, which grow within the leaves of the cotton plant, absorbing the living parts. Organisms that grow on or in plants or animals obtaining their own nourishment from their hosts are called parasites. So the microscopic plants causing diseases of other plants are called parasitic fungi. It is of great importance in speaking of them to apply some term defining this prominent character of parasitism for there are vast numbers of species of fungi, many which are not parasites growing also in plants, that is, they cannot grow on or in a living plant, but only on dead plants or dead parts of plants. Such fungi are called saprophytic fungi to distinguish them from the parasitic forms.

A number of persons prior to my own investigations have examined with the microscope the leaves of cotton affected with the "black rust" and have reported that fungi were present, some attributing to these fungi the cause of the disease. So far as I have been able to learn none of these persons have recorded what these fungi were which were seen, and it is quite probable that no determination was made. The fact alone that fungi are found on the leaves of diseased cotton plants affected with black "rust" is no argument in favor of their being the cause of the disease. The nature of these fungi must first be ascertained before one can predicate anything respecting their causal relation to the disease.

There are several ways in which their nature can be ascertained but even then it can be done only by one who is familiar with the accepted methods of research upon similar subjects, and has at his command the apparatus and literature required for accuracy; just as a trained chemist is the only person who can accurately determine the chemical constitutents of substances capable of analysis.

Confusion of Names for the Disease.—It must be understood that in writing now of black "rust" of cotton, I refer only to the cases which have come under my own observation, either through personal inspection of diseased fields, or through specimens received from farmers. It may be possible that there are other diseases of cotton which are termed also "black rust" which I have not seen. It is unfortunate that the name "*rust*" was ever applied to any disease of cotton since the fungi commonly known as *rusts*, like wheat rust, oat rust, fig rust, etc., all belong to a group of plants called *Uredineæ.* No members of this group have ever been found on the cotton plant so far as recorded, so in that respect there is no *true rust* of cotton yet known. It would be very difficult, however, to bring any other name into popular use, and even if it were possible it would not be appropriate to introduce a new name until all the important complications of the disease shall have been studied. Therefore I shall at present use the term black "rust." I include in this term also what many farmers in Alabama call "red rust," which is but an early or arrested stage of black "rust."

In some cases when a cotton grower speaks of "red rust" he refers to the reddening of the leaves which is so common in worn out lands.

While in North and South Carolina my attention was called to this disease which was chiefly characterized by a reddening of the leaves not produced nor accompanied by any fungous growth. In most cases this seemed to be due to some condition of the soil which induces a hastened maturity of the plant and the development of erythrophyl in the cell sap of the leaves. In some cases, especially in North and South Carolina, the development of erythrophyl is induced by the irritation of mites as I have proved by infection experiments. From several places in both States cotton quite severely injured by mites has been sent me. An account of this was published in Bulletin No. 4 of the South Carolina Agricultural Experiment Station, January, 1889. These mites (*Tetranychus telarius*, Linn.) feed on a great variety of weeds and other plants including clover. It would not be surprising if there would be found in this an explanation of the statement originating in North Carolina that carrying an armful of wilted clover across a cotton field, later the "red rust" could be traced spreading from the same course.

Other cotton growers do not speak of the peculiar reddening of the leaf which I have described as a rust of any kind, rightly saying it is due to some condition of the soil. When they speak of "red rust" they refer to leaves that do not have a healthy green color, there being a tinge of yellow, or even in some cases a tinge of red, accompanied also by dark circular spots on the leaves that are dead, the edges of the leaves usually being dead also. Such a leaf is represented in Plate I., the upper leaf in the figure, and the one at the left below. These are from photographs of diseased leaves.

Again by "black rust" the planter refers to the blackened condition of a whole or large part of the leaf, which ultimately falls off. This continues until the plant is entirely stripped of its leaves. This is only a more advanced or serious stage of the preceding kind of "rust." A leaf with black "rust" is represented at the right hand in the lower figure of Plate I.

A Fungus Disease.—The fungi commonly present and which play an important part in the disease are *Cercospora gossypina* Cooke, *Colletotrichum Gossypii* E. A. Southworth, *Macrosporium nigricantium* Atkinson, a species of *Alternaria* and a bacterial organism which sometimes produces a characteristic disease of the leaves.

The vegetive, or growing portion of the fungi concerned, consists of very minute thread-like bodies which grow on the inside of the leaf. At first the only external sign is the dead spots on the leaf. A little later fruiting threads (fertile hyphæ) grow through the epidermis of the leaf to the outside, and bear on their ends the germs, or spores, of the fungus. These fertile hyphæ and some of the spores are dark colored. Therefore when they appear on the leaf in great numbers they give it a more or less black color.

Difference Between Cotton-leaf Blight and Black "Rust."—Cercospora gossypina is a fungus that has been long known as a parasite of the cotton plant. The first description of it was published by Cooke in Grevillea* from specimens distributed from South Carolina by Ravenel in Rav. Amer. Fungi, No. 593. A fuller description was published by Scribner in the report of the section of Vegetable Pathology.† The disease which it produces when alone is called "cotton-leaf blight." Professor Scribner says (l. c.) that it is quite distinct from the dreaded "cotton rust," and also that it is occasionally confounded with cotton rust. In view of the confusion existing in reference to the name cotton rust it is impossible to tell whether the disease referred to by Professor Scribner as cotton rust is the same as the disease I am writing of. However, some of the planters confuse the cotton leaf blight with the black "rust" as it is known to me for some of the specimens labelled "rust," "red rust" and in one case "black rust," were affected with nothing of a parasitic nature except Cercospora gossypina. This, however, is not so serious after all since all the specimens of black "rust" I have examined show evidences of the Cercospora. Cotton-leaf blight is characterized by irregular light brown or dirty white spots, often bordered by a dark or purple color. Many times the leaf is of a yellowish green color. Sometimes the spots have a blistered appearance, and are so close together as to give this appearance to a large part of the leaf, when it has often a rusty brown appearance. When, however, it is complicated with other fungi, the appearance of the leaf is totally changed.

Botanical Characters of the Fungi.—If the reader will turn to Plate II. and refer to figures 1, 2, and 3, there will be seen the clusters of fertile hyphæ of Cercospora as they appear when magnified under the microscope, projecting from the surface of the leaf. They are dark brown in color, toothed, geniculate, or nearly straight or curved in outline, as represented in figures 3, 2, and 1 respectively. They are produced abundantly on both sides of the leaf. The scars represented on the hyphæ at the angles, or "teeth," represent places where spores were formerly

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*Vol. XII., 1883, September, p. 31.

†Department Agriculture, 1887, pp. 355 and 356. plate I.

attached. Also the scars on the ends of the hyphæ are the same. All the spores are borne at the ends of the hyphæ, but as one spore is formed the hypha grows out from the side of the end, elongates and produces another spore at its new end and so on. The different lenghts of the fertile hyphæ shown in the figures represent proportionately some of the variations which they are subject to dependent upon conditions of the weather. When the atmosphere is very humid and warm with frequent rains they grow very rapidly and are then quite long. The spores are colorless, or hyaline, only their outline and the transverse partitions, and the finely granular protoplasm can be seen. The spores are subject to the same variations in length that the hyphæ are. They are represented in 2a, 3a, etc. They are curved, or flexuous, and very slender, tapering toward the distal end. In figure 1 some are shown still attached to the hyphæ.* The measurements are as follows: Hyphæ .07— .45 mm x .007 mm. Spores. .07—.40 mm x .003—.0035 mm, 5—50 septate.

Colletotrichum Gossypii sometimes produces a distinct disease of the cotton plant and is then called "Anthracnose of cotton."† As this is quite an important disease a separate bulletin is being prepared on it which I hope will be issued shortly after the appearance of this one. For that reason the fungus will not be described nor illustrated here. That it is an aggressive parasite has been proven by myself through inoculations of healthy plants.

Macrosporium nigricantium‡ is illustrated in Plate II., figure 4, *a*, *b*, and *c*. *b* and *c* represent the fertile hyphæ, *c* has a spore still attached to it. The other spores are free. At the place where the hyphæ arise from the mycelium in the leaf they are en-

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*Hitherto the perfect (ascosporous) stage of Cercospora gossypina Cke. has not been discovered. I have found on dead leaves a sphæriaceous fungus which probably is the perfect stage. As studies on it are still in progress I reserve it for future publication.—G. F. A.

†During the past year E. A. Southworth, asst. Mycologist at Washington, D. C., and myself have each studied this disease independently. Specimens were received by Miss Southworth only on the bolls. Her account of the fungus was published in the Journal of Mycology. Vol. VI., No. 3, Jan. 1891,

I have found it not only on the bolls but on the leaves and stalks and have been able to make some interesting observations in the field. A paper on this subject was read by myself before the Amer. Asso. Ag. Colleges and Experiment Stations Champaign, Ill., Nov. 1890.

‡First described by the author in Bot. Gaz., Vol. XVI., Mar. 1891, p. 62.

larged as shown at the lower end in the figure. When a spore is being produced, as at *c*, the hypha becomes somewhat enlarged directly below it. When the spore falls away the hypha elongates at the end, the new growth arising from inside the enlargement, its contour being the same size as that of the hypha just below the enlargement. When the new growth first takes place it appears to be not connected with the enlargement but projecting through it. As the hypha ages this appearance usually is not present and the enlargement seems to taper above into the new growth. The new growth thus formed at the end of the hypha may bear a new spore, and so in favorable weather from two to eight or more spores may be borne on a single hypha, the point where the successive spores were borne being just at the upper end of the successive enlargements. The hyphæ are dark or olive brown and borne on both sides of the leaf. At the enlargements there is usually a darker band around the center. The hyphæ thus have a nodulose appearance, as in such species as *Macrosporium parasiticum* Thüm. The spores are olive brown,oblong, constricted in the middle,and stoutly rostrate at one side of the apex. As the young spore develops it is constricted in the middle before the first transverse partition is formed. This is formed in the constricted portion. Later other transverse, longitudinal and oblique septa are produced. The spore represented at *a* is a little larger proportionately than it should be, from the fact that the drawing was made after the spore had been sown in a cell culture and just prior to germination (when the drawing was made) it was considerably larger from imbibition of water. The fertile hyphæ are usually scattered, rarely in clusters of two or three.

Measurements. Hyphæ are .050—.140 mm long x .006—.007 mm in diameter. Conidia .018—.022 mm x .036—.050 mm.

The *Alternaria* is illustrated in Plate II. figure 5. The drawing is made from a water culture under the microscope, the spore *a* having been taken from among a number of others on a cotton leaf. Parts of several vegetive hyphæ are shown on the underside and at the left. These are the parts of the fungus which grow on the inside of the leaf. The fertile hyphæ are seen to produce in a concatenate manner the spores *b*. These spores as well as the fertile hyphæ are dark brown in color, and in numbers serve to blacken the leaf.

The bacterial disease is often very widespread even when no evidences of the other fungi are to be found,but is mentioned here because frequently it is an accompaniment of the black "rust" and contributes materially to the aggravation of the disease. It is first manifested by a watery appearance in definite areolate spots which are bounded by the veinlets of the leaf. The spots are sometimes very numerous and frequently conjoined; often the disease follows one or more of the main ribs of the leaf being bounded on each side by an irregularly zigzag line. As the disease ages the spots become blackish and then light brown, frequently then bordered by a blackish color where the disease has extended somewhat centrifugally. The dead spots in the leaves sometimes break out leaving many perforations in the leaves with ragged edges, somewhat as results in cotton-leaf blight. The disease hastens the falling off of the leaves.

External Characters and Progress of the Disease.—During the entire season, from July to the close of October, of the thousands of leaves old and young that I examined, *Cercospora gossypina* has been an almost universal accompaniment, and has not been second in point of attack, except perhaps in rare cases. In many cases parallel or immediately succeeding attacks were made by the *Colletotrichum.* The *Macrosporium* as a rule follows closely the attack of the *Cercospora*, indeed sometimes seeming to be first to attack. In such cases possibly it attacked the spots diseased by *Cercospora* before the hyphæ and conidia of the latter were developed. The *Alternaria* usually succeeds the *Macrosporium*, though often seeming to be parallel with it. By its clusters of hyphæ and profusely developed concatenate spores in favorable weather the leaf is soon covered with a mass of spores giving a blackened appearance to the leaves.

My correspondents in Alabama generally use the term "black rust" when the disease progresses very rapidly and the development of the hyphæ of Cercospora and setæ of Colletotrichum, or the Macrosporium and Alternaria spores, is very profuse causing the leaves to appear black. When the disease progresses more slowly, being checked by unfavorable weather, or is in the first stages the term "red rust" is generally used. In such cases the Macrosporium or Alternaria has extended centrifugally the spots attacked by the Cercospora, increasing their size, causing them to become more nearly circular, and marking the spots with concentric lines. Also the edges of the leaf are usually dead and dried, and curled either below or upward, being favorite places for the attack of either the Cercospora or Colletotrichum. The body of the leaf is still green, paled by different shades of a dull yellow or dull purple.

In some cases in the early stages of the disease the Colletotrichum severely attacks the upper part of the stem of the plant and petioles of the leaves, giving the stems a dark color from internal changes,to the leaves a scalded appearance and causing them to shrivel up and dry, much as if frost bitten.

Sometimes the development of the Cercospora may be so great and the attack of the other fungi so tardy as to give the appearance of black "rust" produced by it alone. Specimens of this kind were received from one of my correspondents at Eutaw, Ala. The conditions for the development of the Cercospora were so favorable that from one fourth to three fourths of the leaf surface was covered with a dense mass of the dark brown hyphæ, the remaining portion of the leaf being yellowish with numerous small points of attack. The hyphæ and conidia in such cases are very long.

Where other fungi, as Colletotrichum, Macrosporium and Alternaria are abundant, it is often very difficult to find the Cercospora on the leaf. By placing the leaves, freshly gathered, in moist chambers for ten to twelve hours I have never failed to get an abundance of Cercospora, even on the smallest, uppermost leaves of the plant. Sometimes the Macrosporium is the predominating fungus in the last stage of the disease, giving a black appearance to the entire leaf.

Cercospora and Colletotrichum are both active parasites, and I am convinced from a year's study of Cercospora gossypina that it is a more active and destructive parasite than has been formerly regarded. A diseased condition once started by such a fungus opens the way for the rapid growth and great injury produced by such forms as Macrosporium and Alternaria. It is possible that the Macrosporium may infect the leaves unaided by other fungi. Inoculations of plants free from other forms must be made to determine this.

Cercospora gossypina sometimes produces a serious spot disease of the cotyledons. I first observed this on some young plants started on the horticultural grounds, in September, for experimental purposes. I am told that sometimes in cold seasons in May this spot disease is quite injurious along with "sore-shin." *

CURRENT THEORIES AS TO CAUSE.

Much speculation in agricultural papers has been indulged in regarding the cause of black "rust" of cotton. It would be almost impossible to collect and critically examine all that has been written upon the subject from a purely empirical, or as has been too often the case, from a subjective, standpoint. Some of the current theories, however, are worthy of consideration.

Physical Condition of Soil, Lack of Fertilizers.—Many hold that it is due to the physical condition of the soil, or to a lack of proper fertilization. It is quite likely that there are certain physical conditions of soil which are not so favorable to the healthy growth of the plant as others, and also that there are soils which lack proper and sufficient nutriment for a healthy growth. It is to be hoped that, since progress is being made by experimentation with fertilizers best adapted for the production of cotton on different soils, similar experiments will be made to test the efficacy of certain fertilizers in producing a plant that will be better able to resist the attacks of fungous parasites. Many of the statements currently made that certain fertilizers will surely prevent the "rust" are either without foundation in fact, or the "rust" referred to is not a diseased condition of the plant induced by fungous parasites. For example, the reddening of the leaves so commonly seen on worn out lands is usually nothing else than a

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*A pycnidial form of some sphæriaceous fungus is also frequently an accompaniment of black "rust." It is probably *Phyllosticta gossypina* E. and M. Recent cultures in agar agar peptone broth seem to show that it is the pycnidial stage of an undescribed *Pleospora* which I have found on fallen leaves. —G. F. A.

physiological condition of the plant, which proper fertilizing will, to a great extent, remedy. It is usually in reference to such lands that we hear of the "fence-row" cotton which escapes the "rust." I have seen several cases during the past year where the "fence-row" cotton was affected with the black "rust" and injured just so severely as the cotton by its side in the field. In this case, however, the soil was all fertile. As yet we are far from knowing just what fertilizer to apply to prevent black "rust." Many cases have come under my immediate observation where good land was well fertilized and yet some of the cotton was very badlv diseased. Some of my correspondents who formerly attributed the disease to the peculiar conditons of the soil, lack of fertilizers, etc., say that sometimes in the best soils and with careful fertilizing the disease appears in a very destructive form. The subject has not been inquired into in a satisfactory manner. It should be carefully tested by systematic experiments conducted as thoroughly as is done in determining the fertilizer best adapted to the growth and fruiting of the plant.*

Atmospheric Conditions.—Another theory very commonly held and frequently expressed is that black "rust" is due to "atmospheric conditions." It is an erroneous view, though arising from no fault of those who hold it, but from the fact that these fungous parasites are so small that no one can see them with the natural powers of vision,and so little known that but few people, comparatively speaking, understand how it is that an unseen organism can grow within a plant and kill it. It is true that, while the cause is not due directly to atmospheric conditions, certain conditions of the atmosphere favor the growth of the parasites. The fact is, there are certain temperature and other conditions of the atmosphere that are favorable to the growth of all organisms, even cotton itself. In the case of many plants these conditions vary, so that what is favorable for one plant is unfavorable for another. Long continued wet weather with a relatively high temperature is unfavorable to the growth and fruiting of cotton, but it *is* favorable to the growth of the parasites which produce black "rust."

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*The rust frequently is much worse in spots so that large areas of an acre or more for experiment plats are not so reliable as narrow areas of about 4 row plats across an acre.

It is very reasonable to suppose that, if we had a physical condition of the soil perfectly suited to cotton culture, a fertilizer perfectly adapted to supply the plant with just the proper nutriment, and a climate perfectly regulated to run throughout the season in a manner most favorable to cotton, there would be very little damage from black "rust." But while we are approaching the day when we may know the best fertilizer to be applied to certain soils, and may possibly be able to change to some extent the physical conditions of unfavorable soils, we probably will never be able to control atmospheric conditions which are unfavorable to the growth of cotton and favorable to the growth of its parasites.

Fruiting Cotton More Subject to Disease.—Another theory which may contain a great deal of truth is, that only while cotton is fruiting is it subject to the disease, that barren stalks are never diseased. It is hardly necessary to call attention to the fact that if we avoid the fruiting of cotton, in order to prevent the black "rust," the main object of cotton culture is defeated. Since the above was written I have been informed by Mr. W. H. Lawson that frequently otherwise vigorous plants have been produced on parts of his farm which bore no fruit but were badly diseased by black rust.

The Power of the Plant to Resist Fungous Parasites.—The power which some of the lower organisms have, under favorable circumstances, of successfully resisting the attacks of fungous parasites has been demonstrated by direct observation under the microscope. In some of the higher animals observations of the blood taken from subjects inoculated by injection of the germs into the blood vessels demonstrates that also under favorable circumstances they may successfully resist the attack. From these direct proofs in a few organisms we are enabled to draw the inference that all animals and plants under favorable circumstances can resist the growth of many parasites inimical to their existence. Perhaps the most remarkable of the earlier experiments which demonstrate this power of animals over fungous diseases is the work of Metschnikoff.* The spores of one of the

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*Ueber eine Sprosspilzkrankheit der Daphnien. Beitrag zur Lehre über den Kampf der Phagocyten gegen Krankheitserreger. Virch. Archiv. Bd. 96, 1884, pp. 177-195, 2 Taf. See Zopf; Die Pilze in morphologischer, physiologischer, biologischer und systematischer Beziehuug, 1890, pp. 241 and 261-262.

sprouting fungi (yeast plants) first fed to crustaceans made their way through the alimentary canal into the blood. Certain of the blood corpuscles attack and completely surround a cell of the fungus, and excrete a fluid of the nature of an enzyme which acting upon the fungus cell first deforms and then destroys it. If only a few cells of the fungus entered the blood the action of the peculiar blood corpuscles was sufficient to prevent the growth of the fungus and resist the disease. If, however, numerous germs of the fungus were injected the blood corpuscles were incapable of destroying them all, so that the peculiar blood cells themselves were finally overpowered by the great number of fungus cells, which also excrete an enzyme to act on the corpuscles. Now the fungus was permitted to grow and to develop the disease.

While the higher plants do not have free amœboid cells which can act as the phagocytes, as they are called, in animals do, yet the protoplasm in a healthy condition and under favorable circumstances probably offers resistance to the growth of many fungous parasites. But where the germs of the fungns are very numerous and the plant is under unfavorable conditions of temperature, and these very conditions being favorable to the development of the parasites; the plant may not be able to resist the disease. This in fact is what experiments as well as observations prove in plants as well as in animals. Unfavorable changes in the weather alone sometimes render healthy animals and plants temporarily susceptible to parasitic diseases. Over such unfavorable conditions man has no control except in circumscribed areas. Therefore it has been found necessary in many cases to apply to perfectly healthy plants preventives of infectious diseases to tide them over unfavorable periods. Already in the case of the grape, apple,potatoes,the grains and other plants; substantial success has been met with in the treatment of diseases which every care given to soils and fertilizers cannot prevent.

Experiments.—During this season experiments will be conducted at the Experiment Station with a view to discover some preventive of the disease. Not only will direct applications be made to the plant of substances to check the growth of the spores, but certain fertilizers will be used in parallel experiments, and alternate areas or rows be left untreated as checks, so that some comparisons can be drawn.

The farmers themselves could do valuable work if they could make some careful tests with fertilizers on the coöperative plan. But if undertaken it should be systematically carried out.

Several alternations of treated and untreated rows should be arranged so as to avoid error. If this year should not be a favorable one for the disease experiments should be continued another year.

Object of the Bulletin.—The object of this bulletin is to present some tangible information in regard to the disease called black "rust," to describe it briefly and to give such illustrations of the leaves as will enable farmers to detect the disease and so prevent to a certain extent the confusion which now exists with cotton-leaf blight and some conditions of the leaf which are purely physiological or due to mites. It is hoped that farmers will read the bulletin carefully and preserve it to aid them in observing the diseases of cotton during the present year. I would consider it a great favor if the farmers would observe carefully to distinguish this disease from others and send me specimens of all the different diseased conditions of cotton leaves and bolls which they find. A half dozen or more leaves of each kind should be sent. They should be laid separately between sheets of paper and be supported on one side by stiff paper of some kind, so as to keep them from spoiling while they are in the mails. A great deal of aid can thus be given by farmers themselves in this important investigation. The leaves should be sent to me at Auburn, Ala.

I wish to express my thanks to the farmers who so kindly aided me the past year in sending specimens and notes on the disease. Their names are given below,

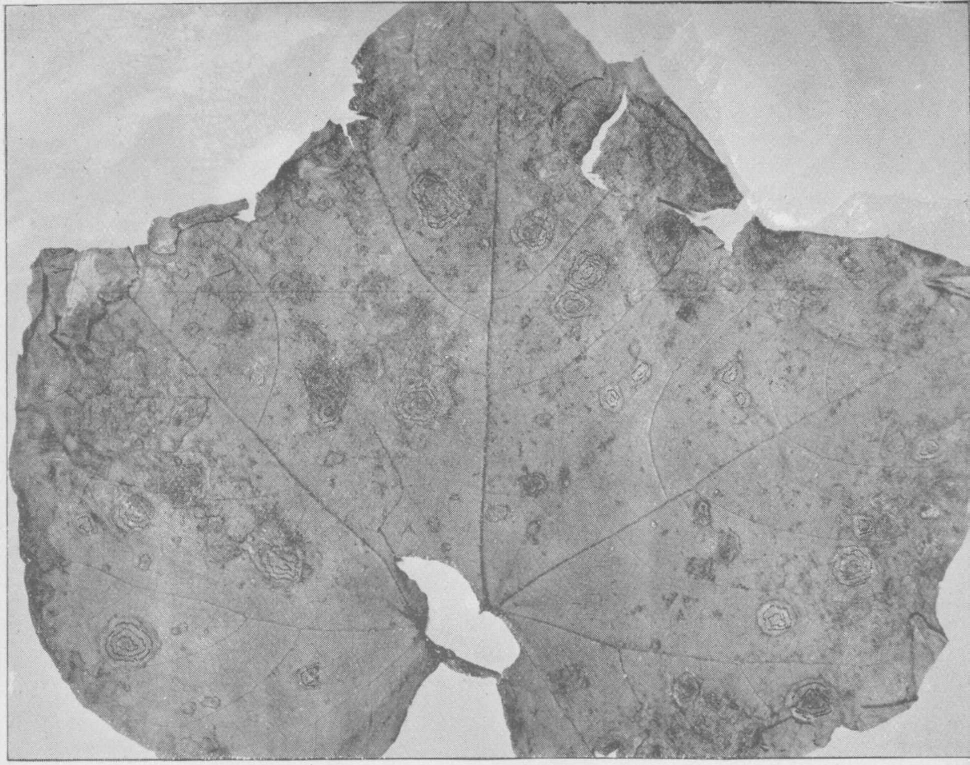
Hon. G R. Banks, Tallassee; W. C. Barkin, Coats Bend; R. E. Browning, Pleasant Hill; S. M. Cathcart, Alberta; C. C. L. Dill, Dillborough; S. A. Driver, Augustin; J, W. Edmunds, Faunsdale; J. W. Eubank, Pine Level G. T. Green, Fayetteville; F. M. Kirksey, Eutaw; R. E. Mobley, West Greene; J. C. Mathews, Crittenden Mills; Rev. J. L. Moultrie, Union Springs; Prof. C. L. Newman, Athens; G. W. Rhodes, Saville; W. M. Trimble, Sandy Creek; J. V. Tutt, Belmont; A. Y. Smith, Prattville; O. D. Smith, Smith's Station; T. J. Waller, Auburn; Mr. Wright, Wright's Mills. Specimens were received twice from some of the gentlemen

Explanation of Plate II. Figures 1, 2, 3, Cercospora gossypina Cooke, clusters of hyphæ, and few conidia; in figure 1 two conidia are still attached to the hyphæ.

Fig. 4 Macrosporium nigricantium Atkinson. *b* and *c* hyphæ. *c* bears a conidium

Fig. 5 Alternaria, *a* spore grown in water a culture, *b* chains of conidia.

All drawn with aid of camera lucida to same scale. Zeiss microscope, ocular 4, objective D used.



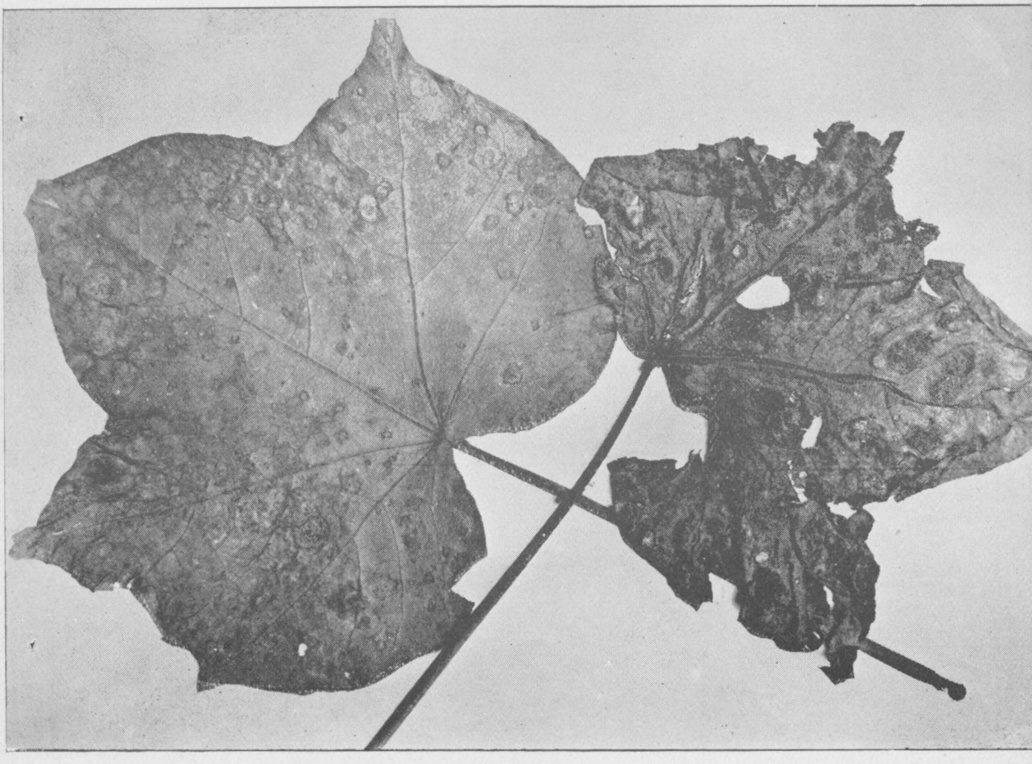


PLATE 2. ATKINSON, SOME FUNGI OF BLACK "RUST" ON COTTON.

Bulletin No. 28. November, 1891.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

WATERMELONS AND CANTALOUPES.

By J. S. NEWMAN & JAS. CLAYTON.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

THE BROWN PRINTING CO., PRINTERS, MONTGOMERY, ALA.

WATERMELONS AND CANTALOUPES.

J. S. NEWMAN AND JAS. CLAYTON.

Productiveness of Seed from different parts of the Melon,

This has been a question of interest to melon growers for a half century, and a few individuals reject the seed grown near the ends of the melon.

In order to test the matter by experiment, a melon, of the variety known as the sugar-loaf, was divided by cross sections into three parts, having each one-third of the longer axis of the melon. The seed were carefully picked from the three parts designated as the stem end, the middle and the blossom end. These were planted separately, under as nearly identical conditions as practicable, April 17th, 1891. The results are given below. While they are not conclusive they are *suggestive.* Seed have been saved from the ends and middle of melons from each plat for more elaborate inquiry.

SHOWING PRODUCTION FROM SEED TAKEN FROM DIFFERENT PARTS OF THE WATERMELON.

PLANTED APRIL 17TH, 1891.	Seed from Stem end.	Seed from Middle.	Seed from Blossom End.
First ripe melons....................	August 11	August 4.	August 7.
Proportion of melons ripe then in No..	1–2	6–7	5–6
Proportion of melons ripe by weight...	56 per ct.	88 per ct.	82 per ct.
Average weight of melons............	23.2 lbs.	27.9 lbs.	24.4 lbs.
Total weight per acre................	10.415 lbs.	14.076 lbs.	10.569 lbs.
Average weight per plant............	23.2 lbs.	32.2 lbs.	24.4 lbs.

Only the merchantable melons were gathered for the test. The largest weighed 36.6 lbs. and came from the seed of the middle section. The smallest, 18 lbs., from the blossom end. The seed from the ends each produced 435 merchantable melons per acre, while those from the middle produced 507 per acre—in number, 72 more than either end—and in weight more than two tons in excess of the ends. The variation in the time of maturity is even more marked than that in production, the middles maturing six-seventh of the melons seven days earlier than the stem end ripened half. The time of ripening ranged from one hundred and nine to one hundred and sixteen days from date of planting. By reference to the table of results of comparison of varieties, it will be seen that the number of days required for maturing this variety ranges from one hundred and to one hundred and nineteen days. The longest period required by the earlier planted—seventeen days earlier—exceeded that required by the stem end only three days. It seems, therefore, that late planted melons require less time for maturing than those planted in early spring.

The seed for this experiment were saved from the melon when in good condition for eating. The seed towards the centre mature earlier than those at either end. Possibly the difference in results would be less marked if the melon was allowed to remain upon the vine until all of the seed were fully ripe. Further inquiry on this line is desirable.

COMPARISON OF VARIETIES.

The following tabulated statement of the characteristics of some popular varieties needs little comment. The season was unfavorable and hence none of the specimens attained to normal size.

Seed of a number of varieties left over in 1888 failed to vegetate.

These seed were purchased in 1888 from three of the most reliable Seedsmen, and it is presumed were grown in 1887 Melon seed are usually supposed to retain vitality for ten years—under the above supposition these were only four years old.

It is worthy of notice that there was only an extreme variation of six days in the time of ripening of the varieties.

As a combination variety for home use and market the Jones melon ranks first. It is not so good for shipping as the Kolb Gem, but superior in quality. It answers well to "top off" a car of Kolb Gems, or for local markets. The sugarloaf gives great satisfaction for home consumption.

COMPARISON OF VARIETIES OF WATER MELONS AND OF SEED OF DIFFERENT AGES.

Plot No.	Names of Varieties.	Seedsman.	Time of ripening.	Average weight.	Length in inches.	Diameter in inches.	Color of Rind.	Color of Flesh.	Color of Seed.
1	Cuba	Experiment Station	July 21.	18	14½	7	dark green stripe	red	white with brown tips.
2	Cuban Queen	Thorburn, 1888	......	..	...	...	....	....	....
3	Early Mountain Sprout	Thorburn, 1888	......	..	..	..	....	....	....
4	Extra Early	Landreth, 1888	......	.	..	..	....	....	....
5	Johnson's Christmas	Alabama Dep't Agr'l, 1888	......	..			....	....	....
6	Jones Melon	Philip Jones	July 21	30	12½	10½	dark green stripe	dark red	white with brown tips.
7	Jones Melon	Mark W. Johnson Seed Co.	July 23	30.6	14	10	dark green stripe	dark red	white with brown tips.
8	Jordan's Gray Monarch	Thorburn, 1888		..		..	....	....	....
9	Kolb Gem.	Experiment Station	July 24	25	12½	9¼	white gr'n stripe	light red	black
10	Mammoth Iron Clad	Thorburn, 1888	......	.	...		....	....	....
11	Mountain Sweet	H. A. Dreer, 1888	......	.		...	....	....	....
12	New Gragg	Livingston	July 23	16 8	10½	9	rattle snake	salmon & red	white with brown tips.
13	Pride of Georgia	Mark W. Johnson Seed Co.	July 21	16.1	10½	8½	dark green stripe	red.	white with brown tips
14	Seminole	Philip Jones	July 21	22	16	7¾	light gray	dark red	brown
15	Sugar Loaf	Philip Jones	July 23	16 6	19	7	light gray	light red	white with brown tips.
16	Sugar Loaf	Experiment Station	July 27	24 5	23	8	light gray	dark red	brown
17	Sugar Loaf	I. I. Moses	July 27	20	21	7½	light gray	pale red	black
18	Texas Melon	W. A. Henderson.	July 21	20	15	11½	dark green stripe	salmon	white with brown tips.
19	Texas Melon	I. I. Moses	July 23	23	16	13	dark green stripe	red	white

COMPARISON OF VARIETIES OF WATER MELONS AND OF SEED OF DIFFERENT AGES—CONTINUED.

Plot No.	Names of varieties.	Seedsman.	Form.	Cavity.	Texture.	Quality.	
1	Cuba	Experiment Station	long	none	firm	best	
2	Cuban Queen	Thorburn, 1888					Failed to vegetate.
3	Early Mountain Sprout	Thorburn, 1888					Failed to vegetate.
4	Extra Early	Landreth, 1888					Failed to vegetate.
5	Johnson's Christmas	Alabama Dep't Agr'l, 1888					Failed to vegetate.
6	Jones Melon	Philip Jones	roundish	none	firm	best	
7	Jones Melon	Mark W. Johnson Seed Co	roundish	none	firm	best	
8	Jordan's Gray Monarch	Thorburn, 1888					Failed to vegetate.
9	Kolb Gem	Experiment Station	roundish	none	very firm	good	
10	Mammoth Iron Clad	Thorburn, 1888					Failed to vegetate.
11	Mountain Sweet	H. A. Dreer, 1888					Failed to vegetate.
12	New Gragg	Livingston	roundish	none	coarse and firm	very good.	
13	Pride of Georgia	Mark W. Johnson Seed Co	roundish	none	coarse	good	
14	Seminole	Philip Jones	long	none	very firm	very good.	
15	Sugar Loaf	Philip Jones	long	none	coarse	good	
16	Sugar Loaf	Experiment Station	long	none	very firm	best	
17	Sugar Loaf	I. I. Moses	long	medium	coarse.	good	
18	Texas Melon	W. A. Henderson	roundish	none	coarse	very good.	
16	Texas Melon	I. I. Moses	roundish	none	coarse.	very good.	

CANTALOUPES.

More than ordinary attention has been given this delicious fruit with the hope of inducing its more general cultivation in the State.

In order to still further encourage it seed were distributed to every section of the State last winter.

Unlike the watermelon, the cantaloupe is most productive upon highly fertilized soil. While the watermelon grows to perfection only upon soils containing a large percentage of sand, the cantaloupe will produce well upon any character of soil which is fertile and in good mechanical condition.

Unlike the watermelon also it will thrive and produce best when planted thickly. Instead of planting in hills six feet apart, plant in rows *four feet* apart and *two feet* in the drill. Cultivate shallow in advance of the growth of the vines which should be disturbed as little as practicable.

The secret of success rests in :

(a) Thorough preparation and fertilization of the soil.

(b) Planting as *early as the season will allow.* To secure an early stand it is well to replant between the hills ten days after the first seed are planted. If the first come the replanted may be chopped out. If the first are killed the replants replace them promptly.

(c) Cultivate early, frequently and shallow. Deep cultivation so mutilates the roots as to prevent fruitfulness. Watermelons bear upon the *main stem* of the vine. Cantaloupes bear upon the *laterals.*

The best quality usually accompanies thorough netting and green flesh. Thorough netting enables the melon to withstand the effects of the sun and escape "sun scald" to which all smooth surfaced varieties are subject in this climate. Varieties having yellow flesh are often sweet but invariably deficient in flavor. High flavor usually accompanies more or less coarseness of texture.

Cantaloupes should not be allowed to ripen fully upon the vines.

For shipment they should be plucked, with stem attached, just long enough before ripening to reach their destination becoming mellow, but not green enough to cause wilting.

For home use pluck when the stem readily separates from the melon under gentle pressure, and store in a cool place to mellow.

If plucked at the proper stage of ripeness the desirable state of mellowness will be reached in twenty-four hours.

Both watermelons and cantaloupes for home consumption should be plucked early in the morning, while freshened by the dew and the cool atmosphere of the night. The tabulated statement which follows gives in condensed form observations made upon twenty-five varieties during the past summer. The classification adopted by the American Pomological Society, the highest authority on such matters, has been retained instead of the usual grading from one to ten as giving, in connection with other observations, a clearer idea of the comparative merits of the varieties.

The observations are made upon a large number of fully developed, typical melons of each variety from day to day during the season of ripening. From these daily records the summary is tabulated.

"Good," "very good" and "best" in the last column is easily understood and taken in connection with the information conveyed in other columns should furnish sufficient guide for selection even to the novice.

COMPARISON OF VARIETIES OF CANTALOUPES.

Plot No.	Names of Varieties. Planted March 30th.	Seedsman.	Time ripe.	Average wt. in lbs.	Form.	Netting.	Length in inches.	Diameter in inches.	Cavity.
1	Acme.	Landreth	July 4.	3.2	oblong.	perfect.	7¼	5½	medium.
2	Atlantic City	Landreth	June 29.	3 6	oblong.	medium	7¾	5½	medium.
3	Banquet	Livingston.	July 10.	3	roundish	perfect.	4½	5	small
4	Delmonico	J. A. Everett	June 29.	4.2	oblong.	imperfect.	6¾	5¾	small
5	Extra Early Cape May	Landreth	June 29.	4.4	flat	imperfect.	5¼	6¾	medium.
6	Extra Early Hackensack	Landreth	July 1.	6	roundish	perfect.	7½	7¾	large
7	Extra Early June.	Landreth	July 3.	5.1	flat	perfect.	5¼	7	medium.
8	Golden Jenney (same as Jenney Lind)	Landreth	July 3	1 5	flat.	imperfect.	3¾	4¼	medium.
9	Grower's Pride.	J. A. Everett	July 1.	6 1	flat.	none.	6	8	large
10	Improved Montreal Market	J. A. Everett	June 29.	5 3	roundish	imperfect.	6½	8¼	large
11	Improved Pine Apple	Newman	July 4.	2.1	oblong and pointed	perfect.	7	5	medium.
12	Livingston's Market Nutmeg	Livingston.	July 7.	3.7	roundish	imperfect.	5½	6	medium.
13	Malta Winter Red Flesh	N. B. & G. Co.	July 21	6 4	roundish	none	8	6¾	large
14	Netted Gem	Landreth	July 1	1.3	roundish	perfect.	4¾	4	medium.
15	Netted Nutmeg	Landreth.	June 28.	2 1	roundish	perfect	4¾	5⅛	small
16	New Giant	Livingston	July 7.	5 6	roundish	none.	6¼	6¾	large
17	Nixon	Philip S. Jones	July 4	5.5	oblong	perfect	8½	6½	large
18	Nutmeg	Bolgiano & Son.	July 2.	4	roundish	perfect	7¾	6½	medium.
19	Osage	J. A. Everett.	July 4.	2 6	roundish	none.	5¾	5½	large
20	Persian	Bouk & Hupert	July 6.	3 3	round	none.	5¼	6	medium.
21	Shumway's Giant.	Bouk & Hupert.	July 10	7	roundish	none.	7¾	8¼	large
22	Shumway's Giant.	J. A. Everett.	July 10.	9	flat	none.	6¾	8¾	large
23	Washington Market.	Buist.	July 10	5 6	roundish	imperfect.	6¾	6½	large
24	Wilson Winter Pine Apple	Hallock	July 21.	6 4	roundish	none.	8	6¾	large
25	Tours Sugar	Hallock	July 16	1 3	round	perfect.	3½	4	small

COMPARISON OF VARIETIES OF CANTALOUPES—CONTINUED.

Plot No.	NAMES OF VARIETIES.	Seedsman.	Color of Flesh.	Texture.	Thickness of rind.	Thickness of flesh.	Corrugations.	Flavor.
1	Acme	Landreth	light green	medium	1/4	1	medium	very good.
2	Atlantic City	Landreth	green with red tint	coarse and soft.	1/8	1 3/8	medium	best
3	Banquet	Livingston	yellow	fine and firm	1/8	1 3/8	shallow.	none
4	Delmonico	J. A. Everett	yellow	fine and firm	1/8	1 1/2	shallow.	none.
5	Extra Early Cape May	Landreth	light green	coarse and soft	1/8	1 1/2	deep	very good.
6	Extra Early Hackensack	Landreth	green.	coarse and soft.	1/8	1 1/4	deep	good.
7	Extra Early June.	Landreth	green	coarse and firm	1/4	1 1/4	deep	very good.
8	Golden Jenney (same as Jenney Lind)	Landreth	green	coarse and soft	1/4	3/4	shallow.	best.
9	Grower's Pride	J. A Everett	yellow	fine and firm	1/4	1 1/4	medium	good
10	Improved Montreal Market	J. A. Everett	light green	fine and firm	1/4	1 1/4	deep	good.
11	Improved Pine Apple	Newman	deep green	coarse and firm.	1/4	1	medium	best
12	Livingston's Market Nutmeg	Livingston.	whiteish green	fine and soft	1/4	1 1/4	shallow.	very good.
13	Malta Winter Red Flesh	N. B. & G. Co.	yellow	fine and firm	1/4	1 1/8	deep	none
14	Netted Gem	Landreth	deep green	fine and soft	1/8	7/8	shallow.	best
15	Netted Nutmeg.	Landreth	green.	coarse and soft	1/8	1 1/8	shallow.	best
16	New Giant	Livingston	yellow	medium	1/4	1 1/4	deep	none
17	Nixon	Philip S. Jones	green with red tint	coarse and soft	1/4	1 1/2	medium	very good.
18	Nutmeg	Bolgiano & Son	light green	coarse and soft.	1/8	1 1/2	shallow.	very good.
19	Osage	J. A. Everett	yellow	fine and firm	1/4	1	medium	none
20	Persian	Bouk & Hupert	yellow	fine and firm	1/8	1	shallow.	none.
21	Shumway's Giant	Bouk & Hupert	yellow.	medium	1/4	1 1/4	deep	good
22	Shumway's Giant	J A Everett	yellow	fine and firm	1/4	1 1/2	shallow.	good .
23	Washington Market	Buist.	light green	fine and firm	1/2	1 1/4	deep	very good.
24	Wilson Winter Pine Apple	Hallock	yellow	fine and firm	1/4	1 1/8	deep	none.
25	Tours Sugar	Hallock	yellow.	fine and firm	1/4	3/4	none	none

Bulletin No. 29. November, 1891.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

GRAPES, RASPBERRIES AND STRAWBERRIES.

By J. S. NEWMAN & JAS. CLAYTON.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

THE BROWN PRINTING CO., PRINTERS, MONTGOMERY, ALA.

Grape Culture--Test of Varieties.

At the earnest solicitation of many, who have been induced to embark in grape culture by reading the bulletins of this station, the following epitome of grape culture is given in connection with the report of experiments with varieties.

The interest that has been excited all over the State in the cultivation of this delicious fruit is gratifying beyond the most sanguine expectations.

Cuttings have been freely given to all who desired them, and rooted plants have been distributed free to all farmers in every section of the State for the double purpose of testing the adaptation of varieties to the different soils and climatic, conditions, and to introduce the cultivation, of the vine to the homes of the people. Besides this distribution thousands of plants, which were the incidental product of instruction given the classes in agriculture in growing nursery stock, have been sold at reasonable prices. That this policy has born good fruit is manifested now in the widespread interest in grape culture, which pervades the entire State.

During an experience of thirty years in practical grape culture, an entire failure of the crop has not occurred.

There is no reason why every citizen of Alabama, who owns an acre of land, should not grow enough grapes to supply the family table from the fifth of July to the first of October. The varieties now growing upon the grounds of this station furnish an abundant supply over this period.

The varieties usually cultivated have been sufficiently tested on these grounds during the last six years to justify definite conclusions as to those best adapted to the sandy and red soils of the State; and, Bulletin No. 12, recently issued from the Canebrake Station, furnishes similar information for the prairie soils of the State. (For this, address W. H. Newman, Uniontown, Ala.) Several varieties, which fail here, have done well on the soil of the Canebrake Station.

GRAPE CULTURE.

SOIL.

The two principal requisites for a soil for grapes are fertility and drainage. Conditions of minor consideration are character and texture of soil and subsoil, elevation and exposure.

Grapes are being successfully grown upon every variety of soil in the State. Where failures have occurred they have generally resulted from a want of correct information as to varieties adapted to the locality and improper or neglectful cultivation and pruning.

PREPARATION OF THE SOIL.

Since the vine is expected to occupy the land for many years, the depth and thoroughness of the preparation of the soil cannot be too strongly emphasized. If the subsoil is clayey or of a tenacious character, the whole area to be planted should be deeply subsoiled and heavily fertilized with manures of the most permanent character, such as ashes and ground bones. The preparation should be commenced a year before planting the vines by growing humus supplying crops upon the land. A crop of rye, well fertilized, should occupy the land the winter before. When ripe, cut the stubble high and follow with a vine-producing variety of peas. Before the immediate preparation for planting is begun, sow over the dead pea vines in November half ton of air-slaked lime per acre. After plowing and subsoiling the whole area of the proposed vineyard, lay off rows eight feet apart, commence two feet from these rows on each side and bed to the middles with a good turn plow. Sow in the space, thus plowed, a ton of compost and four hundred pounds of acid phosphate or ground bone per acre. Plow and harrow until the fertilizers are thoroughly incorporated with the soil and subsoil, and fill the plowed space nearly to the level of the general surface. Open holes eight feet apart in the centre of the plowed space to suit the spread of the roots of the vines, place the roots in their natural position and firm the soil upon them.

PROPAGATION.

Grapes are propagated by cuttings, layers or grafting; most varieties grow so readily from cuttings that this method is almost universally adopted.

Cuttings of the Labrusca, Æstivalis and other types commonly known as "bunch" grapes are taken from the canes of the previous season's growth. They need not to be more than six to eight inches in length. At the base, cut half an inch below, and at the top cut half an inch or an inch above a bud. If taken from long jointed varieties, such as Concord and Perkins, there will usually be only two buds to the cutting, while in short jointed varieties, like the Delaware and Lutie, there will often be four. These cuttings may be taken and planted at any time from November to March, while the vines are being pruned.

Cuttings from the Rotundifolia or muscadine type must be made as early as practicable after the leaves fall—not later than November. If cut later, the vines "bleed" injuriously, and often *destructively.*

These cuttings should be eighteen inches long and cut from the canes of the growth of the previous summer.

LAYERS.

These are single or multiple. The former are made by turning down a new cane at any time during the winter or early spring and covering a part of it with soil, leaving the end above ground. Rooting is facilitated by partly cutting the portion covered with soil, but this is not necessary. During the growing season, abundant roots will form upon the covered part. These roots having formed artificially, as adventitious buds do above ground, they are easily torn from the vine, and hence the latter must be first cut from the parent and a fork or spade run under the roots before attempting to lift the plant.

Multiple layers are made by placing a long new cane in a trench dug for the purpose and staking it down, covering gradually with soil as the canes grow from the joints. The work may be finished at once by covering alternate joints leaving the others above ground. Roots will form upon the joints covered, while canes will grow from those not covered.

In the fall following, cut above each cane and lift the roots carefully as directed for single layers. Some hard wood varieties, notably Norton's Virginia, do not take readily from cuttings, except in very compact soils, and hence layering is generally resorted to as the most reliable means of propagating them. The Rotundifolia type are also commonly propagated in this way.

GRAFTING.

Under certain conditions, this is a desirable method of propagating new varieties rapidly, and of utilizing stocks of wild grapes or inferior varieties.

Grafting is most successfully done upon the part of the stock below the surface of the soil.

The soil is removed from six or eight inches of the base of the stock, which, if large, is cut at right angles to its axis for cleft grafting, which is done by splitting the top of the stock and inserting the scion cut in wedge shape so as to bring the inner bark of the two in contact. Cover the wounded parts of both with grafting wax and, if the stock is not stout enough to bind the scion by its own elasticity, tie with a bass-wood band or with some other soft material. Clay may be substituted for the grafting wax. As soon as the graft is inserted the earth should be drawn up to the bud on the scion and firmly pressed, using care not to displace the graft.

If the stock and scion are nearly the same size a slanting cut is made at the top of the stock and a similar one at the bottom of the scion and these bound together, uniting as much as practicable the inner bark of the two. Cover the point of junction as before.

PLANTING CUTTINGS.

Having the cuttings properly prepared and arranged with all the buds pointing in the same direction, open trenches, three feet apart, and six inches deep with turn plow, having the furrow made by the bar side of the plow as evenly cut and vertical as practicable. Place the cuttings six inches apart against this vertical side of the furrow, forcing the lower ends into the loose soil in the bottom until the upper ends are just even with the surface of the soil. A single furrow thrown upon these with a good turn plow will finish the planting, or they may be covered with hoe or shovel.

The long cuttings of the Rotundifolia type must be placed in the furrow in such inclined position as to have the lower end at the bottom of the furrow, and the other at the top of the soil.

TRANSPLANTING THE ROOTED VINES.

After the soil has been fertilized and prepared as already described, open holes every eight feet as deep as the subsoil has been broken and put two pounds of crushed or broken bones in the bottom of each and upon these a shovel full of well rotted compost or half bushel of vegetable mold from the woods. Cover these with surface soil until the depth of the hole suits the plant to be placed in it. Have the soil highest in the center and sloping to the sides, so that, when the plant is set in the centre, the roots will slope naturally in every direction. If there are two tiers of roots from different joints of the cutting, cover the lower tier with enough soil to reach to the base of the second, holding up the latter while this is being done. Cover the second tier in the same way and fill with surface soil until the plant is set to the same depth as when in the nursery row. Press the soil firmly upon the roots and drive by the side of the plant a stake four feet long for the protection of the plant in spring and to be used for training the new cane in summer. Before setting the plant, cut back the new wood of the cane, to be left, to two plump eyes and remove entirely all others. Cut off all broken or badly bruised roots and trim the ends smoothly.

TREATMENT DURING THE FIRST YEAR.

The space between the rows should be cultivated shallow with harrow, scrape or cultivator until first of May, when two rows of peas should be planted in each, and these cultivated until they occupy the land. These will shade the land and collect plant food for the benefit of the grapes. Gather the peas when ripe and leave the vines upon the surface until the following March.

Two or more canes will grow from each vine. When these attain a length of fifteen to eighteen inches, select the strongest and tie to the stake and remove the others. Keep all except the one cane rubbed off during the summer. When this is three feet long, pinch back the bud to induce a stocky growth.

TREATMENT THE SECOND SEASON.

When the soil is in good condition to be plowed in February or March, apply broadcast one thousand pounds of compost per acre and one hundred pounds each of kainit and acid phosphate. Set the plow to run just two inches deep and plow in the fertilizer. Cultivate shallow and plant peas as in the year before.

Cut back the cane, which grew the first year, to three good eyes. Plant posts of some durable wood in alternate spaces between the vines in the rows. The posts will, therefore, be sixteen feet apart with two vines between them. Stretch tightly two No. 10 wires on these posts—one two feet from the ground and the other four feet. When the new canes grow long enough, tie to the bottom wire, one on each side and one in the centre. When four feet long, pinch back to induce stocky growth. To avoid the danger of binding pass the string around the cane below a leaf, cross the ends between the cane and the wire and tie to the wire. This secures the vine in position and leaves room for growth under the string. There will be a few flowers upon the canes. If the vines are very vigorous these may be allowed to ripen grapes, one bunch to the cane. If not vigorous, the bunches should be removed before flowering.

There should now be three vigorous canes, two trained horizontally upon the lower wire, in opposite directions, and the third extending vertically to the top wire. In most varieties there will be a lateral at each of a majority of the joints.

TREATMENT THE THIRD YEAR.

Fertilize and cultivate as directed for the second year, except that the shallow cultivation is continued through the summer without the peas.

Cut the horizontal canes back to three feet in length, and cut back the laterals to one good eye or bud, or, in the language of the vintner, "spur back to one eye."

Cut the vertical cane one joint above the top wire and spur its laterals as before. The new canes which grow from these laterals, thus spurred, will each produce three bunches of grapes. The number of bunches which a vine will produce may, therefore, be estimated with a considerable degree of accuracy in advance. The crop may thus be regulated to suit the capacity of each vine, as indicated by its vigor. If not vigorous the crop should be reduced by the entire removal of some of the spurs.

The pruning, just described, is known as the "spur" system. This has been compared with the "renewal" system upon the same varieties. Results have invariably been in favor of the spur system.

To prevent over bearing and the production of useless wood, as soon as sufficient growth has been made to make the selection, the feeble canes should be rubbed off, leaving the most vigorous.

As soon as the new canes, from the spurs on the lower wire, are long enough tie to the upper wire. Future treatment need not vary materially from that given for the third year. A liberal manuring, shallow and clean cultivation and systematic spur pruning to one good eye on the new canes will insure annual crops in good quantity and finest quality. Paper bags will protect the grapes from rot, birds and insects, but spraying with fungicides is necessary to protect the vines from disease.

The definite determination of the varieties adapted to our soil and climate is the first requisite for success. The introduction into a vineyard of varieties especially subject to disease, may prove fatal to others which would succeed if removed from such contagion. The susceptible variety serves as a nursery for the propagation of the germs of disease and thus infects the atmosphere surrounding others adjacent. The Black Eagle variety is especially subject to black rot, while the Ives is usually exempt. For three years in succession the grapes on Ives vines growing near the Black Eagle have rotted, while they were exempt in other parts of the same vineyard removed from this, but associated with hardy varieties.

The necrological record, which follows, has no doubt been intensified by the association of so large, a percentage of susceptible varieties, while, on the other hand, the "survival of the fittest" is also emphasized in the hardy varieties, the Ives, Perkins, Concord and Delaware, which withstood so well the influence of the unfavorable conditions by which they were surrounded. The probable communication of disease from vine to vine and variety to variety through the medium of the pruning shears presents food for thought and a subject worthy of inquiry. This subject will receive further attention in a future bulletin containing a report of experiments with varieties of pears.

The accompanying tabulated statement presents, in compact form, *the facts* observed in regard to the varieties named. It is indeed a necrological record in which the "survival of the fittest" is conspicuously illustrated. Fortunately, the surviving varieties are all desirable as well as hardy and disease resisting.

Many of the varieties, which failed, were successful and productive till three years old, but succumbed by the fourth season. Of the four standards, Delaware, Ives, Perkins and Concord, the latter seems the least hardy.

The Wyoming red, a very sweet red grape, is well worthy of cultivation, and is the best early red grape.

Perkins and Ives are the most hardy, productive and reliable. By bagging the Ives and thus prolonging its season, these five varieties will give a supply of excellent fruit for two months.

The Delaware is the standard of excellence as to flavor, and, though a short-jointed slow grower, is exceedingly productive.

These five varieties furnish all the requisites for market, table and wine, and should satisfy the most exacting taste.

From an experience of many years previous to planting this vineyard, I knew that the Ives, Perkins, Delaware and Concord were standards [hence the large number of each planted], but the results of the comparisons here exhibited have emphasized their leadership.

Even a casual examination of the tabulated statement will show the veriest novice the varieties worthy of his attention.

VARIETIES OF GRAPES PLANTED 1886—NORTHERN EXPOSURE.

No. Vines Planted.	Names of Varieties.	Time of Ripening	Growth of Vine.	Black Rot.	Leaf Scald.	Anthracnose or Scab.	Cercospora or Leaf-Blight
6	Agawam	July 20th to 31st	vigorous	badly.	badly	slight	slight
10	Beauty	August 5th to 15th	vigorous	slight	slight	free.	slight
7	Berckman's	July 20th to 30th	vigorous	slight	slight	badly	slight
6	Brighton	July 20th to 30th	vigorous	slight	slight	badly	slight
6	Black Eagle	July 25 to Aug 5th.	vigorous	very badly	badly	medium	slight
7	Catawba	Aug. 10th to 20th	vigorous	slight	slight	free	badly.
5	Champion	Aug. 5th to 15th	vigorous	slight	slight	free	slight
110	Concord	July 20th to 31st	vigorous	slight	badly	free	slight
2	Cynthiana		vigorous	slight	slight	free	slight
106	Delaware	July 20th to 31st	vigorous	badly.	free	slight	slight
4	Diana						
6	Duchess	August 5th to 15th	medium	badly	slight	very badly	slight
6	Elvira						
6	Grein's Golden	August 5th to 15th	vigorous	free	badly	badly	badly
6	Goethe	August 1st to 10th	vigorous	slight	slight	badly	badly
58	Hartford	July 5th to 15th	medium	badly.	slight	badly	badly
2	Humboldt						
6	Iona	July 25 to Aug. 5.	medium	slight.	badly	badly	slight
6	Irving	July 25 to Aug. 5.	not vigorous	slight	badly	badly	badly
109	Ives	July 20th to 31st	vigorous	slight	slight	free	badly.
2	Isabella	August 5th to 15th	vigorous	slight.	badly	free	badly.
6	Jefferson	July 25 to Aug. 5	medium	slight.	slight	very slight.	slight
6	Lady Washington	August 5 to 15	vigorous	medium	badly	badly.	medium
6	Lindley	July 30 to Aug. 10	not vigorous	badly	badly	badly	badly
3	Long or Cunningham	August 10th	vigorous				
2	Lutie	July 20th to 30th	not vigorous	free	badly	free	free

VARIETIES OF GRAPES PLANTED 1886—NORTHERN EXPOSURE—CONTINUED.

No. Vines Planted.	NAMES OF VARIETIES.	Time of Ripening.	Growth of Vine.	Black-Rot.	Leaf Scald.	Anthracnose or Scab.	Cercospora or Leaf-Blight.
6	Martha	July 30 to Aug. 10	vigorous	free	badly	badly	slight
6	Mason's Renting	August 5th to 15th	not vigorous	free	slight	slight	badly
6	Maxatawney	July 25 to Aug. 5	medium	slight	badly	badly	badly
6	Meno	August 5 to 15	not vigorous	badly	very badly	slight	badly
6	Merrimac	July 25 to Aug. 5	not vigorous	badly	badly	slight	slight
6	Moore's Earley	July 5th to 15th	medium	free	slight	free	slight
8	Niagara	July 25 to Aug 5	vigorous	badly	slight	badly	badly
7	Norton's Virginia	August 5 to 15	vigorous	free	free	free	free
2	Othello						
6	Pearl	August 5 to 15	vigorous	badly	badly	slight	slight
107	Perkins	July 5 to 15	vigorous	very slight	free	very slight	slight
1	Peter Wylie	July 20th	not vigorous	badly	badly	badly	slight
6	Pocklington		not vigorous	slight	badly	slight	slight
6	Prentiss	July 25 to Aug 5	not vigorous	free	free	free	slight
6	Rogers No 11	July 25 to Aug. 5	medium	very badly	badly	badly	slight
9	Telegraph	July 25th to Aug. 5	medium	badly	slight	slight	slight
6	Triumph	July 25th to Aug. 5	medium	free	badly	badly	slight
7	Vergennes	July 25th to Aug. 5	vigorous	slight	slight	"	slight
2	Warren		vigorous	free	slight	free	slight
6	Wilder	July 25 to Aug. 5	medium	badly	slight	slight	very slight
6	Worden	July 25 to Aug 5	medium	slight	slight	"	slight
6	Wyoming Red	July 10th to 20th	medium	slight	free	free	badly

VARIETIES OF GRAPES PLANTED 1886—NORTHERN EXPOSURE. —CONTINUED.

No. Vines planted.	NAMES OF VARIETIES.	Downy Mildew.	Grape Curculio.	Type.	Number Dead.	When Died.	Number Living	BERRIES.	
								Size.	Color.
6	Agawam	badly	badly	Hybrid	6	4 in '89, 2 in '90-91	...	large	dark red.
10	Beauty	free	slight	Labrusca.	10	2 in '89, 8 in '90-91	...	medium	red.
7	Berckman's	free	free.	Clinton & Del.	7	all in 1890-91.	..	small.	red.
6	Brighton	very slight	free.	Labr. cross	6	4 in '89, 2 in 1890.	..	medium	red.
6	Black Eagle	free	free	Hybrid	6	1 in '89, 5 in '90-91	..	large	black.
7	Catawba	free	free	Labr.	6	2 in '89, 5 in '90-91	...	medium	red.
5	Champion	free	badly	Labr	5	all in 1890	...	medium	black.
110	Concord	free	badly	Labr	37	in '90 and '91.	73	large	blue-black.
2	Cynthiana	slight	free.	Æstinalis.	1	in 1890	1	small.	black.*
106	Delaware	badly	slight	Labr.	7	in '90-91	99	small	red.
4	Diana	...	...	Labr.	4	in '89	..	medium	reddish.*
6	Duchess	slight	free.	Hybrid	4	in 89-90	2	medium	white.
6	Elvira	...	...	Rip. cross	6	...	...	large	white.
6	Grein's Golden	free	free.	Rip cross	5	2 in '89, 3 in '90-91	1	medium	amber.
6	Goethe	free	free	Hybrid	6	5 in '89, 1 in '90	...	large, obl'ng	purple.
58	Hartford	free	free	Labr.	58	21 in '89, 37 in '90	...	large	black:
2	Humboldt	...	...	Rip. cross	2	in 1889	...	large	white *
6	Iona	free	free.	Labr.	6	all in 1890	...	large	pale red.
6	Irving	free	free	Hybr	6	4 in '89, 2 in '90.	...	large	white.
109	Ives	free	slight	Labr.	1	in 1890	108	medium	black.
2	Isabella	slight	badly.	Labr	2	in 1890	...	medium	black.
6	Jefferson	free	slight	Labr. cross	3	in 1890	3	large	red.
6	Lady Washington	free	free	Hybrid	6	5 in '89, 1 in '90.	...	medium	white.
6	Lindley	slight	slight	Hybrid	4	1 in '89, 3 in '90.	2	large	red.
3	Long or Cunningham	free	...	Æst	3	...	...	small.	dark purple.*
2	Lutie	free	free.	Labr.	...	...	2	large	dark red.*

VARIETIES OF GRAPES PLANTED 1886—NORTHERN EXPOSURE—CONTINUED.

No. Vines Planted.	NAMES OF VARIETIES.	Downy. Mildew.	Grape Curculio.	Type.	Number Dead.	When Died.	Number Living.	BERRIES.	
								Size.	Color.
6	Martha	free	free	Labr	3	in 1890	3	large	white.
6	Mason's Renting	free	free	Labr	6	1890-91	..	medium	white.
6	Maxatawney	badly	slight	Labr	6	all in 1889	..	oblong,med.	white.
6	Meno	free	free	Labr	6	2 in '89, 4 in '90	..	small.	amber.
6	Merrimac	free	free	Hybrid	5	2 in '89, 3 in '90	1	very large	black.
6	Moore's Early	free	free	Labr	5	1 in '89, 4 in '90-91	1	large	black.
8	Niagara	badly	free	Labr. cross	5	1889-90	3	large	white.
7	Norton' Virginia	badly	free	Æst	3	in 1890	4	small	black.
2	Othello			Hybr,	2	all in '89	..	very large	black.*
6	Pearl	slight	free	Rip. cross	6	3 in '89, 3 in '90-91	..	medium	white.
107	Perkins	free	slight	Labr	2	in 1890-91	105	large	brown-red.
1	Peter Wylie	badly		Hybrid	1		..	small	white.*
6	Pocklington	free	free	Labr	6	all in '89-90	..	large	amber.
6	Prentiss	free	free	Labr	6	all 1890	..	medium	white.
6	Rogers No. 11	badly	free	Hybr	6	all '89-90-	..	large	black.
9	Telegraph	free	free	Labr	9	5 in '89, 4 in '90	..	medium	black.
6	Triumph	free	free	Hybr	5	1889	1	large	white.
7	Vergennes	free	free	Labr	7	2 in '89, 5 in '90	..	large	red.
2	Warren	badly	free	Æst	1	1889	1	small.	blue with bl'om*
6	Wilder	slight	slight	Hybr	6	all '89-90	..	very large	black.
6	Worden	free	slight	Labr	5	all '89-90	1	large	black.
6	Wyoming Red	free	badly	Labr	1	in 1891	5	medium	red.

*Planted 1889.

The old vineyard having a northern exposure, it appeared desirable that the same varieties should be planted on a southern exposure, and hence the new vineyard was planted in 1889. Results are shown in the tabulated statement, which follows. These vines bore their first full crop last summer, and yet the mortality is already great—greater than occurred in the old vineyard during the corresponding period. In two more years the record will no doubt differ but little from that now given of the old vineyard. It will be observed that the veteran survivers of the old vineyard are sustaining their reputation for hardiness in the new.

VARIETIES OF GRAPES PLANTED 1889. SOUTHERN EXPOSURE.

Number Planted.	Names of Varieties.	Time of Ripening.	Growth of Vine.	Black Rot.	Leaf Scald.	Anthracnose or Scab.	Grape Leaf Blight.	Downy Mildew.	Type.	No. Dead	When Died	Number Living.	Size of Berries.	Color of Berries.
2	Agawam.	July 20 to 31	Vigorous,	Free	Slight.,	Free	Badly	Free	Hybr	1	1891	1	Large	dark red.
1	Amber		Medium	Free	Badly	Free.	Badly	Free	Rip	1	1891	...	Medium	pale amber.
6	Beauty	Aug. 5 to 15	Vigorous	Slight	Free.	Slight.	Slight	Free	Labr. cross	1	1891	5	Medium	red.
22	Berckman's.	July 20 to 30	Medium	Free	Slight.	Slight.	Slight	Free	Clinton & Dela.	4	1891	18	Small	red.
24	Black Eagle	July 25 to Aug. 5	Vigorous	Badly	Badly	Free.	Slight	Free	Hybr	12	1890-1	12	Very large	black.
3	Black Hawk								Labr.	3	1890	...	Large	*black.
2	Brandt		Not vig	Free	Slight.	Badly,	Free	Free	Hybr	..	...	2	Small	black.
2	Brighton	July 20 to 30	Medium	Free	Free,	Slight	Slight	Free	Labr	1	1891	1	Medium	red.
2	Canada		Not vig	Free	Badly	Badly	Free	Free	Hybr	..	...	2	Medium	black.
6	Catawba.	Aug. 10 to 20	Vigorous	Slight	Slight.	Free.	Badly.	Free.	Labr.	..	...	6	Medium	red.
2	Champion.	Aug. 5 to 15	Vigorous	Free	Free.	Free,	Slight.	Free	Labr	..	...	2	Medium	black.
2	‡Colraine									1	1891	1		†
25	Concord	July 20 to 31	Vigorous	Free	Badly.	Free	Slight	Free	Labr.	2	1891	23	Large	blue black.
2	Cynthiana.	July 20 to 31	Vigoroas	Slight	Free	Free	Slight.,	Slight	Æst	..	...	2	Small.,	black.
24	Delaware	July 20 to 31	Vigorous	Slight	Slight.	Free	Badly	Free	Labr.	5	1891	19	Small	red.
2	Diana		Not vig	Free	Free	Free	Badly	Free	Labr.	..	...	2	Medium	reddish.
2	Duchess.								Hybrid	2	1891	...	Medium	*white.
2	Eldorado	July 25 to Aug. 5	Vigorous	Free	Badly	Very slight	Slight.	Very slight	Labr	2	1391	...	Large	amber.
2	Empire State		Vigorous	Free	Free.	Free,	Badly	Free	Labr. and Rip.	..	..	2	Medium	yellow.
3	Excelsior		Medium	Slight	Slight.	Badly	Badly	Free.	Hybr	1	1891	2	Medium	pale red.
11	Goethe	Aug, 1 to 10	Vigorous	Free	Badly.	Free.	Badly.	Free	Hybr	7	1891	4	Oblong large	purple.
3	Golden Chasselas		Vigorous	Slight	Slight,	Badly	Free	Free	Hybr	3	1891	...	Medium	white.
4	‡Green Mountain									1	1890	3		†
2	Grein's Golden	Aug. 5 to 15	Vigorous	Free	Slight,	Free.	Slight.	Free	Rip. cross	1	1890	1	Medium	amber.
1	Grein's No. 4		Vigorous	Free	Free,	Free	Slight.	Free.	Hybr	..	...	1	Medium	white.

VARIETIES OF GRAPES PLANTED 1889. SOUTHERN EXPOSURE—CONTINUED.

Number Planted.	Names of Varieties.	Time of Ripening.	Growth of Vine.	Black Rot	Leaf Scald.	Anthracnose or Scab.	Grape Leaf Blight.	Downy Mildew.	Type.	No. Dead	When Died	Number Living.	Size of Berries.	Color of Berries.
2	Grein's No. 7		Medium	Free	Badly.	Slight.	Badly.,	Free	Hybr	2	1891		Medium	white.
22	Hartford	July 5 to 15	Medium	Slight	Badly.	Slight.	Slight	Free	Labr	5	1891	17	Large	black.
2	Herbert		Vigorous	Free	Badly.	Slight.	Slight	Badly	Hybr			2	Large	black.
2	Hermann		Vigorous	Free	Slight.	Slight	Free	Slight	Æst.			2	Small	black.
4	Highland		Medium	Free	Free.	Free.	Slight	Free	Hybr	1	1891	3	Large	black with blo'm
2	Humboldt		Vigorous	Slight	Badly.	Free.	Slight	Free	Rip. cross			2	Large	white.
2	Iona								Labr.	1		1	Large	*pale red.
2	Irving	July 25 to Aug. 5	Not vig	Free	Free	Free.	Free	Free	Hybrld	2	1891		Large	white,
1	Israella		Not vig	Free	Slight.	Free.	Badly	Free	Labr	1	1890		Large	black with blo'm
22	Ives	July 20 to 30	Vigorous	Free	Free.	Slight	Slight	Free	Labr			22	Medium	black.
2	Jefferson	July 25 to Aug. 5	Medium	Free	Slight.	Free.	Slight	Free	Labr. cross			2	Large	red.
1	Jessica		Medium	Free	Free	Free,	Badly	Free.	Hybr			1	Medium	yellowish white.
10	Lady Washington	Aug. 5 to 15	Medium	Badly	Badly.	Free.	Free	Free	Hybr	10	1890-1		Medium	white.
2	Lenoir		Vigorous	Slight	Badly.	Very badly	Badly	Badly,	Æst			2	Small	blue black.
2	Lindley	July 30 to Aug. 10	Vigorous	Free	Slight,	Free.	Badly	Slight	Hybr	1	1891	1	Large	red.
2	Long or Cunningh'm		Vigorous	Free	Slight.	Slight	Badly	Free	Æst			2	Small	dark purple.
10	Martha	July 30 to Aug. 10	Medium	Free	Badly.	Free.	Slight,	Free	Labr	3	1891	7	Large	white.
1	Mary Wylie		Vigorous	Slight	Badly.	Badly	Slight	Free		1	1891			
2	Mason's Renting	Aug. 1 to 15	Vigorous	Free	Slight.	Free.	Free	Free	Labr	2	1891		Medium	white.
9	Maxatawney	July 25 to Aug. 5	Medium	Free	Badly.	Badly	Slight	Free	Labr	5	1891	4	Oblong med.	white.
8	Merrimac	July 25 to Aug. 5	Vigorous	Slight	Badly.	Badly	Badly	Badly	Hybr			8	Very large	black.
2	Miland		Vigorous	Free	Badly.	Badly	Slight	Very slight				2	Medium	amber.
1	Moore's Diamond		Medium	Free	Slight.	Badly	Slight	Very slight	Labr			1	Large	greenish white.
2	Moore's Early	July 5 to 15	Not vig	Free	Free	Free.	Slight	Free	Labr	2	1891		Large	black.
2	Missouri Riesling		Vigorous	Free	Slight.	Free.	Badly	Free	Rip	2	1891		Medium	white.
4	Naomi		Vigorous	Slight	Free	Slight.,	Slight	Slight	Hybr	1	1891	3	Medium	pale green.
10	Niagara	July 25 to Aug. 5	Vigorous	Badly	Badly.	Slight	Slight.	Free	Labr. cross	2	1891	8	Large	white.
2	Noah		Not vig	Free	Badly.	Slight	Slight	Free	Rip.	3	1891		Large	white.
2	Norton's Virginia	Aug. 5 to 15	Vigorous	Free	Free	Free.	Slight,	Slight	Æst			2	Small	black.
2	Northern Muscat											2		†
2	Othello		Vigorous	Slight	Slight.	Free.	Badly	Free	Hybr			2	Very large	black.
1	Peabody		Vigorous	Badly	Badly	Badly	Slight.,	Badly		1	1891			
10	Pearl	Aug. 5 to 15	Vigorous	Slight	Badly	Free,	Badly	Free	Rip. cross	10	1891		Medium	white.
23	Perkins	July 5 to 15	Vigorous	Free	Free	Free.	Slight,	Free.	Labr			23	Large	brown red.
2	Pocklington		Medium	Free	Free	Free,	Slight	Free	Labr	2	1891		Large	amber.

VARIETIES OF GRAPES PLANTED 1889. SOUTHERN EXPOSURE—CONTINUED.

Number Planted.	Names of Varieties.	Time of Ripening.	Growth of Vine.	Black Rot.	Leaf Scald.	Anthracnose or Scab.	Grape Leaf Blight.	Downy Mildew.	Type.	No. Dead	When Died.	Number Living.	Size of Berries.	Color of Berries.
2	Poughkeepsie		Medium	Slight	Free	Free.	Badly	Free	Hybr	2	1891		Large	red.
1	Progress or Norfolk.								Labr.	1	1890		Large	red.
1	Rebecca									1	1891			*
2	Rogers' No, 11	July 20 to 30	Vigorous	Badly	Badly	Slight.	Slight.	Badly	Hybr	1	1891	1	Large	black.
2	Rulander		Vigorous	Free	Badly	Free.	Slight.	Free		1	1891	1		
2	Telegraph	July 25 to Aug. 5	Vigorous	Slight	Slight	Free.	Slight.	Slight	Labr.			2	Medium	black.
1	Transparent		Vigorous	Free	Slight	Free.	Badly	Free	Rip, cross	1	1891		Small	white.
3	Triumph		Not vig	Free	Badly	Free	Free	Free.	Hybr	3	1891		Large	white.
1	Ulster Prolific									1	1890			
1	Vinango								Labr	1	1890		Large	red.
9	Vergennes	July 25 to Aug. 5	Vigorous	Free	Slight	Badly	Slight	Free	Labr	4	1891	5	Large	red.
4	Warren		Vigorous	Free	Slight	Slight.	Slight	Badly	Æst			4	Small	blue with bloom.
1	Wilder	July 25 to Aug. 5	Vigorous	Free	Slight	Badly	Free	Free.	Hybr	1	1801		Very large	black.
1	Wilding		Medium	Slight	Free	Free.	Slight.	Free.				1		
1	Worden	July 25 to Aug. 5	Medium	Slight	Slight	Slight.	Free	Free.	Labr	1	1890		Large	black.
6	Wyoming Red	July 10 to 20.	Not vig	Free	Free	Free.	Free	Free	Labr	2	1891	4	Medium	red.
3	Isabella	Aug. 5 to 15	Vigorous	Badly	Badly	Free,	Badly	Slight	Labr			3	Medium	black.
2	Lutie	July 5 to 15	Not vig	Free	Free	Free,	Slight	Free				2	Medium	brown red.

* Replanted 1890. † Planted 1890. ‡ Not fruited at the Station.

ROTUNDIFOLIA OR MUSCADINE TYPE.

This is peculiarly a child of the south which has, hitherto, been sadly neglected. Men are prone to overlook blessings by which they are immediately surrounded while searching abroad for those less to be desired but enchanting in the distance.

The scuppernong is the only variety of this type usually planted, very few farmers being aware of the fact that there are others very much its superior.

In 1886 eight varieties were planted twenty feet apart in rows, along the margin of a branch, and trained upon a trellis of three wires. The vines have been annually pruned by spurring back the canes of the growth of the previous season to six inches.

This type must be pruned in autumn, just after the leaves fall. If pruned later there is danger of destructive bleeding. This method of training places the crop of fruit in easy reach, increases the size of the berries and bunches, and insures a larger yield of grapes of better quality.

The Thomas commences to ripen August 15th, thus continuing the supply from the vineyard of the other types. Other varieties ripen in succession until the middle of September and furnish fruit till October.

The Memory and Mish are especially desirable, combining the good qualities of vigorous growth, hardiness, productiveness and very superior quality.

Desiring to secure the verdict of as large a jury as possible, very many visitors were taken through this vineyard for the purpose of comparing the varieties. Without exception the Memory and Mish were pronounced superior to the Scuppernong. Of the ten varieties compared, the Memory is by far the most vigorous grower.

All are free from disease except an occasional very slight attack of black rot. The proximity of diseased vines of other types may have furnished the spores for the disease.

To propagate this type use *long cuttings*, taken in October or early in November, or layer the vines at any time from October to March.

The tabulated statement sufficiently describes the characteristics of these varieties, except as regards adhering to the stem.

The Scuppernong, James and Jeter drop so readily from the bunch as to cause great waste in gathering. The stem is attached to the berry externally. The Thomas, Memory and Scuppernong seedling do not shed so readily though attached externally. The Flowers, Flowers Improved, Mish and Tenderpulp adhere firmly to the bunch, having the stem attached internally. These last named varieties can be gathered and shipped in bunches as readily as Concord or Ives.

The Mish and Memory are both rated *best* as to quality, though they differ in many respects. The Memory is best in flavor and the Mish best in sweetness. The Memory produces a very large berry while the Mish is small. Both continue long in season. The following tabulated statement needs no comment:

ROTUNDIFOLIA OR MUSCADINE TYPE.—Planted in 1886.

No. Vines.	Names of Varieties.	Time of Ripening.	Growth of Vine.	Form of Grape	Size of Grape.	Size of Bunch.	Productiveness.	Sweetness	Flavor.	Quality.
6	Flowers	Sept. 10	vigorous	slightly oblong	medium	large	very productive.	acid	poor	Thick skin hard pulp. Good.
6	Flowers Improved	Sept. 5	vigorous	slightly oblong	medium	very large	v. prod'ctive	acid	poor	"
2	James*	Sept. 10	medium	slightly flat	large	medium	medium	very sweet	very good.	very good.
5	Jeter*	Aug. 25.	vigorous	round	large	small	medium	medium	foxy	good.
6	Memory	Aug. 20.	very vig's.	slightly oblong	very large	medium	medium	very sweet	best	best.
6	Mish	Sept. 1.	vigorous	round	small	medium	productive	best	very good.	best.
2	Scuppernong	Aug. 20.	vigorous	round	medium	small	medium	very good.	very good.	very good.
6	Scuppernong Seedling	Sept. 10	vigorous	slightly flat	medium	medium	very prod'e	medium	good	good.
6	Tender Pulp	Sept. 10	vigorous	slightly oblong	medium	large	best	medium	good	good.
6	Thomas	Aug. 15.	vigorous	oblong	large	medium	medium	very sweet	very good.	very good.

*Planted in 1887.

RASPBERRIES.

The following varieties have been tested on the grounds of this Station, commencing in 1886:

BLACK CAP TYPE.
(Propagated by layering of tips.)
Caroline.
Doolittle.
Davidson's Thornless.
Florence, (Hybrid, yellow).
Gregg.
Hopkins.
Mammoth Cluster.
Ohio.
Sauhegan.
Shaffer's Colossal, (Hybrid).
Tyler.

RED CAP TYPE.
(Propagated by underground Stem).
Brandywine.
Crimson Beauty.
Cuthbert.
Early Prolific.
Golden Queen.
Highland Hardy.
Hansell.
Marlboro.
New Rochelle.
Rancocas.
Reliance.
Superb.
Thompson's Early Prolific.
Thompson's Early Pride.
Turner.
Welch.

Of the Black Caps the Sauhegan and the Shaffer's Colossal are the most reliable and desirable varieties, but none of this type have proved satisfactory in open field culture here. In garden culture, where they can be partially shaded, they succeed reasonably well. In the field they sun-scald at the arch of the new canes, and on account of our dry falls, fail to propagate.

Of the Red Caps, the Turner has been perfectly satisfactory, being hardy and prolific, with a fruiting season of from three to five weeks. Next to this ranks the Cuthbert, which produces a larger plant and a larger berry, but is less prolific.

Golden Queen ranks first as to the size and quality of the berries, but is neither so hardy nor prolific as the other two.

Thompson's Early Prolific ranks next to the Golden Queen in quality of berry, is prolific, but not so hardy as the Turner and Cuthbert. The remaining varieties have proved unreliable on these grounds.

Since 1886, the following varieties of Strawberries have been planted on the grounds of this Station. Detailed reports have been made upon nearly all of them, from time to time, since 1887. Three new varieties, viz: Banquet, Everbearing and Dubravas No. 3, have not been sufficiently tested for report. The last named has been fruited sufficiently to justify rating it as "promising well."

From the long list of tested varieties, the following six are recommended as those most worthy of cultivation, and are rated in the order named : 1st, Sharpless ; 2d, Wilson ; 3rd, Belmont ; 4th, Buback ; 5th, Eureka or 1001 ; 6th, Haverland. These are all good varieties for the soil of this Station, which represents nearly three-fourths of the soil of the State of Alabama, with sufficient accuracy to render the results of experiments conducted here valuable.

Three of these, Sharpless, Wilson and Eureka or No. 1001, are recommended in Bulletin No. 12, of the Canebrake Station as best, and Haverland did well. Buback and Belmont were not tested there. Gandy, and Champion of Kentucky, did well here but not sufficiently so to be included in the six varieties most highly recommended.

Some of the most desirable varieties of grapes, raspberries and strawberries, tested upon these grounds have been distributed to farmers in nearly all of the counties of this State for experiment and report to this Station. Sufficient time has not elapsed since such distribution to authorize reports, but very valuable results are expected within the next two years from experimental comparison of varieties under such varied conditions.

VARIETIES OF STRAWBERRIES.

1 Agriculturist.
2 Atlantic.
3 Banquet.
4 Belmont.
5 Bidwell.
6 Big Bob.
7 Boyden's No. 30.
8 Bubach.
9 Captain Jack.
10 Champion.
11 Champion of Ky.
12 Charles Downing.
13 Cornelia.
14 Continental.
15 Crescent.
16 Crystal City.
17 Cumberland Triumph.
18 Daniel Boone.
33 Jewell.
34 Jucunda.
35 Jumbo.
36 Kentucky.
37 Lacon.
38 Lady Rusk.
39 Legal Tender.
40 Lida.
41 Longfellow.
42 Manchester.
43 May King.
44 Miner's.
45 Monarch of the West.
46 Monmouth.
47 Mt. Vernon.
48 Mrs. Garfield.
49 Nig's Superb.
50 No. 3 Dubravas.

19 Early Canada.
20 Everbearing.
21 Finch's Seedling.
22 Galceran.
23 Gandy.
24 Glendale.
25 Golden Defiance.
26 Harris' Mammoth.
27 Haverland Seedling.
28 Henderson.
29 Hoffman.
30 Indiana.
31 James Vick.
32 Jersey Queen.

51 No. 1001 or Eureka.
52 Old Iron Clad.
53 Parry.
54 Piper's Seedling.
55 President Lincoln.
56 Primo.
57 Prince of Berries.
58 Sharpless.
59 Triomphe de Gand.
60 Vineland Seedling.
61 Warren.
62 Wilson.
63 Windsor Chief.
64 Wonderful.

Bulletin No. 30. November, 1891.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

APPLES, PEARS, PEACHES AND PLUMS.

BY J. S. NEWMAN.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

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APPLES.

In March, 1885, forty-five varieties of apples were planted, two trees of a kind, for the purpose of determining their adaptation to this soil and climate and to observe their susceptibility to or exemption from disease.

Observations have been made from time to time since 1886, the results of which are tabulated in condensed form for reference. It will be seen that the susceptibility of the same variety to disease varies in different seasons.

Of the list planted, the following have made the most satisfactory growth, viz: Winesap, Limber Twig, Horn, Simmons' Red, Astrachan Red, Elgin Pippin, Ben Davis, Carter's Blue and Kittageskee.

The following have done well but have not made so satisfactory growth as the list just named, viz: American Golden Russet, Cannon Pearmain, Early Harvest, Hewes' Virginia, Rawls' Jennet, Stevenson's Winter, Thornton Seedling and Romanite.

One of each of the following varieties has died, but the remaining one is very thrifty: Carolina Watson, Chattahoochee greening, Hiley's Eureka, Tuscaloosa seedling, Yellow English and Yopp's Favorite.

The following are pronounced failures on this soil, viz: Buncombe, Equinetelee, Family, Laurens Greening, May, Oconee Greening, Palmer, Pryor's Red and Rhodes' Orange.

The remaining list are not failures, but have not done well.

Nineteen varieties bore fruit this year, ripening as follows:

NAME OF VARIETY.	Date of Ripening	NAME OF VARIETY.	Date of Ripening.
Astrachan Red........	June 1st.	Romanite..............	Oct. 8th.
Ben Davis............	Oct. 8th.	Simmons' Red.........	Aug. 18th.
Carter's Blue.........	Aug. 25th.	Stevenson's Winter.....	Oct. 15th.
Early Harvest........	June 5th.	Shockley..............	Oct. 15th.
Horn................	Oct. 1st.	Taunton..............	Oct. 1st.
Horse	July 20th.	Tuscaloosa Seedling....	Oct. 1st.
Hughes' Virginia	Oct. 8th.	Terry's Winter........	Nov. 1st.
Kittageskee..........	Oct. 1st.	Winesap.............	Oct. 8th.
Limbertwig...........	Oct. 8th.	Yellow English.........	Oct. 1st.
Red June............	July 15th.	....	....

Neither the soil nor climate of this section is favorable for growing apples, and hence it is especially important to select proper varieties.

Most of the varieties which have proved successful here are Southern seedlings. Indeed all of the late ripening winter varieties are natives of the South and must of necessity be so, since those brought from the North will ripen a month earlier here than there.

The list of successful varieties given above affords ample field for selection to furnish a family supply throughout the entire year.

Apples need a fertile soil, annually manured and thoroughly cultivated in such manner as to leave the principal roots undisturbed. Small grain should not be sown in an orchard, since it makes its heaviest demands upon the soil just as the crop of fruit is being set and the trees need the exclusive occupancy of the soil.

VARIETIES OF APPLES PLANTED IN MARCH 1885.—SOIL SANDY. NORTHERN EXPOSURE.

No. Planted.	NAMES OF VARIETIES.	1886	1889	1890			1891
		Cedar Rust	May 8th. Blight	May 31. Blight.	June 18. Cedar Rust.	June 18. Leaf Spot.	Blight.
2	American Golden Russet	free	medium	badly	free	badly	badly
2	Astrakan Red	free	slight	free	free	slight	very slight
2	Ben Davis	free	free	slight	free	slight	free
2	Bradford's Best	medium	medium	badly	slight	slight	slight
2	Buncombe	medium.	slight	very slight	free	slight	badly
2	Cannon Pearmain	slight	free	very slight	slight	slight	free
2	Carolina Watson	slight.	free	slight	free	slight	1 free, 1 dead
2	Carter's Blue	medium	free.	slight	slight	slight	very slight.
2	Chattahoochee Greening	slight	badly	badly	free	badly	badly
2	Cook's Seedling	slight	free	slight	slight	slight	badly
2	Early Harvest.	free	free	slight	free	slight	badly
2	Early Red Margaret	slight	free	badly	free	free	1 b'dly, 1 de'd
2	Elgin Rippin	free	slight	very slight	slight	badly	slight
2	Equinetelee	slight	badly	badly cut back	slight	badly	free
2	Family.	medium	slight	very slight.	slight	badly	1 free, 1 d'ad
2	Golden Pippin	badly	medium	b'dly. Cut b'ck	slight	slight	slight
2	Habersham Late.	free	free	slight	free	slight	very slight
2	Hames'	medium	free	badly	slight	slight	slight
2	Hewes' Virginia	free	free	slight	free	slight	slight
2	Hiley's Eureka	medium	badly	badly	badly	slight	slight
2	Horn	medium	medium	badly	badly	badly	slight
2	Horse	medium	free	badly	slight	badly	badly
2	Junaluskee						
2	Kittageskee	free	badly	badly	free	slight	slight
2	Limbertwig	medium	free	slight	free	slight	very slight
2	May	slight	free	very slight	free	slight	1 d'd, 1 sl'ght

VARIETIES OF APPLES PLANTED IN MARCH 1885.--SOIL SANDY. NORTHERN EXPOSURE—CONTINUED.

No Planted.	NAMES OF VARIETIES.	1886	1889	1890			1891
		Cedar Rust	May 8th. Blight.	May 31. Blight.	June 18. Cedar Rust.	June 18. Leaf Spot	Blight.
2	Oconee Greening	medium	free	very slight	free	badly	badly
2	Palmer or Pear	slight	free	badly, cut back	....	slight	very slight
2	Pryor's Red	badly	slight	slight	badly	slight	slight
2	Rawls' Jennet	free	free	free	free	slight	slight
2	Red June	....	....	....	....	....	....
2	Rhodes' Orange	slight	medium	badly	badly	slight	very badly
2	Romanite	slight	medium	badly	slight	badly	badly
2	Shannon Pippin	free	free	slight	slight	slight	slight
2	Shockley	badly	free	badly	slight	badly	badly
2	Simmons' Red	free	free	very slight	slight	slight	very slight
2	Stevenson's Winter	medium	medium	badly	free	slight	slight
2	Summer Queen	free	free	badly	free	1 d'd.1 slight	slight
2	Taunton	slight	medium	badly	free	slight	slight
2	Terry's Winter	slight	slight	1 b'dly, 1 c't b'k	slight	slight	badly
2	Thornton's Seedling	....	....	free	free	slight	free
2	Tuscaloosa Seedling	slight	slight	very slight	free	very slight	slight
2	Winesap	free	free	slight	free	slight	slight
2	Yellow English	free	free	1 b'dly, 1 c't b'k	free	slight	slight
2	Yopp's Favorite	free	free	slight	free	badly	slight

VARIETIES OF APPLES PLANTED IN MARCH 1885 —SOIL SANDY. NORTHERN EXPOSURE.—CONTINUED.

No. Planted.	NAMES OF VARIETIES.	1891—October 20th.					Remarks.
		Cedar Rust	Leaf Spot	Growth of Tree.	Size of Tree.	Shape of Tree.	
2	American Golden Russet	free	badly	vigorous	large	Erect.	
2	Astrakan Red	free	very slight	very vigorous.	large	Curved erect	
2	Ben Davis	free	slight	vigorous	large	Curved erect	
2	Bradford's Best	free	badly	not vigorous	small	Curved erect	Planted too near shade trees.
2	Buncombe	free	slight	not vigorous	small	Erect.	
—	Cannon Pearmain	free	badly	vigorous	medium	Curved erect	
2	Carolina Watson	free	badly	very vigorous	large	Curved erect	
2	Carter's Blue	slight	badly	very vigorous	large	Erect.	
2	Chattahoochee Greening	free	badly	not vigorous	medium	Erect.	Planted too near shade trees.
2	Cook's Seedling	free	slight	not vigorous.	small	Erect.	
2	Early Harvest	free	slight	vigorous	medium	Curved erect	
2	Early Red Margaret	free	badly	not vigorous	medium	Erect.	
2	Elgin Pippin	free	badly	very vigorous	large	Curved erect	
2	Equinetelee	free	badly	cut back		Curved erect.	
2	Family	free	free	not vigorous.	very small	Erect.	
2	Golden Pippin	free	badly	vigorous	medium	Curved erect	
2	Habbersham Late	free	slight	not vigorous	small	Erect.	
2	Hames'	free	slight	not vigorous		Erect	Cut back.
2	Hewes' Virginia	free	slight	vigorous	large	Curved erect.	
2	Hiley's Eureka	free	badly	vigorous	large	Curved erect	
2	Horn	badly	slight	vigorous	medium	Horizontal.	
2	Horse	free	slight	vigorous	medium	Erect.	
2	Junaluskee						
2	Kittageskee	free	slight	vigorous	medium	Drooping.	
2	Limbertwig	free	slight	vigorous	large	Drooping.	
2	May	free	slight	not vigorous	small	Curved erect.	

VARIETIES OF APPLES PLANTED IN MARCH 1885—SOIL SANDY. NORTHERN EXPOSURE.—CONTINUED.

No. Planted.	NAMES OF VARIETIES.	1891—October 20th.					Remarks.
		Cedar Rust.	Leaf Spot.	Growth of tree	Size of Tree.	Shape of Tree	
2	Oconee Greening	free	badly	not vigorous	small	Erect	
2	Palmer or Pear	free	slight	not vigorous	small	Erect.	
2	Pryor's Red	slight	badly	not vigorous	small	Erect	
2	Rawls' Jennet	free	badly	vigorous	large	Curved erect	
2	Red June						
2	Rhodes Orange	free	very badly	not vigorous.	small	Horizontal.	
2	Romanite	badly	slight	vigorous	medium	Horizontal	
2	Shannon Pippin	free	badly	vigorous.	medium	Curved erect.	
2	Shockley	badly	badly	vigorous	medium	Erect	
2	Simmons' Red	free	badly	vigorous	large	Curved erect	
2	Stevenson's Winter	free	slight	vigorous	medium	Curved erect	
2	Summer Queen	free	badly	vigorous	medium	Horizontal	Planted too near shade trees.
2	Taunton	free	slight		small	Curved erect	
2	Terry's Winter	badly	badly	vigorous	medium	Curved erect	
2	Thornton's Seedling	free	free			Curved erect	Planted 1889.
2	Tuscaloosa Seedling	free	badly	not vigorous	small	Curved erect.	
2	Winesap	free	slight	vigorous	large	Curved erect.	
2	Yellow English	free	badly	vigorous	large	Curved erect	
2	Yopp's Favorite	free	badly	vigorous	medium	Erect.	

PEARS.

In 1885 thirty-four varieties of pears of the European type and six of the Oriental were planted under very favorable auspices as to the preparation and fertilization of the soil.

If the varieties were cultivated both as dwarfs and standards; two of each were planted, or four of the variety. If progagated only as dwarfs or only as standards, then but two of the variety were planted. There were at the same time six varieties of the Oriental type planted, six Lecontes and two of each of the others. The object of these plantings was to ascertain the varieties best suited to this soil and climate.

Until 1888, when many of the varieties blossomed for the first time, the trees were models of symmetry and beauty, having been used for class instruction in pruning. The open flowers afforded means of access to the germs of the disease known as "Pear blight," and the work of destruction was commenced. Each successive summer claimed its victims, until now only 26 of the 99 trees of the European type remain, and some of these have been mutilated by the removal of blighted limbs.

To what extent the disease was transmitted from tree to tree through the agency of the pruning shears, cannot be estimated, but it is more than probable that the spread and intensity of the disease was increased by this means.

The fact that healthy trees may be inoculated by the germs adhering to the knife, used in pruning diseased ones, has been clearly demonstrated at the New York Experiment Station.

That the spores are wafted from diseased to healthy trees and carried by insects from flower to flower seems to be also well established. One Smith's hybrid and one large Duchess of the Oriental varieties have been destroyed by blight, while the other specimens of these varieties have been entirely exempt. The two which died stood near the diseased trees of the European type, while the exempt trees were more remote from them.

The importance of promptly removing all diseased branches, by cutting far enough below the blighted part to be sure of leaving only healthy tissue, cannot be too strongly urged.

The branches should not only be cut off, but should be burned as soon as removed.

The diseased branches, if left, become fruitful nurseries from which the spores of the blight are wafted in the air and become the means of spreading the disease.

The pruning shears should be disinfected after being used upon blighted trees before using them upon healthy ones.

The column, in the tabulated statement, showing the number of trees of the different varieties living in 1891—six years after planting—indicates with sufficient clearness which of the varieties named are worthy of cultivation. Of these the Duchess de Angouleme, Seckel and winter Nelis are conspicuously the most blight-resisting varieties.

Of the Oriental varieties the Keiffer and Leconte are the most valuable. The Keiffer commences to bear at four years from planting, and bears annual crops of very large pears, which ripen late in September, when fruit is scarce. Though the fruit grades only "good," its reliability as to healthfulness of the trees and the size of the fruit render it especially desirable.

Another feature in its favor is the fact that it is late in flowering, and hence escapes spring frosts which destroy the fruit on the Leconte and others. The Leconte is a more vigorous grower than the Keiffer and when it escapes frost bears an immense crop of very attractive fruit, which sells well, though grading only "good."

The principal objection to this variety is its habit of very early blooming, which renders it quite unreliable as a crop producer.

The other Oriental varieties have nothing to recommend them except their vigorous growth and handsome appearance.

The tabulated statement which follows is a record of death, but a valuable guide to the pear grower.

VARIETIES OF PEARS, PLANTED MARCH, 1885.

No. of Trees.	EUROPEAN TYPE.	Observations 1889.		Observations 1890.		Observations 1891.		1891.	1891.
	NAMES OF VARIETIES.	May 8. Blight.	Oct. 15. No trees died.	May 31. Blight.	Oct. 18. No trees died.	June. Blight.	Oct. 20. No trees died.	Total No. trees dead.	Total No. trees living.
4	Bartlett	2 free, 2 badly	2	badly	2	....	....	4	....
3	Buerre d'Anjou	free	....	slight	1	badly	2	3	....
4	B'Clairgeau	1 free, 3 badly	1	3 badly	3	....	....	4	....
4	B'Deil	2 free, 2 badly	....	badly	3	slight	....	3	1
2	B'Easter	free	....	badly	2	....	....	2	....
3	Belle Lucrative	1 free, 2 badly	1	badly	2	....	....	3	....
4	Bloodgood	3 free, 1 badly	1	badly	3	....	....	4	....
2	Brandywine	free	....	1 free, 1 slight	2	....	....	2	....
2	B'Superfin	free	....	badly	2	....	....	2	....
4	Buffum	free	....	2 slight, 2 free	2	free	....	2	* 2
2	Comet	free	1	free	....	free	....	1	† 1
4	Clapp's Favorite	2 free, 2 badly	2	free	2	....	....	4	....
2	Columbia	badly	2	....	....	....	....	2	....
4	Dearborn's Seedling	2 free, 2 badly	2	free	2	....	....	4	....
4	Doyenne d'Ete	1 free, 3 badly	1	free	3	....	....	4	....
2	Duchess d'Angouleme	free	....	free	....	free	....	....	2
2	Duchess Pittmason	badly	2	....	....	....	....	2	....
4	Flemish Beauty	free	....	2 free, 2 slight	2	slight	2	4	....
3	B'Giffard	free	....	1 free, 2 badly	2	free	....	2	1
2	Glou Morceau	badly	2	....	....	....	....	2	....
1	Howell	free	....	slight	1	....	....	1	....
2	Kirtland Seckel	badly	1	badly	1	....	....	2	....
2	Lawrence	free	....	1 free, 1 badly	1	free	....	1	1
3	Lawson	free	....	free	....	free	....	....	‡ 3
2	Louise Bonne d'Jersey	free	....	badly	2	....	....	2	....
2	Lucy Duke	free	....	1 free, 1 badly	1	free	....	dwarf 1	st'd'rd 1
4	Mt. Vernon	free	....	slight	2	badly	....	2	2

VARIETIES OF PEARS, PLANTED MARCH, 1885—CONTINUED.

No. of Trees.	EUROPEAN TYPE.	Observations 1889.		Observations 1890.		Observations 1891.		1891	1891.
	NAMES OF VARIETIES.	May 8. Blight.	Oct. 15. No trees died.	May 31. Blight.	Oct. 18. No trees died.	June. Blight.	Oct. 20. No trees died.	Total No. trees dead.	Total No. trees living.
3	Petite Marguerite.............	1 free, 2 badly	2	slight	......	slight	....	2	1
4	Seckel..........................	free	......	3 free, 1 slight	......	3 free, 1 badly	1	1	3
4	Sterling......................	3 free, 1 badly	1	1 free, 2 slight	....	2 free, 1 badly	....	1	§ 3
4	St. Michael Arch Angel	3 free, 1 badly	1	2 free, 1 slight	1	free..........	....	2	2
4	Tyson.........................	free.........	......	2 badly, 2 sl'ht	2	slight	....	2	2
1	White Doyenne.................	free	....	badly	1	....	....	1	... ..
2	Winter Nelis	Slight........	......	slight	....	free	....	....	2
99			21		47		5	73	26
	ORIENTAL TYPE.								
2	Chinese Sand..................	free.........	....	....	2	free..........	....	2	‡
2	Garber's Hybrid	free	.... .	free.........	....	free..........	....	....	2
2	Keiffer's Hybrid..............	free....	....	free	....	free..........	....	.. ..	2
2	Large Duchess...........	free.........	....	1 free, 1 badly	1	free	......	1	1
6	LeConte	free	......	free	....	free	......	... ..	6
2	Smith's Hybrid................	free ...	...	1 free, 1 badly	1	free		1	1

*1 Partly blighted. †1 Killed by rabbits in 1889. ‡ Planted 1889. §2 Partly blighted. ‖ Killed by freeze March, 1890.

PEACHES.

The following list of 37 varieties, two trees of each were planted in 1885.

A careful examination, made November 1st, of each tree develops the fact that all are in vigorous, healthy condition. There are only *four*, out of *seventy-four* planted, missing, and two of these died when transplanted. For convenience of reference the names, class and time of ripening are tabulated.

This, taken in connection with the description of varieties given in Bulletin No. 11, February, 1890, will furnish a convenient guide to those contemplating planting an orchard.

The list furnishes varieties which will give a succession of delicious fruit from June 1st to November 1st.

NAMES, CLASS AND TIME OF RIPENING OF 37 VARIETIES OF PEACHES.

No. trees planted.	Names of Varieties.	Class.	Time of Ripening.
2	Alexander	Semi-cling	June 6th to 25th.
2	Annie Wylie	Cling	Aug. 1st to 12th.
2	Bernard	Free	July 6th to 22nd.
2	Bustian's October	Cling	Sept. 16th to Oct. 14th.
2	Butler Cling		
2	Chinese Cling	Cling	July 20th to 30th.
2	Chinese Free.	Free.	July 10th to 25th.
2	Coggin's Early	Semi-cling	June 6th to 29th.
2	Columbia	Free	July 20th to Aug. 20th.
2	Connor's White	Cling	July 17th to 22nd.
2	Cora	Free.	Sept. 15th to 30th.
2	Crawford's Early	Free.	July 16th to 31st.
2	Crawford's Late	Free.	July 26th to Aug. 10th.
2	Deming's September	Free.	Aug. 20th to 30th.
2	Downing	Semi-cling	June 6th to July 5th.
2	Duff's Yellow	Cling	July 16th to 31st.
2	Duggar's Golden	Cling	July 17th to 31st.
2	Duggar's White		July 16th to 22nd.
2	Eaton's Golden	Cling	Aug. 18th to 27th.
2	Elberta	Free.	July 15th to Aug. 16th.
2	Foster	Free.	July 10th to 31st.
2	Gen'l Lee	Cling	July 1st to 10th.
2	Gen'l Taylor	Cling	June 29th to July 22nd
2	Hale	Semi-cling	June 22nd to July 15th
2	Hudson's November	Cling	Oct. 15th to 25th.
2	Indian Blood	Cling	Aug. 13th to 19th.
2	Lady Parham	Free.	Sept 10th to Oct. 10th
2	Lemon Cling	Cling	Aug. 1st to 20th.
2	Muscogee	Free	July 31st to Aug. 20th.
2	Mixon's White	Cling	Sept. 10th to 25th.
2	Rivers	Semi-cling	June 17th to July 7th.
2	Royal George (Early)	Free	June 26th to July 8th.
2	Stinson's October	Cling	Sept. 10th to Oct.
2	Stump the World	Free.	July 8th to 22nd.
2	Thurber	Free	July 13th to 25th.
2	Tillotson.	Free.	June 28th to July 8th.
2	Tuskena	Cling	July 10th to 27th.

NOTE.

WILD GOOSE PLUMS ON DIFFERENT STOCKS.

For the purpose of comparing the effects of different stocks upon the longevity of the Wild Goose variety, there were planted in 1885:

12 Wild Goose trees on Peach stocks.
12 Wild Goose trees on Seedling Plum roots.
12 Wild Goose trees on Plum cuttings.

An examination on the 23rd November, 1891, showed that there were living and in healthy condition:

On peach roots, *eight* out of twelve planted.
On seedling plum roots, *three* out of twelve planted.
On plum cuttings, *one* out of twelve planted.

Several varieties of peaches budded upon cuttings of the Brill plum have proved very unsatisfactory. The scion in many cases is larger than the stock, and the growth dwarfed.

Bulletin No. 31. November, 1891.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

IRISH AND SWEET POTATOES.

J. S. NEWMAN AND JAS. CLAYTON.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

All communications should be addressed to Experiment Station, Auburn, Alabama.

THE BROWN PRINTING CO., PRINTERS, MONTGOMERY, ALA.

METHODS OF APPLYING MANURE TO IRISH POTATOES AND COMPARISON OF VARIETIES.

An inquiry from Mobile county, received last January, suggested the following experiments with different modes of applying the manure to Irish potatoes as well as that with methods of cultivation. The fact that all three of the methods of applying the coarse manures, commonly used with potatoes, are employed in common practice, suggested that it mattered but little which was adopted. The results show that while there is a difference in the average yield, of the nine varieties, of a little more than eighteen bushels per acre, there is in some instances a greater difference than this in the yield of the same variety on different plots. The inference is, therefore, that the variation, which occurs on the plots differently manured, is not greater than that which might reasonably be expected from the same variety upon different plots under normal conditions. There are nine experiments in each plot. A comparison of the nine varieties used in connection with each inquiry as to the method of applying the manure.

It is interesting to note the difference in the proportion of culls in the different varieties. The Charles Downing is conspicuous in this respect for its large number of small potatoes—49.73 bushels out of a total average yield of 227.34 bushels—while the Early Sunrise, though giving the largest yield, has only a small per cent. of culls—20.08 bushels out of an average total yield of 316.04 bushels.

The difference in the extent to which the same varieties were affected with scab upon the different plots, is not enough to justify even a suspicion that this is due to the relative position of the seed, and hence of the potatoes, to the measure, except in the case of the Maine and Early Sunrise varieties in plot 1.

While the results in the tabulated statement are not decisive, they are interesting.

EXPERIMENT WITH VARIETIES OF POTATOES AND METHODS OF APPLYING MANURE.

No. Stake.	NAMES OF VARIETIES.	How Planted and Fertilized.		Form.	Scab.	Yield per acre in bushels.				Average merchantable yield pr acre.
						Merchantable.	Culls	Total		
	Plot No. 1.									
1	Beauty of Hebron	Manure scattered in furrow and potatoes dropped on it.	1	Oblong	Slight	198 45	51.45	249.90	1	....
2	Burbank Seedling		2	Long	"	282 97	22 78	305.75	2	.....
3	Charles Downing		3	Roundish	"	183.75	45.57	229.32	3	....
4	Southern Grown Early Rose		4	Oblong	"	205 80	25.72	231.52	4	....
5	Houghton Rose or Maine		5	"	Badly	198.45	36 01	234 46	5	.....
6	Early Sunrise		6	Long	"	266.07	19.84	285.91	6	....
7	Empire State		7	Oblong	Free	124 21	38.95	163.16	7	....
8	Peerless		8	Roundish flat.	Slight	268.27	52 92	321.19	8	...
9	White Star		9	Long	"	296.20	25.72	321.92	9	224 91
	Plot No. 2.									
10	Beauty of Hebron	Potatoes dropped in furrow and manure scattered on them.	10	....	Slight	224 91	29 40	254.31	1	.....
11	Burbank Seedling		11	....	Very slight	307 2	23 52	330.75	2	....
12	Charles Downing		12	....	Free	154.31	47.77	202.08	3	....
13	Southern Grown Early Rose		13	....	Slight	216 82	33 07	249 89	4	.....
14	Houghton Rose or Maine		14	....	"	194.77	14.70	209 47	5	....
15	Early Sunrise		15	....	Free	330.01	22 05	352.06	6	....
16	Empire State		16	....	Slight	166 84	25 72	192 56	7	....
17	Peerless		17	....	"	309 43	24.25	333 68	8	.
18	White Star		18	....	"	288.86	22 78	311 64	9	243 68

EXPERIMENT WITH VARIETIES OF POTATOES AND METHODS OF APPLYING MANURE—Continued.

No. Stake	NAMES OF VARIETIES.	How Planted and Fertilized.		Form.	Scab.	Yield per acre in bushels.				Average merchantable yield pr acre.
						Merchantable.	Culls	Total		
	Plot No. 3.									
19	Beauty of Hebron..........................	Manure scattered in furrow, scooter run in it to mix thoroughly and potato dropped on it.	19	....	Slight.. ...	252 10	34 54	286 64	1	....
20	Burbank Seedling.........................		20	....	"	299 88	13 23	313 11	2	....
21	Charles Downing		21	....	Free	194.77	55.86	250 63	3	....
22	Southern Grown Early Rose..............		22	....	Slight.	249 90	14.70	264 60	4	....
23	Houghton Rose or Maine..................		23	....	"	170 52	31.60	202 12	5	...
24	Early Sunrise..		24	....	"	291 79	18 37	310 16	6	....
25	Empire State		25	....	"	174.93	38 96	213 89	7	...
26	Peerless....................................		26	....	"	297.67	20 58	318 25	8	
7	White Star.....		27	....	"	260 92	11 02	271 94	9	243 61

The accompanying tabulated statement showing results of different methods of cultivating the Irish potato needs little comment. The soil upon which the potatoes were grown is sandy and dry, and yet mulching between the rows proved apparently injurious.

The half or flat bed culture produced one hundred bushels per acre more than the mulched.

This experiment is so much involved in the character of the season during the growth of the potato that it cannot be taken as a reliable guide.

The season of growth was sufficiently moist without the mulch.

EFFECTS OF DIFFERENT METHODS OF CULTIVATING IRISH POTATOES.

NAME OF VARIETY.	How Cultivated.	Scab.	Bushels Merchantable per acre.	Bushels Culls per acre.	Bushels. Total yield per acre.
Peerless..........	Level culture.......	Slight. ...	207.27	19.84	227.11
Peerless..........	Half bed...........	Badly.....	277.09	22.05	299.14
Peerless	Full bed.	Slight	253 57	18 37	271 94
Peerless. ..	Mulch between rows	" ...	185 22	14 70	199 92

The question as to whether the Irish potato should be cut for seed or the whole tuber planted, has been a mooted one amongst growers.

The results point to the propriety of planting the whole potato as decisively as a single experiment could well do.

The increased yield resulting from the use of the whole potato—of that cut to one eye—154.34 bushels per acre will justify the additional expense for seed.

RESULTS FROM DIFFERENT MODES OF PREPARING THE SEED.

NAME OF VARIETIES	How Treated.	Scab.	Bushels merchantable per acre.	Bushels culls per acre.	Bushels. Total yield per acre.
Peerless..........	Cut to one eye	Badly. ..	181 54	16 92	198.46
Peerless..........	Cut to two eyes. .	Slight...	264.60	25.72	290 32
Peerless...........	Cut to three eyes.	Slight....	205 80	23 52	229 32
Peerless	Whole potato ..	Badly....	316 05	36.75	352.80

A COMPARISON OF LARGE WITH SMALL SWEET POTATOES FOR BEDDING.

While the majority of sweet potato growers use the small potatoes for bedding, because of the cheapness and the greater number of eyes or buds in a given quantity, some of the most successful growers have used large potatoes for seed with uniformly satisfactory results.

The large potatoes produce very few sets, and, hence, to secure plants for a large area a large quantity of roots of edible size is required. On the other hand, the small potatoes having more surface exposed in a given area of bed, produce plants in greater abundance. Economy, therefore, seems to point to the use of the culls.

This practice is not pursued in other vegetables or field crops; but, as a rule, the best is used for seed.

Some successful growers use for seed only roots grown from vines. The results in this case are decidedly in favor of the use of large potatoes for bedding. This would be the natural course to be pursued if improvement of the potato was the object in view.

As in the case of the use of whole potatoes already discussed, the increased yield justifies the additional expense in the value of seed used.

RESULTS OF COMPARISON OF LARGE AND SMALL SEED SWEET POTATOES.

PLANTS DRAWN FROM BEDDING LARGE POTATOES.			PLANTS DRAWN FROM BEDDING SMALL POTATOES.		
Yield in bushels per acre large potatoes.	Yield in bushels per acre small potatoes.	Total yield in bushels per acre.	Yield in bushels per acre large potatoes.	Yield in bushels per acre small potatoes.	Total yield in bushels per acre.
99.72	36 47	136.19	75.20	23 56	98.76

Bulletin No. 32. November, 1891.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

CORN, WHEAT AND OATS.

J. S. NEWMAN AND JAS. CLAYTON.

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EXPERIMENT STATION, AUBURN, ALA.

THE BROWN PRINTING CO., PRINTERS, MONTGOMERY, ALA.

EXPERIMENTS WITH CORN.

Eighteen thoroughbred varieties of corn were planted, in plots, upon land practically uniform in productiveness. Four hundred pounds of cotton seed meal were broadcasted, per acre, before breaking the land. After breaking thoroughly with Stark Dixie turn plows, furrows were opened with shovel plow four feet apart. In these, 2,000 pounds of compost (of cotton seed, stable manure and acid phosphate mixed by the "corn formula," viz: 500 pounds acid phosphate and 750 pounds each of cotton seed and stable manure, per acre,) were applied and mixed with the soil by one "bull tongue" furrow. The corn was then dropped every two feet in the drill. This gave eight square feet to each hill of corn. Upon half of the space occupied by each variety two stalks were left to each hill and one stalk on the other half.

The piece of land selected for this experiment was dry sandy branch bottom. The branch dries up in the summer. The seasons were very favorable until the plants were in flower, when a drouth of several weeks duration seriously injured the crop.

The cultivation was shallow throughout—done with 30-inch Terrell heel scrapes. Hoes were not used at all. The uniformly increased yield from two stalks to the hill indicate the propriety of thick planting upon soil deeply and thoroughly prepared, heavily fertilized and judiciously cultivated.

The Experiment Station yellow and the Clayton bread corn were very slightly injured by weevil. Some of the early gourd seed varieties were rendered valueless by their attack.

The Experiment Station yellow has been very much improved by selection of seed, from the top ear of stalks bearing two well developed ears, during the last seven years.

Careful hands pass through the field and select the seed from the double eared stalks in the shuck. This is stored to itself. When shucked, only the well developed ears, having the cob covered with grain typical of the variety, are selected for seed. This has resulted in very great improvement, both in the productiveness and adaptation of this variety to this soil and climate.

The yields reported in the following table represent the weights of *thoroughly dried*, *shelled* corn.

The Welborn's Conscience variety was reduced in yield by the influence of the roots of a tree in an adjoining field.

VARIETIES OF CORN COMPARED ON PLOTS.

Names of Varieties.	Number of stalks to to the hill.	YIELD PER ACRE.			
		Bushels sound shelled corn.	Bushels rotten shelled corn.	Total bushels shelled corn.	Pounds of fodder.
Blount's Prolific	1 Stalk	36 21	1.71	37.92	1060
	2 “ ..	63.64	1.50	65.14	2000
Bullock's Prolific	1 “ ..	27.78	......	27 78	1148
	2 “ ..	54 28	1.93	56.21	2336
Clayton Bread	1 “ ..	26.28	.35	26 63	1244
	2 “ ..	62.14	.....	62.14	2504
Early Mastadon	1 “ ..	25.64	4.57	30.21	780
	2 “ ..	34 64	4.43	39.07	1440
Experiment Station Yellow.	1 “ ..	38.93	.35	39.28	1200
	2 “ ..	64.07	.43	64.50	2400
Giant Broad Grain	1 “ ..	30 93	.85	31.78	620
	2 “ ..	52.00	1.71	53.71	1000
Golden Beauty	1 “ ..	29.65	.35	30 00	520
	2 “ ..	47.35	3.43	50.78	860
Golden Dent	1 “ ..	32 64	.14	32.78	560
	2 “ ..	58.50	......	58.50	1080
Hickory King	1 “ ..	27.50	.....	27.50	640
	2 “ ..	50.93	.50	51.43	1120
Hunnicutt	1 “ ..	39.21	1.36	40.57	800
	2 “ ..	54.08	1.21	55 29	1160
Improved Gourd Seed	1 “ ..	29.79	1.07	30.86	440
	2 “ ..	50.00	6.64	56 64	900
Improved Learning	1 “ ..	27.21	1.15	28.36	240
	2 “ ..	43.93	2.14	46.07	440
Mobley's Red Cob	1 “ ..	30.35	1.43	31.78	600
Lindsay's Horse Tooth	1 “ ..	28 71	.36	29.07	1000
	2 “ ..	44.43	1.57	46.00	1780
Piasa King	1 “ ..	29 36	3.43	32 79	988
	2 “ ..	41.93	3.64	45.57	1880
Welborn's Conscience	1 “ ..	24.14	1.57	25.71	960
	2 “ ..	34.86	1.43	26.29	2080
Tennessee Valley	1 “ ..	28.78	.....	28 78	1120
	2 “ ..	53.36	.35	53.71	2200
Hawkins' Improved	1 “ ..	23.00	....	23 00	1120
	2 “ ..	48.00	.42	48 42	1840

The following six varieties were planted on a larger scale, in the general field crop with results as shown in the statement which follows. The land upon which they were planted was uniform in character, except plot 7, which was thinner than the others, but was more heavily fertilized than any except plot 6, which was similarly manured.

The general crop was fertilized with 250 pounds cotton seed meal and 1,000 pounds compost per acre. No. 6 had 476 pounds of cotton seed meal and 1,000 pounds compost per acre, and No. 7 450 pounds cotton seed meal and 1,000 pounds compost per acre, all applied in the drill.

The growing season was favorable for the development of the plant, but the yield of corn was seriously impaired by a severe drouth which extended through the flowering season. The cultivation was flat and shallow and done entirely with heel scrapes—four furrows to the row constituted the entire cultivation. The results obtained upon the small plots are sustained in the field.

VARIETIES OF CORN COMPARED ON A FIELD SCALE.

	Name of Variety.	Yield per acre. Shelled.
1	Lindsay's Horsetooth	25⅛ bushels.
2	Improved Virginia Gourd Seed	23 "
3	Hunnicutt	24 2-12 bushels.
4	Welborn's Conscience	17 47-72 "
5	Experiment Station Yellow	25 13-18 "
6	Clayton Bread	27 11-72 "
7	Experiment Station Yellow	28 17-72 "

Experiments with Top-dressing Oats.

On November 27th, 1890, 300 pounds of cotton seed meal and 200 pounds of acid phosphate were broadcasted over an acre intended to be sown to oats.

January 7th, 1891, 700 pounds of compost were added, applied broadcast, and two bushels of Ewing oats sown and plowed in with scooter.

March 24th, 1891, plots of 1-16 acre each were measured and the following top-dress applied, with results as stated below:

Plot No.	Fertilizers Used for Top-Dressing per Acre.	Yield of Clean Oats per Acre in pounds.	Yield of Clean Oats per Acre in bushels.
1	200 pounds cotton seed meal	1105.6	34.55
2	150 pounds nitrate soda	1164.8	36.40
3	Without top-dressing	934.4	29.20
4	200 pounds acid phosphate 150 pounds nitrate soda	915.2	28.60
5	200 pounds cotton seed meal 200 pounds acid phosphate	814.4	25.45
6	150 pounds kainit	1000.	31.25

Upon a soil of entirely different character—the first foot composed largely of drift pebbles—600 pounds of cotton seed meal, and 400 pounds of acid phosphate, per acre, were sown broadcast, and thoroughly incorporated with the soil by means of scooter plow and harrow.

November 17th, 1890, four bushels per acre of Mexican Rust-proof oats were broadcasted and plowed in.

March 30th, 1891, using 1-9 acre plots, the following experiment with top-dressing was instituted with results as stated below:

Plot No.	Fertilizer Used as Top Dressing per Acre.	Yield per acre in clean Oats, in lbs.	Yield per Acre Clean Oats, bushels.
1	150 pounds Nitrate Soda	1260	39.37
2	Without Top-Dressing	945.9	29.55
3	200 pounds cotton seed meal	868 5	27.14

The results obtained from the top-dressing will be disappointing to all who saw the oats while growing. Visitors very commonly estimated the yield, where nitrate of soda was used, at double that not top-dressed. The application of nitrate of soda was excessive, causing extraordinary development of straw and deepening the green color of the leaves.

The straw made such succulent growth that, before ripening the grain, it lodged and the small yield, compared with the previous promising appearance, resulted.

KANSAS AND TEXAS RUST PROOF OATS.

As Texas Rust Proof Oats were selling much higher than the Kansas Rust Proof for seed, it was deemed proper to compare them to determine the propriety of such difference in price. The following tabulation furnishes the results. The results indicate that the difference in price was not justifiable.

Comparison of Kansas and Texas Rustproof varieties—seed purchased of Alliance Store, Opelika, Alabama, and planted January 27th, 1891.

Kansas seed weighed per bushel.........32 pounds.
Texas seed weighed per bushel..........29.3 pounds.
$\frac{1}{4}$ of acre was planted with 16 pounds of Kansas.
$\frac{1}{4}$ of acre was planted with 14.6 pounds of Texas.

On April 7th the above $\frac{1}{4}$ acre plots were divided into $\frac{1}{8}$ acre plots, and top dressed as follows:

Plot number.	Fertilizer Used for Top Dressing per Acre.	Yield of Clean Oats per Acre in Pounds.	Yield of Clean Oats per Acre in Bushels.
1	64 pounds Nitrate Soda (Kansas).....................	576.	18.00
2	64 pounds Nitrate Soda (Texas)......................	553.6	17.30

VARIETIES OF WHEAT PLANTED DECEMBER 1st, 1890.

Plot Number.	Names of Varieties.	Time of Ripening.	Average height in feet.	Average length of heads in inches.	Bearded or smooth	Number of grains to the mesh.
1	Anglo Canadian*	Jan. 13 .	3¾	5	Bearded ..	2 to 3
2	Bird Proof*	" 16...	3½	2¾	Smooth.	2 to 3.
3	Earliest of All†	" 4.	3	5¼	" ..	1 to 2
4	Flour Ball†.	" 15 ..	3½	2¾	" ..	2 to 3
5	Holborn's Wonder*.	" 16..	2¾	4¼	" ..	1 to 2
6	Hundred Fold.	" 16 .	2¾	4¼	" ..	2 to 3
7	Miller's Delight*	" 13	3½	4¼	" ..	2 to 4
8	Pearl*	" 15..	3½	4¼	" ..	2 to 3
9	Pride of the Market* .. .	" 15 .	3¼	4	" .	2 to 3
10	Prince of Wales†	" 16 ..	3¼	2¾	" .	2 to 3
11	Queen*	" 15 .	3¼	3½	"	2 to 3
12	de Reiti†.	" 13.	3	5	Bearded.	2 to 3
13	Stand-Up*..	" 8 ..	2¾	2¾	Smooth ..	2 to 3,
14	White Richelle de Naples† .	" 8	3¼	5¼	"	2 to 4

* Presented by Jas. Carter & Co., High Hilborn, London, England.
† Presented by U. S. Secretary of Agriculture.

Small packets of the above varieties marked with an asterisk were presented by James Carter & Co., of High Holborn, London, for the purpose of having their adaptation to this soil and climate tested. Similar quantities of three other varieties were also planted as shown. The area planted in each was too small to compare yields. The late ripening varieties were somewhat injured by rust, while those which ripened early escaped.

Two varieties of wheat were received from the Assistant Secretary of Agriculture in 1890 for experiment, viz :

White Richelle de Naples, a very fine smooth headed variety, having plump white berries, and de Reiti, a red bearded variety.

Thirty pounds of each of these were sown upon half an acre fertilized with 300 pounds of cotton seed meal and 200 pounds of acid phosphate per acre. The seed were sown November 29th, 1890, and harrowed in. April 7th, 1891, each half acre was divided into three equal plots, one of which was tropdressed with 200 pounds cotton seed meal per acre, one with

100 pounds of nitrate of soda per acre, and one left without top-dress.

The results indicate that the top-dressing produced no effect.

	Yield per acre in bushels.	
	Red de Rieti.	White Richelle de Naples.
Top-dressed with 200 lbs. C. S. meal per acre	10 77	12 37
Without top-dress.	11.15	12 35
Top-dressed with 100 lbs. nitr. soda per acre.	10 38	11 91

These two varieties were imported by the Secretary of Agriculture from the South of France, where they were very popular. Their yield and quality were so satisfactory here that they were deemed worthy of more thorough trial.

In addition to more extended trial on this Station, one peck was sent to each of forty experimenters cultivating different typical soils of the State. Small quantities have also been presented to the Stations in South Carolina and Mississippi.

The varieties received from Jas. Carter & Co. have been planted again. Though planted late last year some of these varieties produced well and were entirely free from rust and smut. Some of the late ripening varieties rusted, but proved productive and promise to do well after acclimation.

Bulletin No. 33. **December, 1891.**

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

COTTON

J. S. NEWMAN AND JAS. CLAYTON.

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EXPERIMENT STATION, AUBURN, ALA.

THE BROWN PRINTING CO., PRINTERS, MONTGOMERY, ALA.

EXPERIMENTS WITH COTTON, 1891.

COMPARISON OF VARIETIES.

An effort was made the past Spring to obtain as many varieties of cotton as possible, and twenty-nine were secured and planted on April 15th for the purpose of comparing their productiveness and yield and quality of lint.

The soil upon which these varieties were planted was supposed to be perfectly uniform, but later in the season such a difference in the growth of the plant was discovered, that only plots 1 to 13 could be compared with each other, and 14 to 27 with each other.

In the preparation of the soil 250 pounds cotton seed meal and 250 pounds acid phosphate per acre, were used broadcast, and thoroughly plowed in. The rows were measured exactly 4 feet apart, and 200 pounds of the above mixture applied in the drill, per acre, at a total cost of $6.67.

The cotton was carefully picked and stored, each variety to itself, until time of ginning, when all were weighed under like conditions, and ginned separately. A sample of each variety was numbered and sent to Mr. H. C. Parker, of Montgomery, Ala., for classification and valuation.

The length of staple and valuation will be interesting to cotton growers.

The following tabulated statement shows the comparative yield per acre in seed cotton and lint, and the per cent. of lint, length of staple and price.

COMPARISON OF VARIETIES OF COTTON—1891.

	NAMES OF VARIETIES.	YIELD PER ACRE.		Per cent. of lint.	Length of Staple.	Price.	
		Seed Cotton.	Lint Cotton.				
1	Allen Long Staple	2011	563	.28	1¼	8¾	Weak.
2	Barnett	2035	621	30.52	1	8	
3	Cherry's Cluster	2064	607	29.42	⅞	7	Staple too short.
4	Cook, J. C.	1294	446	34.53	¾	6¾	
5	Cook, W. A.	2259	607	26 89	1½	13½	Well ginned—strength fair.
6	Dixon	2021	626	30.98	13-16	6⅞	
7	Gold Dust	1927	577	30.13	13-16	6⅞	
8	Hawkins Improved	1934	532	32.69	⅞	7⅛	Hard (canebrake).
9	Hunnicutt	2157	663	30.75	1	7¼	
10	Herlong	1953	579	29 70	¾	6¾	Poor color—staple too short.
11	Jones Improved	1709	514	30.10	13-16	6⅞	
12	Jones Long Staple	1752	494	28 26	1¼	9	Well ginned.
13	Keith	2007	603	30 06	1	7¼	
14	King, T. J.	1419	440	31 00	.	..	
15	Okra	1295	378	29 18	1⅛	7¾	Medium price based on.
16	Peeler	1555	436	28 05	1¼	9	
17	Peerless	1581	468	29.63	⅞	7	
18	Peterkin Improved	1475	465	31.51	....	.....	
19	Petit Gulf	1516	481	31 76	1	7¼	
20	Rameses	1525	415	27.19	⅞	7	
21	Scrub	1412	403	28.57	⅞	7	
22	Southern Hope	1556	426	27 38	1¼	9	Well ginned.
23	Storm Proof	1048	325	31 05	1	7	Poor color.
24	Truitt	1676	489	29.22	1	7¼	
25	Welborn's Pet	1295	394	30 37	1	7¼	
26	Wonderful	1372	361	26 38	1⅜	10½	Well ginned—strength fair.
26½	Bailey	1526	388	25 39	1⅛	7¾	Well ginned, medium price based on.
27	Zellner	1784	509	28.57	1	7¼	
28	Jones No. 1, Short Staple	....	....	33 76	¾	6¾	Staple to short.

COMPARISON OF VARIETIES OF COTTON ON FIELD SCALE, AND TESTS OF GINS.

The following statement shows a comparison of varieties of cotton on a larger scale in the field, also shows a test made on the Gullett and Pratt Gins, the former furnished by the Gullett Gin Co., Amite, La., and the latter purchased of the Pratt Gin Co., Prattville, Ala.

It is claimed that the Gullett Gin makes a better sample than any other, and to determine the comparative value of the two, samples were taken from each, as the varieties were ginned, only bearing numbers, and sent to Mr. Parker, of Montgomery, as previously stated. This experiment shows no perceptible difference between the two gins.

The following amounts of fertilizers were used per acre: 1000 pounds of compost at $5.00, and 200 pounds cotton seed meal at $2.17, making a total cost of $7.17.

The entire culture was done with the Terrell heel scrape.

COMPARISON OF VARIETIES OF COTTON ON FIELD SCALE, AND TESTS OF GINS.

Number.	NAMES OF VARIETIES.	Yield per Acre.	GULLETT GIN.			PRATT GIN.		
			Per cent. of Lint.	Length of Staple.	Price.	Per cent. of Lint.	Length of Staple.	Price.
1	Cook, W. A	931	31.73	1¼	9	29 59	1⅜	11½
2	Gold Dust....	.....	32.75	⅞	7	27.50	⅞	7
3	King, T. J...........	990	35 55	1	7¼	34.69	13-16	6⅞
4	Peerless	1648	32.51	13-16	6⅞	32 72	13-16	6⅞
5	Peterkin..............	1013	37.33	1	7¼	36.13	1	7
6	Southern Hope.......	1003	36.86	1⅛	7¾	32.02	1⅛	7½
7	Truitt	1713	34.63	1	7	32.60	⅞	7
8	Welborn's Selected..	.....	32 07	.....	.....	32 31		

CLUSTER AND LONG-LIMBED VARIETIES OF COTTON AND DISTANCES.

The following tabulated statement as a comparison of Cluster and Long-limbed varieties of cotton at different distances. It appears from this experiment that 1 by 4 is the limit of distance for the Cluster, and 2 by 4 the limit for the Long-limbed, as they both decrease with greater distance.

The total cost expended for fertilizers was $6.68 per acre, and the culture was made with a Terrell heel scrape.

COMPARISON OF CLUSTER AND LONG-LIMBED VARIETIES OF COTTON AT DIFFERENT DISTANCES.

Plot Number.	NAMES OF VARIETIES.	Distance.	Yield in lbs. seed cotton per acre.
1	Welborn's Pet (Cluster).................	1 x 4 feet	2519
2	" "	2 x 4 feet	2010
3	" "	3 x 4 feet	2077
4	" "	4 x 4 feet	1145
5	Peeler (Long-Limbed)..................	2 x 4 feet.	1983
6	" "	3 x 4 feet	1487
7	" "	4 x 4 feet	1453
8	" "	4 x 5 feet	1333

EXPERIMENTS WITH PHOSPHATE.

Question—Will the vegetable matter in freshly cleared land supply all the nitrogen needed by the cotton plant?

This experiment in reply to the above question was begun in 1890, and published in Bulletin No. 22, and was continued this year without changing the rows, or the addition of any more fertilizers.

By reference to the following tabulated statement, it will be seen that the yield from the use of phosphate alone is greater in 1891 than in 1890; but in combination with cotton seed meal, the yield was greater in 1890.

PHOSPHATE ALONE, AND PHOSPHATE AND NITRGGEN APPLIED ON NEW GROUND IN 1890.

Plot Number.	NAMES OF FERTILIZERS AND QUANTITY USED PER ACRE.	PER ACRE.			
		Total yield lbs. seed cotton—1891.	Increase in pounds seed cotton over no manure—1891.	Total yield pounds seed cotton—1890.	Increase in lbs. seed seed cotton over no manure—1890.
1	500 lbs. Acid Phosphate	851	513	819	360
2	500 lbs. Acid Phosphate 500 lbs. Cotton Seed Meal	816	478	1017	558
3	1000 lbs. Acid Phosphate	790	452	883	424
4	No Manure	338	....	459	.....
5	1000 lbs. Acid Phosphate 1000 lbs. Cotton Seed Meal	936	598	1213	754

For the purpose of answering numerous enquiries concerning many different kinds of cotton now being cultivated, the following description of 28 varieties tested on this Station during 1891, is published for the benefit of those interested.

ALLEN LONG STAPLE.

Stalks large, open pyramid. Wood limbs near base and very large. Fruit limbs long, with joints of medium length. Bolls large and pointed. Prolific for long limed and long staple cotton. Staple very long and fine. Medium as to time of maturity.

BAILEY.

Stalk small, pyramidal. Limbs drooping, and joints long. Bolls small and roundish. Prolific. Staple medium, and suggests a recent cross with Sea Island. Seed black and sleek. Early.

BARNETT.

Stalk tall, pyramidal. Wood limbs scarce and small—only at the base. Fruit limbs short, jointed. Prolific. Bolls medium and round. Staple short. Late.

CHERRY'S CLUSTER.

Stalk medium, compact, pyramidal. Wood limbs abundant and fruitful. Fruit limbs longer, and longer jointed than the Peerless, which it somewhat resembles. Bolls small and round. Prolific. Staple short. Early.

J. C. COOK.

Stalk medium, pyramidal, purple. Leaves purple underneath, presenting a singular appearance. Devoid of wood limbs. Fruit limbs long, and long jointed. Bolls round. Staple very short. Not prolific. Very late.

W. A. COOK.

Stalk tall and stragging. Wood limbs less developed than on the Allen Long Staple. Fruit limbs short for a long staple cotton. Bolls large and tapering. Staple very fine and long. Late.

DIXON.

Stalk small, compact, pyramidal. Few wood limbs. Fruit limbs short jointed. Quite prolific. Bolls small and round. Staple short. Early.

GOLD DUST.

Stalk small and straggling. Limbs long, joints medium in length. Very few wood limbs. Bolls small and round. Foliage meagre. Staple very short. Moderately prolific. Early.

HAWKINS IMPROVED.

Stalk large, pyramidal. Limbs short jointed. Wood limbs well up on the stalks. Bolls above medium and roundish. Staple short. Prolific. Medium in time of maturing.

HERLONG.

Stalk medium in size, compact, pyramid. Well supplied with wood limbs. Fruit limbs short and short jointed, often two bolls to the joint. Bolls round, medium in size. Staple short. Seed green. Prolific. Early.

HUNNICUTT.

Stalks large and well limbed. Limbs long and drooping, with long joints. Well supplied with wood limbs. Fruit limbs long jointed, with one boll to the joint. Bolls large, slightly pointed. Staple short, but above the average. Prolific for long limbed cotton. Late.

JONES' IMPROVED.

Stalk below medium in size, and moderately prolific. Few wood limbs. Fruit limbs short jointed and drooping. Bolls roundish, and above medium. Staple short. Early.

JONES' LONG STAPLE.

Stalk large and straggling. Limbs long and long jointed. Bolls large and pointed. Staple long. Not prolific. Late.

KEITH.

Stalk above medium. Pyramidal. Deficient in wood limbs. Fruit limbs short jointed, with one boll to the joint. Bolls medium and round. Prolific. Staple short. Early.

T. J. KING.

Stalk very small and pyramidal, and generally devoid of limbs. Fruit limbs long, long jointed and drooping. Bolls small. Staple very short and prolific for a long limed cotton. Very early.

PEELER.

Stalk very large and straggling. Fruit limbs long, long jointed and drooping. Wood limbs abundant and long. Bolls large and tapering, arranged singly on the joints. Staple long. Not prolific. Late.

PEERLESS.

Stalk medium, compact pyramid. Wood limbs abundant and reach well up on the stalk. Fruit limbs long and short jointed near the base, growing shorter towards the top. Bolls round and small, and often two appears to the joint. Very prolific. Staple short. Early.

PETERKIN IMPROVED.

Stalk tall and straggling. Fruit limbs long near base. Wood limbs drooping, long and long jointed. Bolls small and pointed. Staple long—seed very small. Not prolific. Late.

PETIT GULF.

Stalk large and straggling. Wood limbs long and abundant near the bottom. Fruit limbs long, long 'jointed and drooping. Bolls medium and pointed. Staple long. Not prolific. Late.

RAMESES.

Stalk medium and pyramidal. Bolls round and medium. Fruit limbs long and short jointed. Prolific. Staple short. Early.

SCRUB.

Stalks of various sizes and styles. Limbs long and long jointed. Bolls round, roundish and pointed. Not prolific. Stable short. Early.

SOUTHERN HOPE.

Stalk tall and straggling. Limbs long, long jointed and drooping. Not prolific. Bolls medium and pointed. Staple long. Late.

STORM PROOF.

Stalks tall, acute pyramidal. Limbs medium in length and drooping. Bolls large and slightly pointed. Not prolific. Staple medium. Late. Cotton adheres tenaciously to the boll, rendering it troublesome to pick.

TRUITT.

Stalks medium and pyramidal. Limbs long and short jointed, with one boll to the joint. Bolls very large, round and stem to boll long. Staple short. Prolific for a long limed cotton. Medium as to time of maturity.

WELBORN'S PET.

Stalk tall, and devoid of wood limbs, except at base. Fruit limbs very short, maintaining equal length all the way up the slalk. A strictly cluster cotton—two to three bolls from one base. Bolls medium and round. Staple short. Early.

WONDERFUL.

Stalk tall and pyramidal. Limbs long, long jointed and drooping. Bolls large and pointed. Prolific for a long limbed and long staple variety. Staple long. Late.

ZELLNER IMPROVED.

Stalk medium and pyramidal. Fruit limbs long, with short joints. Bolls roundish and above medium. Staple short. Early.

OKRA.

Stalk small and straggling. Open pyramid. Limbs long, and length medium between joints. Bolls small. Leaves deeply lobed like okra leaves. Prolific for a long limed variety. Staple short. Early.

Bulletin No. 34. **January, 1892.**

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

CO-OPERATIVE SOIL-TEST EXPERIMENTS

FOR 1891.

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THE BROWN PRINTING CO., PRINTERS, MONTGOMERY, ALA.

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CO-OPERATIVE SOIL-TEST EXPERIMENTS,

FOR 1891.

Experiments on the adaptation of fertilizers to the soils of different sections of the State were made, under uniform directions issued by the Experiment Station, by the following persons in the counties named. Full directions in regard to the applications of the fertilizers, the methods of cultivation, etc., were published in Bulletins Nos. 12 and 23.

The fertilizers were carefully analyzed, mixed, weighed, placed in bags and numbered, according to the plot on which each was to be used, at the Experiment Station, and then shipped with freight prepaid, to the experimenter:

NAMES.	POST-OFFICE.	COUNTY.
Aday, L. C. Rev	Newburgh	Franklin.
Beasley, E. J.	Red Level	Covington.
Brown, D. L.	Randolph	Bibb.
Bishop, M. A	Madison	Madison.
Bradley, F. W	Walker Springs	Clarke.
Brannon, J. M.	Seale	Russell.
Compton, G. W	Dixon's Mills	Marengo.
Cross, R. H.	Letohatchie	Lowndes.
Davis, E. M., Maj	Prattville	Autauga.
Davidson, J. A	Yantley Creek	Choctaw.
Dick, R. M.	Attalla	Etowah.
Deer, John F.	Monroeville	Monroe.
Ewing, R. T.	Centre	Cherokee.
Ellison, J. M.	Creek Stand	Macon.
Gordon, John, Dr.	Healing Springs	Washington.
Goodwyn, A. T.	Robinson Springs	Elmore.
Hobdy, J. M.	Louisville	Barbour.
Hall, S. M.	Hackleburgh	Marion.
Hall, Wm. B.	Lowndesboro	Lowndes.
Inzer, J. T	Eden	St. Clair.
Johnson, Uriah	Trinity Station	Morgan.
Killebrew, J. C.	Newton	Dale.
Kennedy, J. M.	Oak Lone	Clay.
Logan, J. A.	Clanton	Chilton.

NAMES.	POST-OFFICE.	COUNTY.
Miller, W. H	Union	Greene.
Martin, Wm	Greensboro	Hale.
Mize, J. W	Remlap	Blount.
Melton, W. B.	Davis' Creek	Fayette.
Manning, W. S	Oxford.	Calhoun.
Newman, W. H.	Uniontown	Perry.
Newman, C. L	Athens	Limestone.
Oliver, J. P	Dadeville	Tallapoosa.
Ott, J. C.	Florence	Lauderdale.
Pitts, J. W	Cresswell Station	Shelby.
Porter, J. M. T.	Georgiana	Butler.
Pruitt, S. A	Chesser	Pike
Radney, J. H	Roanoke	Randolph.
Stroud, Z. T	Aberfoil	Bullock.
Snuggs, T. A	Holly Pond.	Cullman.
Sellers, W. H.	Geneva	Geneva.
White, W. L	Hattan	Lawrence.
Gillis, Dan, jr	Abbeville	Henry.

Special experiments were made by—

Cory, A. F	Mulberry	Autauga.

No reports were received at the date of issuing this Bulletin, from the following co-operative experimenters to whom fertilizers were sent:

NAMES.	POST-OFFICE.	COUNTY.
J. A. Davidson	Yantley Creek	Choctaw.
J. F. Deer	Monroeville	Monroe.
S. M. Hall.	Hackleburgh.	Marion.
Experiment Station	Uniontown	Perry.
Experiment Station	Athens	Limestone.
J. C. Ott	Florence	Lauderdale*.

* Report lost.

Cost of Fertilizers Applied per Acre.

In order that the experimenters and other farmers may better understand the inquiry made upon the different plots, the cost of the different materials used is given in the statement which follows. The calculations are made upon the cost laid down at Auburn. The local freights upon the packages reshipped to the depots of the experimenters would produce a false impression, since the average local rate of freight charged upon the amount sent to each experimenter from Auburn to their depots exceeds five dollars per ton. Shipped in quantity, the freight to the various depots of the experimenters would average little more than that from the factories to Auburn. Again, in estimating profits resulting from the use of the different fertilizers, it will be more convenient to have a common standard of comparison.

Quantity and Cost per Acre of Fertilizers used by Co-operative Soil Test Experimenters, 1891.

Plot 1.	96 lbs. Nitrate Soda	$	2 13
2.	240 lbs. Acid Phosphate		1 98
3.	64 lbs. Muriate Potash		1 44
4.	No manure.		
5.	96 lbs. Nitrate Soda	$2 13	
	64 lbs. Muriate Potash	1 44	3 57
6.	96 lbs. Nitrate Soda	2 13	
	240 lbs. Acid Phosphate	1 98	4 11
7.	64 lbs. Muriate Potash	1 44	
	240 lbs. Acid Phosphate	1 98	3 42
8.	No manure.		
9.	96 lbs. Nitrate Soda	2 13	
	240 lbs. Acid Phosphate	1 98	
	64 lbs. Muriate Potash	1 44	5 55
10.	240 lbs. Floats		1 88
11.	240 lbs. Floats.	1 88	
	96 lbs. Nitrate Soda	2 13	4 01
12.	No manure.		
13.	848 lbs. Green Cotton seed @ 45c. per cwt.		3 81
14.	848 lbs. Green Cotton seed, " "	3 81	
	240 lbs. Floats.	1 88	5 69
15.	4,240 lbs. Stable manure, @ $1 per 1,000 lbs.		4 24
16.	240 lbs. Acid Phosphate.	1 98	
	240 lbs. Cotton Seed Meal	2 60	4 58

The following table shows quantity of potash, phosphoric acid, nitrogen (and its equivalent of ammonia) contained in the different fertilizers used per acre, as determined by Prof. N. T. Lupton, State Chemist:

Plot No.	NAMES OF FERTILIZERS.	Lbs. Potash.	Lbs. phosphoric Acid Available.	Lbs. Phosphoric Acid Insoluble.	Lbs. Nitrogen.	Lbs. equivalent to Ammonia.
1	96 lbs. Nitrate Soda	.....	.....	.....	14.58	17.70
2	240 lbs. Acid Phosphate	.....	35.96	6.07	.....	.....
3	64 lbs. Muriate Potash	33.47	.....	.....	....	.....
4	No manure	.....	....	....	....	.....
5	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash	33.47	.....	.....	14 58	17.70
6	96 lbs. Nitrate Soda 240 lbs. Acid Phosphate	.....	35.96	6.07	14 58	17.70
7	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	33 47	35.96	6.07	.....	.....
8	No manure	.....	.....	.....	.....	.....
9	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate 64 lbs. Muriate Potash	33.47	35.96	6.07	14.58	17.70
10	240 lbs. Floats	.....	20 08	46.84	.....	.....
11	240 lbs. Floats, 96 lbs. Nitrate Soda	.....	20.08	46.84	14.58	17.70
12	No manure	.....	.....	.....	.....	.....
13	848 lbs. Green Cotton Seed	10.6	.....	10.17	21.2	25.74
14	848 lbs. Green Cotton Seed, 240 lbs. Floats	10 6	20 08	57.01	21.2	25.74
15	4,240 lbs. Stable Manure	28.40	.....	13.14	26.71	32 43
16	240 lbs. Acid Phosphate. 240 lbs. Cotton Seed Meal.	4 20	35.96	13.27	16.80	20.35

Nitrogen, Potash and Intercultural Experiments.

In addition to the co-operative experiments already mentioned, Mr. A. F. Cory, Mulberry, Autauga county, an Alumnus of the A. & M. College, conducted some special nitrogen, potash and intercultural experiments.

EXPERIMENTS MADE BY REV. L. C. ADAY,

Newburgh, Franklin County.

Soil, Red Cedar Land—Sub-Soil, Red Clay.

Average yield of unmanured plots 611 pounds per acre. By adding the yield of plots 4, 8 and 12, and dividing the amount by 3, we have 611 pounds average yield per acre of unmanured plots, which serves as a basis for comparison for this as well as the following experiments. It is interesting to note the effects of different fertilizers upon the maturity of the cotton plant in this experiment, which can be seen from dates of picking. Mr. Aday cultivated this crop throughout with heel scrape. The general indications from the results are, that the soil needs nitrogen, phosphoric acid and potash. By reference to plot number 9, a complete fertilizer, the largest yield is observed, except in plot number 15, stable manure, which contains phosphoric acid and potash to a certain extent, in combination with nitrogen. The yield in plot No. 14, green cotton seed and floats, is very marked.

The following tabulated statement is the result of Mr. Aday's experiment:

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Sept. 10th.	Lbs. cotton, 2nd picking Oct. 3rd.	Lbs. cotton, 3d picking. Oct 22nd.	Lbs. cotton, 4th picking. Nov. 16th.	Total yield per plot.	Total yield per Acre.
1	6 lbs nitrate soda...	96 lbs nitrate soda	2	24	14	4	44	704
2	15 lbs acid phosphate	240 lbs acid phosph	3	33	10	2	48	768
3	4 lbs muriate potash.	64 lbs muriate pot.	2	29	16½	8	55½	888
4	No manure.	No manure ...	2	22	16	6	46	736
5	6 lbs nitrate soda 4 lbs mur'te potash	96 lbs nitrate soda 64 lbs muriate pot.	1½	24	16	9	50½	808
6	6 lbs nitrate soda. 15 lbs acid phosph.	96 lbs nitrate soda 240 lbs acid phosp.	6½	38	10	4	58½	936
7	4 lbs muriate pota. 15 “ acid phospha.	64 lbs muriate pot. 240 lbs acid phosh	4	40	9	4	57	912
8	No manure.	No manure.	2	18	8	6	34	544
9	6 lbs nitrate soda 15 “ acid phospha. 4 lbs muriate pota.	96 lbs nitrate soda 240 lbs acid phosp. 64 lbs muriate pot.	6½	46	12	5	69½	1112
10	15 lbs. Floats..... .	240 lbs Floats....	5	35	10	6	56	896
11	15 lbs Floats .. 6 lbs nitrate soda.	240 lbs Floats ... 96 “ nitrate soda	6	39	10	4	59	944
12	No manure.........	No manure. ...	2½	22	5	4	33½	553
13	53 lbs green cotton S	848 lbs. G. C. seed	6	34	14	6	60	916
14	53 lbs G. Cot. seed 15 lbs Floats.. .	848 lbs green C. S. 240 lbs Floats ...	5	36	20	10	71	1136
15	265 lbs stable manure	4240 lbs stable ma.	4	42	24	13	43	1328
16	15 lbs acid phosph. 15 “ cotton S. meal	240 lbs acid phos 240 “ C. seed meal	5	36	18	6	35	1040

EXPERIMENT MADE BY MR. E. J. BEASELY,

RED LEVEL, COVINGTON COUNTY.

Soil, Red—Sub-soil, Clay.

Average yield of unmanured plots, 325 pounds per acre. Mr Beasely reports that he cultivated his cotton according to instructions in Bulletin No. 12, which contains directions for all experimenters alike. The indications are, from the following statement, that phosphoric acid is the principle element needed in this soil.

By observing the yield of each unmanured plot, it will be seen that there is a want of uniformity in the soil of this test acre.

No. Plot.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 15th	Lbs. Cotton, 2nd picking Oct. 10th.	Lbs. Cotton, 3rd picking. Nov. 10th.	Lbs. Cotton, 4th picking. Nov. 20th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda .	96 lbs nitrate soda	2	4	5	5	16	256
2	15 lbs acid phosphate	240 " acid phosph.	18	12	6	5	41	656
3	4 lbs muriate potash.	64 " muriate pot	4	8	5	4	21	336
4	No manure.	No manure	2	6	4	3	15	240
5	6 lbs nitrate soda 4 " muriate pota	96 lbs nitrate soda 64 lbs mur. potash	4	8	6	5	23	368
6	6 " nitrate soda 15 " acid phospha.	96 " nitrate soda 240" A. phosphate	20	16	7	8	51	816
7	4 lbs muriate pota. 15 " acid phospha	64 " muriate pota. 240" acid phosph.	20	16	8	8	52	832
8	No manure.	No manure.	6	8	6	5	25	400
9	6 lbs nitrate soda. 4 " muriate pota 15 " acid phospha	96 lbs nitrate soda 64 " muriate pot 240" acid phospha	26	16	8	8	58	928
10	15 lbs Floats..	240 lbs Floats	16	18	7	6	47	752
11	15 lbs Floats .. 6 " nitrate soda.	240 " " 96 " nitrate soda	12	16	10	6	44	704
12	No manure	No manure ..	4	6	6	5	21	336
13	53 lbs green cotton S.	348 lbs green C. S	24	20	8	8	60	960
14	53 lbs green C. S 15 lbs Floats ...	348 lbs green C. S. 240 lbs Float	36	18	6	5	65	1040
15	265 lbs stable manur'	4240 " stable man.	26	12	8	5	51	813
16	15 " acid phospha. 15 " cotton seed M.	240 " acid phospb 240 cotton seed M	42	12	2	1	57	912

EXPERIMENT MADE BY MR. D. L. BROWN,

RANDOLPH, BIBB COUNTY.

Soil, Sandy—Sub-soil, Clay.

Average yield of unmanured plots 517 pounds per acre. In this experiment Mr. Brown reports that the cotton did not come up until the 27th May, on account of drought, and that plot number 2 was over flowed, and damaged from a very heavy rain. Hence no conclusion will be drawn as to comparison.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Oct. 15th.	Lbs. Cotton. 2nd picking. Nov. 14th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda........	96 lbs nitrate soda......	10	18	28	448
2	15 lbs acid phosphate.....	240 lbs acid phosphate..	8	12	20	320
3	4 lbs muriate potash......	64 " muriate potash..	10	16	26	416
4	No manure.	No manure.	10	17	27	432
5	6 lbs nitrate soda....... 4 " muriate potash.....	96 lbs nitrate soda...... 64 " muriate potash...	10	18	28	448
6	6 lbs nitrate soda. ..... 15 " acid phosphate....	96 " nitrate soda ..... 240 lbs acid phosphate.	30	24	54	864
7	4 lbs muriate potash .... 15 lbs acid phosphate...	64 " muriate potash. 240 " acid phosphate...	18	24	42	672
8	No manure.	No manure.	12	20	32	512
9	6 lbs nitrate soda ..... 4 " muriate potash... 15 " acid phosphate...	96 lbs nitrate soda. .. 64 " muriate potash... 240 " acid phosphate..	24	20	44	704
10	15 lbs Floats.............	240 " Floats.	14	24	38	608
11	15 lbs Floats .... 6 " nitrate soda	240 " Floats . ... 96 " nitrate soda	16	30	46	736
12	No manure	No manure.......	10	28	38	608
13	53 lbs green cotton seed...	848 lbs green cotton seed	20	18	38	608
14	53 lbs green cotton seed. 15 " Floats	848 " green cotton seed 240 " Floats.	26	22	48	768
15	265 lbs stable manure...	4240 lbs stable manure.	18	28	46	736
16	15 lbs acid phosphate... 15 lbs cotton seed meal..	240 lbs acid phosphate 240 " cotton seed meal	30	22	52	832

EXPERIMENT MADE BY Mr. M. A. BISHOP,

Madison, Madison County.

Soil, Clay Loam—Sub-soil, Stiff Clay.

Average yield of unmanured plots, 312 pounds per acre. Mr. Bishop in his report says, owing to drought he did not get a stand of cotton until the 5th of June.

The seasons were perfect from the time the cotton came up until July 27th, after which time no rain fell for three months. The unfertilized plots did not make an average crop on account of the late date of its coming up, fully 10 per cent. of the bolls being destroyed by frost.

Mr. Bishop calls especial attention to the fact, that the use of fertilizers is necessary to hasten the maturity of the crop. Cultivation was thorough. The slight increase in plot number 4 is explained by the removal of rocks and chunks piled on it the previous year. This ground has been in cultivation since 1857.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking .Sept. 21st.	Lbs. cotton, 2nd picking Oct. 15th.	Lbs. cotton 3rd picking. Nov. 20th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda.........	96 lbs nitrate soda	10	14	8	32	512
2	15 " acid phosphate......	240 " acid phosph.	8	12	8	28	448
3	4 " muriate potash......	64 " muriate pot.	8	16	10	34	544
4	No manure	No manure	....	6	16	22	352
5	6 lbs nitrate soda .... 4 " muriate potash ..	96 lbs nitr'te soda 64 " muriate pot	10	12	6	28	448
6	6 " nitrate soda. .... 15 " acid phosphate ..	96 " nitrate soda 240 " acid phosp.	18	20	12	50	800
7	4 " muriate potash .. 15 " acid phosphate....	64 " muriate pot. 240 " acid phosph	16	14	10	40	640
8	No manure...............	No manure ..	....	7	11	18	288
9	6 lbs nitrate soda ..... 4 " muriate potash.... 15 " acid phosphate....	96 lbs nitrate soda 64 " muriate pot. 240 " acid phosph	19	17	14	50	800
10	15 " Floats	240 " Floats	6	14	10	30	480
11	15 " Floats .... 6 " nitrate soda......	240 " Floats ..... 296 " nitrate soda	11	13	14	38	608
12	No manure	No manure......	.....	7½	11	18½	296
13	53 lbs green cotton seed	848 lbs green C. S.	.....	16	10	26	416
14	53 " green cotton seed 15 " Floats	848 " green C. S. 240 " Floats	6	18	8	32	512
15	265 " stable manure ..	4240" stable m'nu.	16	20	8	44	704
16	15 " acid phosphate .. 15 " cotton seed meal..	240 " acid phosp 240 " cotton S. M.	15	11	8	34	544

EXPERIMENT MADE BY MR. T. W. BRADLEY,

WALKER SPRINGS, CLARKE COUNTY.

Soil, Sandy—Sub soil, Clay.

Average yield per acre of unmanured plots 384 pounds. From Mr. Bradley's report, it will be seen that this test acre is not of even fertility as is shown by comparing unmanured plots 4, 8 and 12, among themselves. By noticing the yield from use of fertilizers applied singly, and in combination, it is evident that this soil is lacking in all three main elements of plant food, while acid phosphate is needed most of any. As a rule, plants are not fastidious from what source they obtain nitrogen, yet by comparing plot 6—acid phosphate and nitrate soda—with plot 16—acid phosphate and cotton seed meal—the influence of nitrogen in the cotton seed meal in plot 16 seems to be effectual in giving better results.

By comparing plot 11, nitrate soda and floats, with plot 14, cotton seed and floats, the results are in favor of plot 14. These are not positive conclusions, but in this experiment the indications are as above stated. This land was never fertilized, and the following tabulated statement shows the results of Mr. Bradley's experiment:

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking, Sept. 10th	Lbs. cotton, 2nd picking Oct. 1st.	Lbs cotton, 3rd picking. Oct 15th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	8	29	6	33	528
2	15 " acid phosphate	240 " acid phosph	16	35	4½	55½	888
3	4 " muriate potash	64 " muriate pot.	4	18	4	26	416
4	No manure.	No manure	6	21	4	31	496
5	6 lbs nitrate soda. .... 4 " muriate potash ..	96 lbs nitrate soda. 64 " muriate pota.	32	20	4½	56½	904
6	6 " nitrate soda. .... 15 " acid phosphate....	96 " nitrate soda. 240" acid phosph.	4	37	4	45	720
7	4 " muriate potash.... 15 " acid phosphate ..	64 " muriate pota 240" acid phospha	28	25	4½	57½	920
8	No manure...........	No manure....	4	12	3	19	304
9	6 lbs nitrate soda ... 4 " muriate potash.... 15 " acid phosphate....	96 lbs nitrate soda. 64 " muriate pot. 240" acid phosph.	16	37	6	59	944
10	15 " Floats...........	240 lbs Floats....	24	24	4	52	832
11	15 " Floats............ 6 " nitrate soda.......	240 " Floats.... 96 " nitrate soda	12	27	4½	43½	696
12	No manure............	No manure......	4	14	4	22	352
13	53 lbs green cotton seed	848 lbs green C. S.	36	24	6	66	1056
14	53 " green cotton seed. 15 " Floats...........	848 " green C. S. 240 " Floats.....	14	40	2½	56½	904
15	265 " stable manue.....	4240" stable m'nu.	30	25	3	58	928
16	15 " acid phosphate... 15 " cotton seed meal..	240 " acid phosph 240 " cotton S. M.	28	34	8	70	1120

EXPERIMENT MADE BY MR. J. M. BRANNON,

SEALE, RUSSELL COUNTY.

Soil, Sandy—Subsoil, Clay.

Average yield of unmanured plots 504 pounds per are. Mr. Brannon says the land on which this test was made has been in cultivation for forty years, and is known as "poor sandy land." For the last twenty years it has been slightly fertilized each year with cotton seed.

In securing a stand of cotton, no trouble was experienced and the cultivation was thorough.

From this report the indications are that a complete fertilizer is needed as is shown in plot No. 9, which contains the three leading elements of plant food. No benefit is derived from the use of floats; but the results from acid phosphate and cotton seed meal in plot No. 16, as compared with stable manure in plot No. 15, are very decided.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Sept. 19th.	Lbs. cotton, 2nd picking. Oct. 15.	Lbs. cotton, 3d picking. Nov. 5.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	20	14	3	37	592
2	15 " acid phosphate	240 " acid phosph.	27	12	4	43	688
3	4 " muriate potash	64 " muriate pot.	20	10	3	33	528
4	No manure.	No manure. ...	15	9	2½	26½	424
5	6 lbs nitrate soda ..... 4 " muriate potash . .	96 lbs nitrate soda 64 " muri'te pota	23	14	3	40	640
6	6 " nitrate soda .... 15 " acid phosphate ..	96 " nitrate soda. 240 " acid phosph.	29	4	1	34	544
7	4 " muriate potash ... 15 " acid phosphate ...	64 " muriate pot. 240 " acid phosph.	34	9	3½	46½	744
8	No manure.............	No manure	25	5	3	33	528
9	6 lbs nitrate soda ..... 4 " muriate potash... 15 " acid phosphate...	96 lbs nitrate soda 64 " muri'te pot 240 " acid phosph	44	15½	5	64½	1032
10	15 " Floats.....	240 " Floats	21	2¼	½	23¾	380
11	15 " Floats ... . 6 " nitrate soda	240 " Floats ..... 96 " nitrate soda.	31½	4½	2	38	608
12	No manure.............	No manure.......	25	9	1	35	560
13	53 lbs green cotton seed	848 lbs green C. S.	34	5	2	41	656
14	53 " green cotton seed. 15 " Floats	848 " green cot. S 240 " Floats	28	5	1½	34½	552
15	265 " stable manure ...	4240" stable man.	29	2¾	1	42¾	684
16	15 " acid phosphate... 15 " cotton seed meal.	240 " acid phosph. 240 " cotton S. M.	46	3	1	50	800

EXPERIMENT MADE BY MR. G. W. COMPTON,

DIXON'S MILLS, MARENGO COUNTY,

Soil, Dark Sandy—Sub-soil, Clay.

Average yield of unmanured plots 665 pounds per acre. Mr. Compton says that he has been cultivating this land for the last twenty years, manuring lightly each year with green cotton seed. The seasons being so unfavorable for seed to germinate that he did not get a stand at the proper time and the consequence was had to plant over, and did not secure a stand until June 1st.

After June 1st every thing was propitious to the growth of the plant until September 11th, after which time no rain fell until Novembr 9th, which dry spell materially affected its maturity on account of the lateness of getting a stand. The yield from acid phosphate alone in plot 2, is very striking in this experiment, and in combination with nitrate soda on plot 6, the results are nearly as great as in plot 9 where a complete fertilizer was used. Attention is called to the increased yield of floats in plot No. 10, over acid phosphate in plot No. 2, and in combination with green cotton seed in No. 14, the yield is greater than in plot No. 9, a complete fertilizer. The indications are that this soil is deficient in phosphoric acid. The land on which this experiment was conducted, was cleared 60 years ago.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking, Sept. 25.	Lbs. cotton, 2nd picking, Oct. 9.	Lbs. cotton, 3d picking, Oct. 24th.	Lbs. cotton, 4th picking, Nov. 9th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda..	96 lbs nitrate soda	12	19	8	6	45	720
2	15 " acid phosphate	240 " acid phosph.	18	22½	6	4½	51	816
3	4 " muriate potash	64 " muriate pot.	8	14	8	7	37	592
4	No manure....... ..	No manure.....	9	14½	10	7	40½	648
5	6 lbs nitrate soda 4 " muriate potash	96 lbs nitrate soda 64 " muriate pota.	8½	15½	8½	9½	42	672
6	6 " nitrate soda.. 15" acid phosph'te	96 " nitrate soda 240" acid phospha	21	23½	8½	5½	58½	936
7	4 " muriate potas. 15" acid phosphat'	64 " mur'te p'ash. 240" acid phosph.	14	22½	9½	5	51	816
8	No manure......	No manure......	9	14½	7½	6½	37½	568
9	6 lbs nitraie soda 4 " muriale potas' 15 " acid phospha	96 lbs nitr'te soda 64 " muriate pot. 240 " acid phosph.	19½	22½	10½	8	60½	968
10	15 " Floats	240 " Floats.....	14½	21	10	8	53½	866
11	15 " Floats ...... 6 " nitrate soda.	240 " Floats 96 " nitrate soda.	16	22	12½	7	57½	920
12	No manure......	No manure..	9½	14	11	8	42½	680
13	53 lbs green cotton S	848 lbs green C. S.	20	24	9	6½	59½	952
14	53 lbs green C.seed 15 " Floats	848 " green C. S. 240 " Floats.....	23½	23	10½	4½	61½	984
15	265 " stable m'ure.	4246" stable m'nre	23½	22	8½	5	59	944
16	15 " acid phosph. 15 " C. seed meal	240 " acid phosph. 240 " cotton S. M.	20½	16½	8	4	49	784

EXPERIMENT MADE BY MR. R. H. CROSS,

LETOHATCHIE, LOWNDES COUNTY.

Soil, Sandy Loam—Sub-soil, Yellow Clay.

Average yield of unmanured plots, 352 pounds per acre. The uniform fertility of this experiment acre is about as good as is usually found.

By comparing the yield from plots 1, 2 and 3, with the average yield of unmanured plots 4, 8 and 12, it will be seen that the increased yield from plots 1 and 3, is greater than from plot 2. In plots 5, 6 and 7 where the elements are in combination, the yield in plot 5, is less than in 6 and 7, while in plot 9, a complete fertilizer, the increase over the average of unmanured plots is 384 pounds.

Plot 10, floats alone, gives an increase over no manure of 80 lbs., while in combination with nitrate soda, in plot 11, the increased yield is 288 pounds, and with green cotton seed in plot 14, the increased yield is 336 pounds. This experiment would indicate that floats can be used with satisfactory results on the soil selected by Mr. Cross. By referring to plot 15, stable manure, it will be observed that there is a falling-off in yield, while in plot 16, acid phosphate and cotton seed meal, the yield is very satisfactory.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Sept. 16.	Lbs cotton, 2nd picking. Sept. 28	Lbs. cotton, 3rd picking. Oct. 14.	Lbs. cotton, 4th picking. Nov. 17.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	9	13	6	7	35	560
2	15 " acid phosphate	240 " acid phosph.	10	12	7	5	34	544
3	4 " muriate potash.	64 " muriate pot	13	14	6	4	37	592
4	No manure	No manure. ...	8	10	3	2	23	368
5	6 lbs nitrate soda 4 " muriate p'ash.	96 lbs nitrate soda 64 " muriate pot.	11	14	6	8	39	624
6	6 " nitrate soda 15 " acid phospha.	96 " nitrate soda. 240 " acid phosph.	14	16	9	3	42	672
7	4 " muriate pota. 15 " acid phospha.	64 " muriate pot. 240 " acid phosph.	10	12	13	7	42	672
8	No manure. ..	No manure	4	6	8	3	21	336
9	6 lbs nitrate .... 4 ' muriate pota 15 " acid phospha	96 lbs nitrate soda 64 " muriate pot. 240 " acid phosph.	15	18	10	3	46	736
10	15 " Floats......	240 " Floats	7	9	6	5	27	432
11	15 " Floats...... 6 " nitrate soda	240 " Floats . .. 96 " nitrate soda.	9	12	11	8	40	640
12	No manure	No manure......	7	9	4	2	22	352
13	53 lbs green cotton S.	848 lbs green C. S.	15	17	13	9	54	864
14	53 " " " seed. 15 " Floats.....	848 " green C. S. 240 " Floats.....	16	13	10	4	43	688
15	265 " stable manure	4240" stable m'nre	12	7	6	2	27	432
16	15 " acid phospha. 15 " cotton S. meal	240 " acid phosph. 240 " cotton S. M.	16	20	14	6	56	896

EXPERIMENT BY Maj. E. M. DAVIS,

PRATTVILLE, AUTAUGA COUNTY.

Soil, Sandy Loam—Sub-Soil, Red Clay.

Average yield per acre of unmanured plots 695 lbs. Mr. Davis says in his report, that nitrogen is the element most needed in his soil, which is the general indication from results of his experiment. While the increased yield in plot 9, a complete fertilizer, is 135 lbs. over plot 1, nitrate soda, yet in comparison with plot 13, green cotton seed, and plot 15, stable manure, the results point to nitrogen as the chief element lacking. By comparing unmanured plots 4, 8 and 12, with each other, an increase is noticed in each sncceessive one. For instance, the difference in yield between plots 4 and 8, is 30 lbs., and between 4 and 12, 75 lbs., indicating an uneveness in the fertility of this acre. If this be a fact, the increased yield from use of floats in plot 10, over acid phosphate in plot 2, is accounted for. The foregoing being true, the increase of plots 11, 14 and 16 is also explained. Further experiment, however, is necessary to establish a conclusion. Too much care cannot be exercised in selecting soil of uniform productiveness for experiment.

No. Plot.	Lbs. Fertilizers Per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton. 1st picking.	Lbs cotton, 2nd picking.	Total yield per plot.	Total yield per acre.
1	6 lbs nitrate soda.... ...	96 lbs. nitrate soda.. ..	45	7	52	780
2	15 lbs acid phosphate. ...	240 lbs acid phosphate..	41½	3	44½	667
3	4 lbs muriate potash	64 lbs muriate potash.	37	5	42	630
4	No manure.	No manure.	39	5	44	660
5	6 lbs nitrate soda....... 4 lbs muriate potash....	96 lbs nitrate soda ... 64 lbs muriate potash	45	10	55	825
6	6 lbs nitrate soda. .... 15 lbs acid phosphate...	96 lbs nitrate soda .. 240 lbs acid phosphate.	47	10	57	855
7	4 lbs muriate potash .. 15 lbs acid phosphate..	64 lbs muriate potash 240 lbs acid phosphate..	41	8	49	735
8	No manure.	No manure....	34	12	46	690
9	6 lbs nitrate soda. ..... 15 lbs acid phosphate... 4 lbs Muriate potash....	96 lbs nitrate soda .. 240 lbs acid phosphate. 64 lbs muriate potash..	51	10	61	915
10	15 lbs Floats	240 lbs Floats.	41½	6	47½	712½
11	15 lbs Floats.. .. .. 6 lbs nitrate soda.	240 lbs Floats. .... 96 lbs nitrate soda	51	7	58	870
12	No manure.	No manure.	45	4	49	735
13	53 lbs green cotton seed ..	848 lbs green cotton seed	57	8	65	975
14	53 lbs green cotton seed. 15 lbs Floats........ ..	848 lbs green cotton seed 240 lbs Floats.	59	5	64	960
15	265 lbs stable manure. ..	4240 lbs stable manure..	61	4	65	975
16	15 lbs acid phosphate... 15 lbs cotton seed meal..	240 lbs acid phosphate.. 240 lbs cotton seed meal.	61	4	65	975

EXPERIMENT MADE BY MR. R. M. DICK,

ATTALLA, ETOWAH COUNTY.

Soil, Red Loam—Sub-soil, Red Clay.

Average yield of unmanured plots 240 pounds per acre. We have in this experiment a fact noticeable in other experiments, which is, that while several elements taken separately and applied to the soil are not beneficial, and even in some instances, decrease the yield from unmanured plots, yet, when the same are combined the results are very desirable. For instance, the average yield of unmanured plots 4, 8 and 12 being 240 pounds per acre, plot No. 1, nitrate of soda alone, gives 40 pounds less than average of no manure. But in plot No. 6, in combination with acid phosphate, the increased yield over plot No. 2, acid phosphate alone, is 384 pounds.

It will be observed that plot No. 2, acid phosphate, gives an increase of 376 pounds per acre over no manure. Furthermore, by comparing plots Nos. 3, 5 and 9, where muriate potash was used, its effects were injurious rather than beneficial. While the increased yield from use of floats in plots Nos. 10, 11 and 14, is not as great as from the use of acid phosphate in plots 2 and 6, still, the result is satisfactory, taking into consideration the difference in the cost of the two fertilizers.

From the foregoing, it will be seen that phosphoric acid and nitrogen are the main elements needed in this soil.

No. Plot.	Lbs. Fertilizers per Plot	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept. 23.	Lbs. cotton, 2nd picking. Oct. 5th.	Lbs. cotton, 3rd picking. Oct. 23d.	Lbs. cotton, 4th picking. Nov. 9th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	1½	2	6	3	12½	200
2	15 " acid phosphate	240 " acid phosph	21½	9	6	2	38½	616
3	4 " muriate potash	64 " muriate pot.	1½	3	6	3	13½	216
4	No manure.....	No manure......	1½	3	6	3½	14	224
5	6 lbs nitrate soda 4 " muriate pota.	96 lbs nitrate soda 64 " muriate pot	1½	4	6½	3½	15½	248
6	6 " nitrate soda 15 " acid phospha	96 " nitrate soda. 240 " acid phosph.	36½	14	9	3	62½	1000
7	4 " muriate pota. 15 " acid phospha	64 "muriate pota. 240 " acid phosph	20	11	8½	3	42½	680
8	No manure......	No manure.	2	3½	7	4	16½	264
9	6 lbs nitrate soda 4 " muri'te pot'sh 15 " acid phospha.	96 lbs nitrate soda 64 " muriate pot. 240 " acid phospha	30	15	11	3½	59½	952
10	15 " Floats	240 " Floats	6½	7½	10	5	29	464
11	15 " Floats. ..... 6 " nitrate soda..	240 " Floats ...... 96 " nitrate soda.	5	6	8½	5	24½	392
12	No manure	No manure.......	2	3½	6	3	14½	232
13	53 lbs green cotton S.	848 lbs green C. S.	12	8½	9	4¼	34	544
14	53 " " " seed 15 " Floats.	848 " green C. S. 240 " Floats ...	21	13	10½	4½	49	784
15	265 lbs stable manur.	4240" stable m'ure	23	15	11	4	53	848
16	15 " acid phospha. 15 " cotton S. meal	240 " acid phosph. 240 " cotton S. M.	18	12	11½	3½	45	720

EXPERIMENT MADE BY MR. R. T. EWING,

ROUND MOUNTAIN, CHEROKEE COUNTY.

Soil, Gray, Sandy, Piney Woods—Sub-soil, Yellow Sand.

Average yield unmanured plots per acre, 320 pounds. In this experiment, no perceptible benefit is seen from the application of nitrate soda in plot No. 1, and while there is shown a slight increase in plot No. 3, muriate potash, over no manure, it is no greater in this instance than occurs in the unmanured plots 4, 8 and 12. In plot No. 2, acid phosphate, there is an increased yield of 160 pounds over average of no manure. By comparing plot No. 6 with plot No. 9, it is shown that muriate potash is of no value in this combination; but in plot No. 7, combined with acid phosphate, the increased yield is 192 pounds over acid phosphate alone in plot No. 2. The increased yield from use of floats in plots 10, 11 and 14 over the average of no manure, while not as great as in some instances, is satisfactory. The best results obtained from this experiment are from plot 15, stable manure, and plot 16 cotton seed meal and acid phosphate.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Oct. 12.	Lbs. cotton, 2nd picking. Nov. 3.	Lbs. cotton, 3rd picking. Dec. 3.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda..	96 lbs nitrate soda.....	8	8	4	20	320
2	15 " acid phosphate	240 " acid phosphate...	18	10	2	30	480
3	4 " muriate potash	64 " muriate potash...	10	8	4	22	352
4	No manure	No manure.	8	8	4	20	320
5	6 lbs nitrate soda 4 " muriate pota	96 lbs nitrate soda, 64 " muriate potash...	6	10	4	20	320
6	6 " nitrate soda 15 " acid phospha	96 " nitrate soda, 240 " acid phosphate...	24	18	4	46	736
7	4 " muriate pota. 15 " acid phospha	64 " muriate potash, 240 " acid phosphate...	20	18	4	42	672
8	No manure..	No manure.......	4	8	4	16	256
9	6 " nitrate soda. 4 " muriate pota. 15 " acid phospha.	96 " nitrate soda, 64 " muriate potash, 240 " acid phosphate..	26	18	2	46	736
10	15 " Floats.	240 " Floats...........	12	10	4	26	416
11	15 " Floats....... 6 " nitrate soda	240 " Floats, 96 " nitrate soda	12	14	4	30	480
12	No manue	No manure.	8	12	4	24	384
13	53 " green cot'n S.	848 " green cotton seed	16	20	2	38	608
14	53 " green C. S.. 15 " Floats.......	848 " green cotton seed, 240 " Floats	16	24	4	44	704
15	265 lbs stable m'nure	4240" stable manure ...	40	20	4	64	1024
16	15 " acid phosphat 15 " cotton S. meal	240 " acid phosphate, 240 " cotton seed meal..	22	26	4	52	832

EXPERIMENT MADE BY Mr. J. M. ELLISON,

CREEK STAND, MACON COUNTY.

Soil, Sandy—Sub-soil, Sandy.

Average yield per acre of unmanured plots 596 pounds. Mr. Ellison in making his report, writes as follows: " I can not account for No. 12 making more than Nos. 4 and 8, but I do know that I made no mistake. There can be no reason for this as I can see, there being no difference in the plots." Owing to the uneveness of this soil which is seen by comparing unmanured plots 4, 8 and 12 with each other, no conclusions will be drawn. The following tabulated statement show the result of Mr. Ellison's experiment:

No. Plot.	Lbs Fertilizers per Plot.	Lbs. Fertilizer per Acre.	Lbs. cotton, 1st picking. Aug. 19.	Lbs. cotton, 2nd picking. Aug. 25.	Lbs. cotton, 3rd picking Sept. 8.	Lbs. cotton, 4th picking. Nov. 2.	Total yield per plot.	Total yield per Acre.
1	6 lbs nitrate soda..	96 lbs nitrate soda	12	13	17	8	50	800
2	15 " acid phosphate	240 " acid phosph.	14	21	24	10	69	1104
3	4 " muriate potash	64 " muriate pot	7	10	13	7	37	592
4	No manure	No manure.	9	8	11	3	31	492
5	6 lbs nitrate soda. 4 " muri'te pot'sh	96 " nitrate soda, 64 " muriate pot.	4	10	19	11	44	704
6	6 " nitrate soda 15 " acid phospha.	96 " nitrate soda, 240 " acid phospha	8	15	21	12	56	896
7	4 " muriate pota. 15 " acid phospha	64 " muriate pota 240 " acid phosph	7	10	15	7	39	624
8	No manure...	No manure..	7	8	7	3	25	400
9	6 " nitrate soda 4 " muriate pota. 15 " acid phospha.	96 " nitrate soda, 64 " muriate pot. 240 " acid phosph.	7	14	20	10	51	816
10	15 " Floats.	240 " Floats	14	17	15	6	52	832
11	15 " Floats. 6 " nitrate soda..	240 " Floats ..... 96 " nitrate soda	13	19	14	12	58	928
12	No manure..	No manure	15	20	15	6	56	896
13	53 " green C. seed.	848 " green cot. S.	20	18	20	12	70	1120
14	53 " " " 15 " Floats.	848 " " " 240 " Floats	15	16	13	10	54	864
15	265 " stable manure	4240" stable m'ure	21	16	10	12	59	944
16	15 " acid phospha. 15 " cotton seed M	240 " acid phosph 240 " cotton S. M.	17	12	12	10	51	816

EXPERIMENT MADE BY DR. JOHN GORDON,

HEALING SPRINGS, WASHINGTON COUNTY.

Soil, Sandy Loam—Sub-soil, Sandy Loam.

Average yield of unmanured plots, per acre, 64 pounds. Dr. Gordon reports that this experiment was planted in Peterkin cotton and owing to unfavorable seasons, a stand was not secured until May 22d. The last two weeks of August were very hot and dry, causing the top crop to shed. He says cultivation was made strictly according to instructions. The following tabulated statement shows the results of Dr. Gordan's experiment, and especial attention is called to the increased yield from use of fertilizers, over the average of unmanured plots 4, 8 and 12, which is 64 pounds.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	39½	632
2	15 " acid phosphate	240 " acid phosphate	45	720
3	4 " muriate potash	64 " muriate potash	16¼	260
4	No manure	No manure	5	80
5	6 lbs nitrate soda 4 " muriate potash	96 " nitrate soda, 64 " muriate potash	10	160
6	6 " nitrate soda. 15 " acid phosphate	96 " nitrate soda, 240 " acid phosphate	24	384
7	4 " muriate potash 15 " acid phosphate	64 " muriate potash, 240 " acid phosphate	30	480
8	No manure	No manure	3	48
9	6 " nitrate soda. 4 " muriate potash 15 " acid phosphate	96 " nitrate soda, 64 " muriate potash, 240 " acid phosphate	40	640
10	15 " Floats	240 " Floats.	11	176
11	15 " Floats 6 " nitrate soda	240 " Floats, 96 " nitrate soda	21½	344
12	No manure	No manure	4	64
13	53 " green cotton seed	848 " green cotton seed	21½	344
14	53 " green cotton seed 15 " Floats	848 " green cotton seed, 240 " Floats.	23½	376
15	265 " stable manure	4240" stable manure	47¼	756
16	15 " acid phosphate 15 " cotton seed meal	240 " acid phosphate, 240 " cotton seed meal	56½	904

EXPERIMENT MADE BY Mr. A. T. GOODWYN,

Robinson's Springs, Elmore County.

Soil, Gray Sandy—Sub-soil, Red Clay.

Average yield per acre of unmanured plots, 469 pounds. Attention is called to the uneven fertility of this acre, by comparing unmanured plots 4, 8 and 12 with each other.

Mr. Goodwyn says that the land was prepared and cultivated thoroughly, fertilizers put down March 30th, and cotton planted April 16th; stand was secured by May 1st. Worms stripped off all leaves by October 2d. Cotton was picked, in every instance, in the afternoon and carefully weighed. Seasons were better than an average. The following statement shows the result of Mr. Goodwyn's experiment:

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Sept. 8.	Lbs. cotton, 2nd picking. Oct. 7.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda........	96 lbs nitrate soda....	16	14	30	480
2	15 " acid phosphate	240 " acid phosphate...	34	12	46	736
3	4 " muriate potash......	64 " muriate potash...	18	22	40	640
4	No manure..............	No manure......	16	16	32	512
5	6 lbs nitrate soda .... 4 " muriate potash....	96 " nitrate soda, 64 " muriate potash..	16	28	44	704
6	6 " nitrate soda........ 15 " acid phosphate	96 " nitrate soda 240 " acid phosphate...	46	22	68	1088
7	4 " muriate potash ... 15 " acid phosphate....	64 " muriate potash, 240 " acid phosphate...	36	18	54	864
8	No manure..............	No manure	18	16	34	544
9	6 lbs nitrate soda ..... 4 " muriate potash .. 15 " acid phosphate ..	96 " nitrate soda, 64 " muriate potash, 240 " acid phosphate...	44	24	68	1088
10	15 " Floats...........	240 " Floats	18	10	28	448
11	15 " Floats............ 6 " nitrate soda..	240 " Floats 96 " nitrate soda	28	14	42	672
12	No manure........	No manure.	14	8	22	352
13	53 " green cotton seed..	848 " green cotton seed.	16	26	42	672
14	53 " green cotton seed.. 15 " Floats............	848 " green cotton seed, 240 " Float.	26	6	32	512
15	265 " stable manure.....	4240" stable manure ..	44	2	46	736
16	15 " acid phosphate ... 15 " cotton seed meal..	240 " acid phosphate. 240 " cotton seed meal	40	20	60	960

EXPERIMENT MADE BY MR. J. M. HOBDY,

LOUISVILLE, BARBOUR COUNTY.

Soil, Sandy Loam—Sub-soil, Red Clay.

Average yield, no manure, 725 pounds per acre. By noticing the yield from the unmanured plots 4, 8 and 12, a lack of uniform fertility of the soil is the first thing to be readily observed. It is to be noticed furthermore, in this report, that the soil is lacking in every principle element necessary for plant food, and that no one taken separately increases the yield, but by putting two ingredients together (one of the ingredients being acid phosphate), as in plots 6 and 7, a satisfactory result is developed, compared with No. 5. In plot No. 10, floats, the increased yield over no manure is 75 pounds, which difference is not so great as between the unmanured plots 8 and 12, it being 160 pounds, and which result should not be misleading.

This is another instance of the importance of having land of uniform fertility for conducting experiments. Mr. Hobdy says he exercised great care in making this experiment, yet, the irregularity of the soil alluded to above, as is shown by results, suggests great pains in selecting an acre of as even fertility as possible.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept 7.	Lbs. cotton, 2nd picking. Sept. 20.	Lbs. cotton, 3rd picking. Oct. 3.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda....	96 lbs nitrate soda..	12	14	4	30	480
2	15 " acid phosphate.	240 " acid phosphate.	20	16	6	42	672
3	4 " muriate potash..	64 " muriate potash.	10	20	7	37	592
4	No manure..... ...	No manure. ..	13	18	8	39	624
5	6 lbs nitrate soda 4 " muriate potash	96 " nitrate soda 64 " muriate potash.	10	26	6	42	672
6	6 " nitrate soda.. 15 " acid phosphate	96 " nitrate soda, 240 " acid phosphate.	32	28	16	76	1216
7	4 " muriate potash 15 " acid phosphate	64 " muriate potash 240 " acid phosphate.	29	24	10	63	1008
8	No manure.........	No manure.....	12	24	12	48	768
9	6 lbs nitrate soda.. 4 " muriate potash 15 " acid phosphate	96 " nitrate soda, 64 " muriate potash, 240 " acid phosphate	32	30	8	70	1020
10	15 " Floats.........	240 " Floats.........	16	24	10	50	800
11	15 " Floats .... 6 " nitrate soda...	240 " Floats, 96 " nitrate soda....	17	28	8	53	848
12	No manure....	No manure. ..	15	22	12	49	784
13	53 " green cotton S.	848 " green cotton s'ed	27	26	8	61	976
14	53 " green cotton S 15 " Floats. ...	848 " " " " 240 " Floats	22	22	6	50	800
15	265 " stable manure	4240" stable manure..	31	20	6	57	912
16	15 " acid phosphate 15 " cotton seed M.	240 " acid phosphate. 240 " cotton seed meal	24	18	6	48	768

EXPERIMENT MADE BY MR. WM. B. HALL,

LOWNDESBORO, LOWNDES COUNTY.

Soil, Lime Prairie. Sub-soil, Black Clay.

Average yield, no manure, 341 pounds per acre. Mr. Hall says that the land selected for this experiment has been in cultivation about 50 years, and is called old prairie. It was thoroughly prepared and cultivated. The third picking was lost by a raid from cattle breaking in, and while the yield from this picking might have been small, yet the loss of it vitiates the experiment as no accurate conclusions can be arrived at. The following tabulated statement shows the results obtained, and it indicates that the soil is deficient in all three elements of plant-food. Further investigation is necessary to come to a conclusion :

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs cotton, 1st picking, Oct.	Lbs cotton, 2nd picking, Nov.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	12	18	30	480
2	15 lbs acid phosphate	240 lbs acid phosphate	8	22	30	480
3	4 lbs muriate potash	64 lbs muriate potash	8	20	28	448
4	No manure	No manure	6	18	24	384
5	6 lbs nitrate soda 4 lbs muriate potash	96 lbs nitrate soda, 64 lbs muriate potash	14	22	36	576
6	6 lbs nitrate soda 15 lbs acid phosphate	96 lbs nitrate soda, 240 lbs acid phosphate	16	30	46	736
7	4 lbs muriate potash 15 lbs acid phosphate	64 lbs muriate potash, 240 lbs acid phosphate	10	26	36	576
8	No manure	No manure.	6	16	22	352
9	6 lbs nitrate soda 4 lbs muriate potash 15 lbs acid phosphate	96 lbs nitrate soda, 64 lbs muriate potash, 240 lbs acid phosphate	20	30	50	800
10	15 lbs Floats	240 lbs Floats	10	16	26	416
11	15 lbs Floats 6 lbs nitrate soda	240 lbs Floats, 96 lbs nitrate soda	14	26	40	640
12	No manure	No manure	4	14	18	288
13	53 lbs green cotton seed.	848 lbs green cotton seed	8	22	30	480
14	53 lbs green cotton seed 15 lbs Floats	848 lbs green cotton seed 240 lbs Floats	10	22	32	512
15	265 lbs stable manure	4240 lbs stable manure	22	58	80	280
16	15 lbs acid phosphate 15 lbs cotton seed meal	240 lbs acid phosphate, 240 lbs cotton seed meal	20	36	56	896

EXPERIMENT MADE BY MR. J. T. INZER,

EDEN, ST. CLAIR COUNTY.

Soil, Sandy Loam—Sub-soil, Yellow Clay.

Average yield of unmanured plots per acre, 837 lbs.

Mr. Inzer says that the land on which this experiment was made has been in cultivation five years. Owing to unfavorable seasons, a good stand of cotton was not obtained until the 10th of June.

Although the cultivation varied from instructions, yet the results show that the soil is deficient in the chief elements of plant food as is shown in plots 5, 6, 7, 8 and 9. By comparing the unmanured plots 4 and 12, it will be seen that this acre is not uniform in productiveness, yet the increased yield from floats, nitrate soda and green cotton seed, in plots 10, 11, 13 and 14 is satisfactory. However, cotton seed meal and acid phosphate in plot 16, give the best results.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept. 15.	Lbs. cotton, 2nd picking. Oct. 1st.	Lbs. cotton, 3rd picking. Oct. 29th.	Lbs. cotton, 4th picking Nov. 20th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	16	24	18	6	64	1024
2	15 " acid phosphate	240 " acid phosph	24	20	14	8	66	1056
3	4 " muriate potash	64 " muriate pot.	10	20	14	12	56	896
4	No manure. . .	No manure......	8	14	12	14	48.	768
5	6 lbs nitrate soda 4 " muriate pota.	96 lbs nitrate soda 64 " muriate pot	14	24	18	10	66	1056
6	6 " nitrate soda 15 " acid phospha	96 " nitrate soda. 240 " acid phosph.	20	24	16	8	68	1088.
7	4 " muriate pota. 15 " acid phospha	64 "muriate pota. 240 " acid phosph	24	36	14	8	82	1312
8	No manure.... .	No manure.....	9	16	14	14	53	848
9	6 lbs nitrate soda 4 " muri'te pot'sh 15 " acid phospha.	96 lbs nitrate soda 64 " muriate pot. 240 " acid phospha	28	28	18	10	84	1344
10	15 " Floats	240 " Floats	10	20	16	12	58	928
11	15 " Floats . 6 " nitrate soda.	240 " Floats ..... 96 " nitrate soda.	14	32	18	12	76	1216
12	No manure... .	No manure . .	12	14	16	14	56	896
13	53 lbs green cotton S.	848 lbs green C. S.	18	24	20	8	70	1120
14	53 " " " seed 15 " Floats	848 " green C. S. 240 " Floats	28	26	22	12	88	1408
15	265 lbs stable manur.	4240" stable m'ure	28	24	24	14	90	1440
16	15 " acid phospha 15 " cotton S. meal	240 " acid phosph. 240 " cotton S M.	40	30	32	18	120	1920

EXPERIMENT MADE BY MR. URIAH JOHNSON.

TRINITY STATION, MORGAN COUNTY.

Soil, Red Sandy Loam—Sub-soil, Red Clay.

Average yield of unmanured plots, 384 lbs. per acre. Mr. Johnson having given in his report the average yield per acre of the unmanured plots, 4, 8, and 12, placed the same amount opposite each plot, there is no data left by which the uniform fertility of this acre can be determined.

Mr. Johnson writes that he did not get a stand of cotton until June 6th, on account of drought, and consequently thinks his crop not so good as it would have been, had the seed come up in due time. From the results of this experiment, the leading element needed in this soil is phosphoric acid. The average yield of unmanured plots, 4, 8 and 12, being 384 lbs. per acre, the increased yield on plot 2, acid phosphate is 416 lbs. over no manure. And it will be further noticed, that while acid phosphate in combination with nitrate soda as in plot 6, or with muriate potash in plot 7, gives satisfactory results, yet the yield proportionately is not so great as from the use of acid phosphate alone. By comparing plot 9, a complete fertilizer, with plots 6 and 7, it will be seen that the additional use of nitrate soda has added nothing to the increased yield over plot 7, whereas plot 16, cotton seed meal and acid phosphate, has given the best results in this experiment.

If the fertility of this acre be uniform, the increased yield from the use of floats in plots 10, 11 and 14, points to a lack of phosphoric acid in this soil, which in combination with nitrogen as in plots 11 and 14, shows an increased yield. The nitrogen in plot 11 being more readily available as plant food, is not retained in the soil as in green cotton seed in plot 14, which may explain the difference in these two plots. As a rule, plants are not fastidious from what source nitrogen comes, just so its supply is sufficient.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Dec. 1st.	Lbs. Cotton. 2nd picking. Dec. 25th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda........	96 lbs nitrate soda	10	26	36	576
2	15 lbs acid phosphate ...	240 lbs acid phosphate..	20	30	50	800
3	4 lbs muriate potash	64 “ muriate potash..	8	20	28	448
4	No manure................	No manure	10	14	24	384
5	6 lbs nitrate soda ..... 4 “ muriate potash....	96 lbs nitrate soda...... 64 “ muriate potash...	8	20	28	448
6	6 lbs nitrate soda....... 15 “ acid phosphate...	96 “ nitrate soda ..... 240 lbs acid phosphate..	28	24	52	832
7	4 lbs muriate potash .. 15 lbs acid phosphate...	64 “ muriate potash. 240 “ acid phosphate...	28	32	60	960
8	No manure.	No manure.	10	14	24	384
9	6 lbs nitrate soda ..... 4 “ muriate potash... 15 “ acid phosphate...	96 lbs nitrate soda. .. 64 “ muriate potash... 240 “ acid phosphate..	34	26	60	960
10	15 lbs Floats............	240 “ Floats...........	24	22	46	736
11	15 lbs Floats .... 6 “ nitrate soda	240 “ Floats .... 96 “ nitrate soda	26	26	52	832
12	No manure	No manure	12	12	24	384
13	53 lbs green cotton seed...	848 lbs green cotton seed	38	20	58	928
14	53 lbs green cotton seed. 15 “ Floats	848 “ green cotton seed 240 “ Floats..........	42	24	66	1056
15	265 lbs stable manure . .	4240 lbs stable manure	44	24	68	1088
16	15 lbs acid phosphate... 15 lbs cotton seed meal	240 lbs acid phosphate 240 “ cotton seed meal	52	24	76	1216

EXPERIMENT MADE BY MR. J. C. KILLEBREW,

NEWTON, DALE COUNTY.

Soil, Sandy Loam—Sub-soil, Red Clay.

Average yield of unmanured plots per acre, 464 lbs. Mr. Killebrew says in his report that the land from which this experiment acre was selected has been in cultivation 15 years, is very poor, and even after lying out for the past 2 years, vegetation was very scant. He says he is satisfied that his land needs more nitrogen than is found in standard fertilizers, which are the indications from this report. In plot No. 1, nitrate soda, there is an increased yield of 80 lbs. per acre over average of no manure In plot 2 acid phosphate, the yield is the same as no manure. In plot 3, muriate potash, the yield is 176 lbs. less than average of no manure. Plot 5, a combination of nitrate soda and muriate potash, gives a striking increase over average of no manure, while plot 6, nitrate soda and phosphate and plot 7 muriate potash and phosphate show a very small increase over no manure. In plot 9, the three elements, show about the same results as in plot 5, where nitrate soda and muriate potash are used; but by comparing plot 5 with plot 16, the indications are, that acid phosphate in combination with cotton seed meal gives satisfactory results. By reference to plot No. 10, floats, the yield is 64 lbs. per acre less than the average of no manure, while in plots 11 and 14, by the addition of nitrogen, the yield is increased 144 lbs. per acre over no manure. In plot 15, stable manure, the best results are obtained, which also indicate the need of nitrogen in this soil.

Attention is called to the uniform fertility of this experiment acre.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept. 10th.	Lbs. cotton, 2nd picking. Oct. 1st.	Lbs. cotton, 3d picking. Oct. 26th	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	10	16	8	34	544
2	15 " acid phosphate ...	240 " acid phosph.	9	13	7	29	464
3	4 " muriate potash	64 " muriate pot.	6	7	5	18	288
4	No manure.	No manure.	8	12	9	29	464
5	6 lbs nitrate soda ..... 4 " muriate potash .	96 lbs nitrate soda 64 " muri'te pota	16¾	23	13	52¾	844
6	6 " nitrate soda ... 15 " acid phosphate .	96 " nitrate soda. 240 " acid phosph.	13	14	10	37	592
7	4 " muriate potash .. 15 " acid phosphate ...	64 " muriate pot. 240 " acid phosph.	10	17	9	36	576
8	No manure...........	No manure	8	9	11	28	448
9	6 lbs nitrate soda .... 4 " muriate potash... 15 " acid phosphate...	96 lbs nitrate soda 64 " muri'te pot 240 " acid phosph	13	26	14	53	848
10	15 " Floats........	240 " Floats	9	7	9	25	400
11	15 " Floats ... . 6 " nitrate soda	240 " Floats . . 96 " nitrate soda.	11	17	10	28	608
12	No manure	No manure ..	6	13	11	30	480
13	53 lbs green cotton seed	848 lbs green C S.	11	13	14	38	608
14	53 " green cotton seed 15 " Floats	848 " green cot. S 240 " Floats	10	13	15	38	608
15	265 " stable manure ..	4240" stable man.	17	25	20	62	992
16	15 " acid phosphate 15 " cotton seed meal.	240 " acid phosph. 240 " cotton S. M	13	23	18	54	864

EXPERIMENT MADE BY MR. J. M. KENNEDY,

OAK LONE, CLAY COUNTY.

Soil, Red—Sub-soil Red, Stiff Magnetic Iron.

Average yield of unmanured plots per acre, 389 lbs. Attention is called to the irregular fertility of this acre—plot 4 yielding 256 lbs. per acre, plot 8 400 lbs. and plot 12,512 lbs., the average being 389 lbs. without manure. Mr. Kennedy says: "Owing to very unpropitious seasons, this experiment is not as satisfactory as it would have been, had the seasons been favorable. Cotton was planted April 19th— came up June 19th and was not put to a stand until July 10th."

The indications are that plot No. 9, a complete fertilizer, gives the best results in this experiment, as the soil seems deficient in all the chief elements of plant food, though the increased yield from acid phosphate and nitrate soda in plot 6, and acid phosphate and muriate potash in plot 7, is very satisfactory. In plot 10, floats alone, an increased yield is shown, notwithstanding the lack of uniform fertility of the soil and by the addition of nitrogen as in plot 11, the increase yield is still further advanced. Attention is directed to the following falling off of stable manure in plot 15, and when plot 16, acid phosphate and cotton seed meal is compared with plot 9, the results are not so good as from a complete fertilizer in No. 9.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking, Oct. 9.	Lbs. cotton, 2nd picking Oct. 25.	Lbs. cotton, 3d picking Nov. 9th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda..	3	8	6	17	272
2	15 " acid phosphate....	240 " acid phosph...	7	14	9	30	480
3	4 " muriate potash....	64 " muriate pot..	3	6	8	17	272
4	No manure............	No manure	3	7	6	16	256
5	6 lbs nitrate soda..... 4 " muriate potash....	96 lbs nitrate soda 64 " muriate pota...	5	11	9	25	400
6	6 " nitrate soda ..... 15" acid phosph'te ..	96 " nitrate soda. 240" acid phospha..	14	20	16	50	800
7	4 " muriate potas. .. 15" acid phosphat'....	64 " mur'te p'ash. 240" acid phosph...	11	21	16	48	768
8	No manure	No manure.........	5	10	10	25	400
9	6 lbs nitrate soda..... 4 "muriate potas'.... 15 " acid phospha.....	96 lbs nitr'te soda 64 " muriate pot. 240 " acid phosph...	13	22	18	53	848
10	15 " Floats	240 " Floats	10	16	10	36	576
11	15 " Floats........... 6 " nitrate soda.....	240 " Floats ... 96 " nitrate soda...	11	22	13	46	736
12	No manure.	No manure.	7	13	12	32	512
13	53 lbs green cotton S....	848 lbs green C. S...	8	10	7	25	400
14	53 lbs green C.seed... 15 " Floats	848 " green C. S. 240 " Floats	12	13	9	34	544
15	265 " stable m'ure....	4240" stable m'nre..	11	13	10	34	544
16	15 " acid phosph..... 15 " C. seed meal ..	240 " acid phosph. 240 " cotton S. M...	20	17	17	44	704

EXPERIMENT MADE BY MR. J. A. LOGAN,

CLANTON, CHILTON COUNTY.

Soil, Mulatto and Sandy—Sub-soil, Red Clay.

Average yield of unmanured plots, 509 lbs. Mr. Logan states that he prepared and cultivated this test acre thoroughly, and made as many as three careful observations on the growth and maturity of the plant from the use of fertilizers. Attention is called to the uniform fertility of the soil, by observing the yield of the unmanured plots 4, 8 and 12. The increased yield over no manure from the use of acid phosphate in this soil, is very decided, as is shown in plot 2, giving 363 lbs., and in plot 6, in combination with nitrate soda the increase is 475 lbs. over no manure, giving better results than acid phosphate alone. It will be seen by referring to plots 3, 5, 7 and 9 and comparing them with plot 2, no decided benefit is derived from the use of muriate potash. From the use of floats in plot 10, we have an increase over no manure of 131 lbs., and by the addition of nitrate soda as in plot 11, we have an increase of 235 lbs. and in plot 14, floats and green cotton seed combined, we have an increase of 281 lbs. The increased yield from the use of floats is not so great as from ascid phosphate; but when the cost of the two are compared, the results are satisfactory. The yield from stable manure in plot 15 is very marked, and from cotton seed meal and acid phosphate in plot 16, the result is as great as could be expected when compared with plots 9 and 10.

No. Plot.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. Cotton, 1st picking. Sept. 16th	Lbs Cotton, 2nd picking Oct. 6th.	Lbs. Cotton, 3rd picking. Nov. 16th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda..	6	20	8½	34½	552
2	15 lbs acid phosphate ..	240 " acid phosph...	35½	16½	2½	54½	872
3	4 lbs muriate potash.....	64 " muriate pot...	8½	19	9	36½	584
4	No manure.	No manure	10	20	4½	34½	552
5	6 lbs nitrate soda ... 4 " muriate pota....	96 lbs nitrate soda. 64 lbs mur. potash..	9	20½	8	37½	600
6	6 " nitrate soda..... 15 " acid phospha....	96 " nitrate soda. 240" A. phosphate..	42	18	1½	61½	984
7	4 lbs muriate pota. .. 15 " acid phospha. ...	64 " muriate pota. 240" acid phosph...	29½	19	2	50½	808
8	No manure.............	No manure.........	6	15	7	28	448
9	6 lbs nitrate soda.... . 4 " muriate pota.... 15 " acid phospha. ..	96 lbs nitrate soda 64 " muriate pot. 240" acid phospha..	38	15½	1	54½	872
10	15 lbs Floats............	240 lbs Floats	20½	17	2½	40	640
11	15 lbs Floats . ... 6 " nitrate soda......	240 " " .. 96 " nitrate soda..	18½	22½	5½	46½	744
12	No manure	No manure	4	18½	10½	33½	528
13	53 lbs green cotton S. ...	848 lbs green C. S...	14½	23½	6½	44½	712
14	53 lbs green C. S.. .. 15 lbs Floats.	848 lbs green C. S. 240 lbs Float	21½	23	5½	50	800
15	265 lbs stable manur' ...	4240 " stable man...	35½	22½	6½	64½	1032
16	15 " acid phospha..... 15 " cotton seed M. ...	240 " acid phosph 240 cotton seed M...	26½	25½	6½	58½	936

EXPERIMENT MADE BY MR. W. H. MILLER,

UNION, GREENE COUNTY.

Soil, Sandy—Sub-soil, Clay.

Average yield per acre of unmanured plots, 104 pounds. By noticing the yield from the unmanured plots 4, 8 and 12, the irregularity of the fertility of this acre is plainly seen. Mr. Miller writes in making his report, that his land has been in cultivation 52 years, was never fertilized, and is very poor; and while it has been lying out for the past 4 years, the growth of vegetation was very scant. This soil is very deficient in the three main elements of plant food, as is shown by comparing plots 1, 2 and 3, where the fertilizers were applied singly, with plot 9, a complete fertilizer, where all were combined. This report certainly shows very gratifying results. The increased yield from floats in plots 10, 11 and 14, is very decided. The yield from plots 15 and 16 is nearly the same, and alike satisfactory. Much more could be said about this report, but it is so plain and decided in showing such bountiful and profitable returns from the use of fertilizers, that further comment is unnecessary.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept. 14th.	Lbs. cotton, 2nd picking. Sept. 26th	Lbs. cotton 3rd picking. Nov. 24th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda...... ..	96 lbs nitrate soda	....	2	4	6	96
2	15 " acid phosphate	240 " acid phosph.	10	14	8	32	512
3	4 " muriate potash	64 " muriate pot.	....	1½	2½	4	64
4	No manure	No manure	....	1½	2	3½	56
5	6 lbs nitrate soda ... 4 " muriate potash ..	96 lbs nitr'te soda 64 " muriate pot	....	1½	2	3½	56
6	6 " nitrate soda. ... 15 " acid phosphate ..	96 " nitrate soda 240 " acid phosp.	20	28	12	60	960
7	4 " muriate potash... 15 " acid phosphate....	64 " muriate pot. 240 " acid phosph	12	18	18	48	768
8	No manure	No manure	.....	2	4	6	96
9	6 lbs nitrate soda ... 4 " muriate potash... 15 " acid phosphate ..	96 lbs nitrate soda 64 " muriate pot. 240 " acid phosph	16	32	28	76	1216
10	15 " Floats	240 " Floats	4	14	10	28	448
11	15 " Floats .... 6 " nitrate soda......	240 " Floats 296 " nitrate soda	6	20	16	42	672
12	No manure	No manure	.....	6	4	10	160
13	53 lbs green cotton seed	848 lbs green C. S.	8	34	32	74	1184
14	53 " green cotton seed 15 " Floats	848 " green C. S. 240 " Floats	14	24	34	72	1152
15	265 " stable manure	4240" stable m'nu.	16	20	32	68	1088
16	15 " acid phosphate .. 15 " cotton seed meal..	240 " acid phosp 240 " cotton S. M.	16	22	28	66	1056

EXPERIMENT MADE BY MR. J. W. MIZE,

REMLAP, BLOUNT COUNTY.

Soil, Red Sandy—Sub-soil, Sticky, Mineral Nature.

Average yield of unmanured plots per acre, 331 pounds. From Mr. Mize's report, it is evident that acid phosphate is the principal element needed in this soil, and that a combination of acid phosphate and nitrate soda as shown in plot No. 6, gives better results than the complete fertilizer in plot No. 9. In plot 15, stable manure, there is a marked decrease in comparison with plot 16, acid phosphate and cotton seed meal, which plot gives the greatest yield of any in this experiment.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking, Sept. 28th	Lbs. cotton. 2nd picking Oct 19th.	Lbs cotton, 3rd picking. Nov 2nd.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	1	4½	15½	21	336
2	15 " acid phosphate	240 " acid phosph	6½	12½	17	36	576
3	4 " muriate potash	64 " muriate pot.	1½	7	17	25½	408
4	No manure.	No manure	1	4½	15	20½	328
5	6 lbs nitrate soda. ... 4 " muriate potash ..	96 lbs nitrate soda. 64 " muriate pota.	1	6	16	23	368
6	6 " nitrate soda ..... 15 " acid phosphate....	96 " nitrate soda. 240" acid phosph.	8	16½	18	42½	680
7	4 " muriate potash... 15 " acid phosphate ..	64 " muriate pota 240" acid phospha	4½	12½	14	31	496
8	No manure	No manure	1	8	12½	21½	344
9	6 lbs nitrate soda ... 4 " muriate potash .. 15 " acid phosphate....	96 lbs nitrate soda. 64 " muriate pot. 240" acid phosph.	3	13½	17	33½	536
10	15 " Floats.	240 lbs Floats ..	1½	10	14	25½	408
11	15 " Floats. .... 6 " nitrate soda......	240 " Floats . 96 " nitrate soda	1	10	17	28	448
12	No manure	No manure......	1	5	14	20	320
13	53 lbs green cotton seed	848 lbs green C. S.	4	15½	16	35½	568
14	53 " green cotton seed 15 " Floats	848 " green C. S. 240 " Floats. ..	2½	10	15½	28	448
15	265 " stable manue....	4240" stable m'nu.	1½	11	16½	29	464
16	15 " acid phosphate... 15 " cotton seed meal.	240 " acid phosph 240 " cotton S. M.	10	18½	16	34½	712

EXPERIMENT MADE BY MR. W. B. MELTON,

DAVIS' CREEK, FAYETTE COUNTY.

Soil, White and Gray—Sub-soil Clay.

Average yield per acre of unmanured plots, 245 lbs. Mr. Melton selected an acre for this experiment of almost uniform fertility as will be seen by comparing the unmanured plots 4, 8 and 12 with each other. It will be observed that this soil claims phosphoric acid as the principle element needed as is demonstrated in plot 2, and by comparing this plot with 1 and 3. By adding muriate potash as in plot 7, better results are obtained than from plots 5 and 6, but the complete fertilizer in plot 9, gives the best results of all. Floats alone in plot 10, show better results than the combination in nitrogen in plot 11; but in plot 14 in combination with green cotton seed, the increase in yield is decided. By comparing plot 15 stable manure and plot 16 phosphate and cotton seed meal, with plot 9, this result also favors a complete fertilizer.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Sept. 9.	Lbs. cotton, 2nd picking. Sept. 27	Lbs. cotton, 3rd picking. Oct. 15.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda......	96 lbs nitrate soda.	0	4	6	10	160
2	15 " acid phosphate.....	240 " acid phosph...	7	18	10	35	560
3	4 " muriate potash....	64 " muriate pot .	0	11	13	24	384
4	No manure	No manure.	0	9	6	15	240
5	{ 6 lbs nitrate soda.... { 4 " muriate p'ash....	96 lbs nitrate soda 64 " muriate pot...	0	6	12	18	288
6	{ 6 " nitrate soda .... {15 " acid phospha....	96 " nitrate soda. 240 " acid phosph...	8	22	12	42	672
7	{ 4 " muriate pota.... {15 " acid phospha.....	64 " muriate pot. 240 " acid phosph...	4	24	16	44	704
8	No manure.	No manure	0	6	10	16	256
9	{ 6 lbs nitrate .... { 4 ' muriate pota..... {15 " acid phospha ..	96 lbs nitrate soda 64 " muriate pot. 240 " acid phosph...	7	32	23	62	992
10	15 " Floats...........	240 " Floats	2	16	7	25	400
11	{15 " Floats.......... { 6 " nitrate soda.....	240 " Floats . ... 96 " nitrate soda...	0	13	8	21	336
12	No manure	No manure.	0	9	6	15	240
13	53 lbs green cotton S. ..	848 lbs green C. S..	3	19	14	36	576
14	{53 " " " seed. .. {15 " Floats	848 " green C. S. 240 " Floats..	5	24	12	41	656
15	265 " stable manure....	4240" stable m'nre..	7	37	15	59	944
16	{15 " acid phospha. .. {15 " cotton S. meal ..	240 " acid phosph. 240 " cotton S. M.	5	27	16	48	768

EXPERIMENT MADE BY Mr. W. S. MANNING,

Oxford, Calhoun County.

Soil, Mulatto—Sub-soil, Red Clay.

Average yield per acre of unmanured plots, 171 lbs. It will be seen from Mr. Manning's report that acid phosphate is the element most needed in this soil which is plainly demonstrated by comparing plot 2 acid phosphate, with plots 1 and 3; and by combining acid phosphate and nitrate soda in plot 6, the results are better than from 5 and 7. By a combination of all three elements as in plot 9, the best results in the entire experiment, are shown. A slight increase in plot 10 from the use of floats is manifest, but when nitrogen is added as in plots 11 and 14, the increased yield over no manure is decidedly in favor of the combination with green cotton seed. Plot 15, stable manure, shows a decided falling off, while plot 16, cotton seed meal and acid phosphate, shows very satisfactory results.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking.	Lbs cotton, 2nd picking.	Lbs. cotton, 3rd picking.	Total yield per plot.	Total yield per acre.
1	6 lbs nitrate soda	96 lbs. nitrate soda	5	4	4	13	208
2	15 lbs acid phosphate	240 lbs acid phosphate	11	10	9	30	480
3	4 lbs muriate potash	64 lbs muriate potash	4	5	4	13	208
4	No manure.	No manure.	4	5	4	13	208
5	6 lbs nitrate soda. 4 lbs muriate potash	96 lbs nitrate soda 64 lbs muriate potash	3	4	3	10	160
6	6 lbs nitrate soda 15 lbs acid phosphate	96 lbs nitrate soda 240 lbs acid phosphate	21	10	9	40	640
7	4 lbs muriate potash 15 lbs acid phosphate	64 lbs muriate potash 240 lbs acid phosphate	17	9	7	33	528
8	No manure.	No manure	3	2	4	9	144
9	6 lbs nitrate soda. 15 lbs acid phosphate. 4 lbs Muriate potash	96 lbs nitrate soda 240 lbs acid phosphate 64 lbs muriate potash	23	18	10	51	816
10	15 lbs Floats	240 lbs Floats.	4	7	5	16	256
11	15 lbs Floats. 6 lbs nitrate soda.	240 lbs Floats. 96 lbs nitrate soda	6	8	6	20	320
12	No manure.	No manure.	2	3	.5	10	160
13	53 lbs green cotton seed	848 lbs green cotton S.	7	7	6	20	320
14	53 lbs green cotton S. 15 lbs Floats..	848 lbs green cotton S 240 lbs Floats.	18	19	10	47	752
15	265 lbs stable manure.	4240 lbs stable manure	11	9	8	28	448
16	15 lbs acid phosphate. 15 lbs cott'n seed meal	240 lbs acid phosphate 240 lbs cotton S meal.	18	11	10	39	624

EXPERIMENT MADE BY MR. J. P. OLIVER,

DADEVILLE, TALLAPOOSA COUNTY.

Soil, Gray Sandy—Sub-soil, Clay.

Average yield per acre of unmanured plots, 432 pounds. Mr. Oliver reports that he followed instructions accurately in conducting this experiment. The uniform fertility of this acre is satisfactory. From this report, all three main elements of plant food were beneficial to the soil, particularly in a combination, as is indicated by plots 6, 7 and 9, compared with 1, 2 and 3. The increased yield from use of acid phosphate alone in plot 2, compared with the unmanured plots 4, 8 and 12, is very decided. Especial attention is called to the increased yield from floats in plot No. 10, being 296 pounds per acre over average of no manure, and in combination with nitrate soda in plot 11, the increased yield over no manure is 384 pounds. Comparing the nitrogenous effects with floats in plot 11, with plot No. 14, the results are in favor of green cotton seed. Plots 15 and 16, compared with plot 9, give results in favor of plot 9, complete fertilizer.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept 16th.	Lbs. cotton, 2nd picking Oct. 5th.	Lbs. cotton, 3d picking. Nov. 9th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda.......	96 lbs nitrate soda..	2½	14	8	24½	392
2	15 lbs acid phosphate....	240 lbs acid phosph..	15	19	6	40	640
3	4 lbs muriate potash....	64 lbs muriate pot...	3½	14	6	23½	376
4	No manure.	No manure .	3½	14	8	25½	408
5	6 lbs nitrate soda .... 4 lbs mur'te potash....	96 lbs nitrate soda 64 lbs muriate pot...	3½	16	9	28½	456
6	6 lbs nitrate soda..... 15 lbs acid phosph.....	96 lbs nitrate soda 240 lbs acid phosp...	22½	28	5	55½	888
7	4 lbs muriate pota..... 15 " acid phospha.....	64 lbs muriate pot. 240 lbs acid phosh..	15½	25	6	46½	744
8	No manure	No manure.	3½	15	8	26½	424
9	6 lbs nitrate soda..... 15 " acid phospha..... 4 lbs muriate pota.....	96 lbs nitrate soda 240 lbs acid phosp. 64 lbs muriate pot...	22	29	9	60	960
10	15 lbs. Floats	240 lbs Floats	10	27½	8	45½	728
11	15 lbs Floats ..... 6 lbs nitrate soda.....	240 lbs Floats ... 96 " nitrate soda..	11	30	10	51	816
12	No manure	No manure	2	15	12	29	464
13	53 lbs green cotton S.....	848 lbs. G. C. seed..	6½	23	12	41½	664
14	53 lbs G. Cot. seed.... 15 lbs Floats..	848 lbs green C. S. 240 lbs Floats	16	28½	10	54½	872
15	265 lbs stable manure ...	4240 lbs stable ma...	17½	32½	4	54	864
16	15 lbs acid phosph..... 15 " cotton S. meal ...	240 lbs acid phos. 240 " C. seed meal..	19½	32	8	59½	952

EXPERIMENT MADE BY MR. J. W. PITTS,

CRESSWELL STATION, SHELBY COUNTY.

Soil, Thin Brown or Mulatto—Sub-soil, Stiff Red Clay.

Average yield per acre of unmanured plots, 317 lbs. Mr. Pitts says that the acre selected for this experiment was thin upland, which had been in cultivation 50 years, but during the last 8 or 10 years had rested and grown up in sedge. Owing to a protracted drought in the Spring, cotton did not come up until the 24th of May, and then only an imperfect stand was secured. Preparation of ground and cultivation of crop, were carried out according to instructions. Attention is directed to the uniformity of the soil in this acre, as is shown in plots 4, 8 and 12. The indications are that nitrogen and phosphoric acid are the only two elements beneficial in this experiment. There is some increase from use of potash alone in plot 3, but in combination either with nitrate soda in plot 5, or with acid phosphate in plot 7, or with both phosphate and nitrate soda in plot 9, the yield is decreased compared with plots 2 and 6. The increased yield from floats alone in plot 10, is slight, but in combination with nitrogen in plots 11 and 14, is very satisfactory. Stable manure in plot 15, and acid phosphate and cotton seed meal in plot 16, produce the best results.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking, Sept. 28th.	Lbs. cotton, 2nd picking. Oct 26th.	Lbs. cotton, 3rd picking. Nov. 25th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	20½	20	5	45½	728
2	15 " acid phosphate......	240 " acid phosph	21½	22½	4	48	768
3	4 " muriate potash	64 " muriate pot.	9	19½	8½	37	592
4	No manure.	No manure	6	8½	5½	20	320
5	6 lbs nitrate soda...... 4 " muriate potash ..	96 lbs nitrate soda. 64 " muriate pota.	3½	7½	1½	12½	200
6	6 " nitrate soda....... 15 " acid phosphate....	96 " nitrate soda. 240" acid phosph.	25	23	2½	50½	808
7	4 " muriate potash.... 15 " acid phosphate....	64 " muriate pota. 240" acid phospha	19½	21	4½	45	720
8	No manure	No manure...... .	9	9½	2	20½	328
9	6 lbs nitrate soda .... 4 " muriate potash.... 15 " acid phosphate....	96 lbs nitrate soda. 64 " muriate pot. 240" acid phosph.	22½	20	5	47½	760
10	15 " Floats............	240 lbs Floats....	10	10½	1½	22	352
11	15 " Floats............ 6 " nitrate soda.......	240 " Floats .... 96 " nitrate soda	15	13	6½	34½	552
12	No manure............	No manure......	7	9	3	19½	304
13	53 lbs green cotton seed	848 lbs green C. S.	13	15	4	32	512
14	53 " green cotton seed 15 " Floats...........	848 " green C. S. 240 " Floats.....	17½	20½	6	44	704
15	265 " stable manue....	4240" stable m'nu.	29½	23	6	58½	936
16	15 " acid phosphate... 15 " cotton seed meal..	240 " acid phosph 240 " cotton S. M.	29½	20	5	54½	872

EXPERIMENT MADE BY MR. T. M. J. PORTER,

GEORGIANA, BUTLER COUNTY.

Soil, Light Sandy—Sub-soil, Red and Yellow Sandy Clay.

Average yield per acre of unmanured plots, 200 pounds. Mr. Porter planted this test acre April 23rd, and failing to get a stand, replanted May 7th, in Peterkin cotton. The land was quite uniform in fertility, as is shown by the unmanured plots 4, 8 and 12. In this experiment, the soil shows a lack of all three elements of plant food, as is shown by the increased yield in plot No. 9.

The use of floats in plots 10 and 14 show an increased yield, and why there should be a falling off in plot 11, cannot be explained. It will be noticed that there is a falling off in stable manure in plot 15, while acid phosphate and cotton seed meal in plot 16, give good results.

No. Plot.	Lbs. Fertilizers per Plot	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept 28th.	Lbs. cotton, 2nd picking Oct. 21st.	Lbs. cotton, 3d picking. Nov. 3rd.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda......	96 lbs nitrate soda.	6	5	1½	12½	200
2	15 lbs acid phosphate ..	240 lbs acid phosph.	25	11	4	40	640
3	4 lbs muriate potash.	64 lbs muriate pot...	10½	9	2	21½	344
4	No manure.	No manure .	6	6	2	14	224
5	6 lbs nitrate soda ... 4 lbs mur'te potash....	96 lbs nitrate soda 64 lbs muriate pot...	6	7½	2½	16	256
6	6 lbs nitrate soda. .. 15 lbs acid phosph. ..	96 lbs nitrate soda 240 lbs acid phosp..	32	10	4½	46½	744
7	4 lbs muriate pota.... 15 " acid phospha....	64 lbs muriate pot. 240 lbs acid phosh..	27½	10½	4½	42½	680
8	No manure	No manure........	7½	4	1	12½	200
9	6 lbs nitrate soda.... 15 " acid phospha..... 4 lbs muriate pota. ..	96 lbs nitrate soda 240 lbs acid phosp. 64 lbs muriate pot...	35½	10½	4	50	800
10	15 lbs. Floats..........	240 lbs Floats.....	18½	7½	2	28	448
11	15 lbs Floats ... 6 lbs nitrate soda.....	240 lbs Floats ... 96 " nitrate soda.	14	7½	1½	23	368
12	No manure	No manure . . .	6½	3½	1	11	176
13	53 lbs green cotton S.....	848 lbs. G. C. seed..	30½	9½	2½	42½	680
14	53 lbs G. Cot. seed .. 15 lbs Floats.........	848 lbs green C. S. 240 lbs Floats	40	7	3	50	800
15	265 lbs stable manure ...	4240 lbs stable ma...	28	6½	1	35½	568
16	15 lbs acid phosph..... 15 " cotton S. meal ...	240 lbs acid phos. 240 " C. seed meal..	39	7	1½	47½	760

EXPERIMENT MADE BY Mr. S. A. PRUITT,

Chesser, Pike County.

Soil, Sandy—Sub-soil, Sandy Clay.

Average yield of no manure per acre, 384 pounds. Judging from Mr. Pruitt's report in this experiment, the soil is lacking in the three main elements of plant food.

Attention is called specially to the uniform fertility of this acre, and also to the increased yield from use of fertilizers, in every instance, over unmanured plots. Fertilizers, evidently are a great source of benefit to this land.

No. Plot.	Lbs Fertilizers per Plot.	Lbs. Fertilizer per Acre.	Lbs. cotton, 1st picking. Sept. 19.	Lbs. cotton, 2nd picking. Oct. 10.	Lbs. cotton, 3rd picking Oct. 25.	Lbs. cotton, 4th picking. Nov. 6.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda..	96 lbs nitrate soda	29	19	2	3	53	848
2	15 " acid phosphate	240 " acid phosph.	19	12	1	2	34	544
3	4 " muriate potash	64 " muriate pot	20	14	2	4	40	640
4	No manure ..	No manure.	9	7	3	6	25	400
5	6 lbs nitrate soda. 4 " muri'te pot'sh	96 " nitrate soda, 64 " muriate pot.	18	16	5	2	41	656
6	6 " nitrate soda 15 " acid phospha.	96 " nitrate soda, 240 " acid phospha	29	22	2	1	54	864
7	4 " muriate pota. 15 " acid phospha	64 " muriate pota 240 " acid phosph.	28	17	1	1	47	752
8	No manure...	No manure..	8	7	2	7	24	384
9	6 " nitrate soda 4 " muriate pota. 15 " acid phospha.	96 " nitrate soda, 64 " muriate pot. 240 " acid phosph.	43	26	4	1	74	1184
10	15 " Floats.	240 " Floats.....	28	21	1	½	50½	808
11	15 " Floats. 6 " nitrate soda..	240 " Floats ..... 96 " nitrate soda	39	16	1	2	58	928
12	No manure...	No manure	7	8	2	6	23	368
13	53 " green C. seed.	848 " green cot. S.	30	19	4	2	55	880
14	53 " " " 15 " Floats.......	848 " " " 240 " Floats	39	28	3	1	71	1136
15	265 " stable manure	4240" stable m'ure	50	41	5	2	98	1568
16	15 " acid phospha. 15 " cotton seed M	240 " acid phosph 240 " cotton S. M.	53	54	6	1	114	1824

EXPERIMENT MADE BY MR. J. H. RADNEY,

ROANOKE, RANDOLPH COUNTY.

Soil, Sandy Loam—Sub-soil, Clay.

Average yield per acre of unmanured plots, 299 pounds. Mr. Radney states that this land has been in cultivation 25 years. By noticing the yield from plots 1, 2 and 3 where the fertilizers were applied singly, it will he observed that muriate potash gives the best results; but in combination, as in plots 5, 6 and 7, nitrate soda and acid phosphate in plot 6 give the best. In plot 9, a complete fertilizer, the yield is the same as plot 5, and less than plots 6 and 7.

The yield from floats alone in plot 10, and in combination with nitrate soda in plot 11, is better than in plot 14 in combination with green cotton seed. Plot 15, stable manure, gives the best results, except plot 6 nitrate soda and acid phosphate.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Sept. 15th.	Lbs. cotton, 2nd picking. Oct. 10th	Lbs. cotton, 3d picking. Nov. 8th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	1	14	2	17	272
2	15 " acid phosphate	240 " acid phosph.	5	15	4	24	384
3	4 " muriate potash	64 " muriate pot.	6	16	3	25	400
4	No manure.	No manure. ..	7	6	5	18	288
5	6 lbs nitrate soda ..... 4 " muriate potash .	96 lbs nitrate soda 64 " muri'te pota	9	18	7	34	544
6	6 " nitrate soda ... 15 " acid phosphate .	96 " nitrate soda. 240 " acid phosph.	27	17	3	47	752
7	4 " muriate potash .. 15 " acid phosphate ..	64 " muriate pot. 240 " acid phosph.	16	18	5	39	624
8	No manure...........	No manure	8	6	7	21	336
9	6 lbs nitrate soda ... 4 " muriate potash... 15 " acid phosphate..	96 lbs nitrate soda 64 " muri'te pot 240 " acid phosph.	17	9	8	34	544
10	15 " Floats...........	240 " Floats	5	16	7	28	448
11	15 " Floats .... 6 " nitrate soda	240 " Floats .... 96 " nitrate soda.	8	17	5	30	480
12	No manure.............	No manure......	6	5	6	17	272
13	53 lbs green cotton seed	848 lbs green C. S.	12	10	9	31	496
14	53 " green cotton seed 15 " Floats	848 " green cot. S 240 " Floats	9	10	8	27	432
15	265 " stable manure ...	4240" stable man.	25	10½	9	44½	712
16	15 " acid phosphate.. 15 " cotton seed meal.	240 " acid phosph. 240 " cotton S. M.	10	18	6	34	544

EXPERIMENT MADE BY MR. Z. T. STROUD,

ABERFOIL, BULLOCK COUNTY.

Soil, Light Gray—Sub-soil, Clay.

Average yield per acre of unmanured plots, 227 pounds. The uniform fertility of this acre is very marked as will be observed from the unmanured plots 4, 8 and 12. Mr. Stroud in his report says that instructions as to preparation of ground and cultivation of crop, were strictly carried out, and everything was favorable to the growth of the crop up to the last of July, after which time the extremely dry weather caused a general falling off, though plots 1, 2, 3, 5, 7 and 9 stood the drought better than the others. Results indicate the need of a complete fertilizer on this soil, as is shown by the increased yield in plot No. 9, which is the largest obtained. This is the only one in these experiments, except one, (by Mr. R. H. Cross whose results are about the same) where nitrate soda and acid phosphate in combination as in plot 6, give less results than in plots 5 and 7.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept. 1.	Lbs. cotton, 2nd picking. Sept. 24.	Lbs. cotton, 3rd picking. Oct. 22.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda ...	96 lbs nitrate soda..	4	12	5	21	336
2	15 " acid phosphate.	240 " acid phosphate.	14	9	1	24	384
3	4 " muriate potash..	64 " muriate potash	6	16	8	30	480
4	No manure...... ..	No manure. ...	6	8	½	14½	232
5	6 lbs nitrate soda 4 " muriate potash	96 " nitrate soda 64 " muriate potash	7	26	8½	41½	664
6	6 " nitrate soda.. 15 " acid phosphate	96 " nitrate soda, 240 " acid phosphate.	17	7	½	24½	392
7	4 " muriate potash 15 " acid phosphate	64 " muriate potash 240 " acid phosphate.	18	17	3½	38½	616
8	No manure.........	No manure.....	7	6	1	14	224
9	6 lbs nitrate soda . 4 " muriate potash 15 " acid phosphate	96 " nitrate soda, 64 " muriate potash, 240 " acid phosphate	23	26	3	52	832
10	15 " Floats.........	240 " Floats	11	5	⅛	16⅛	258
11	15 " Floats .... 6 " nitrate soda..	240 " Floats, 96 " nitrate soda ...	10	6½	..	16½	264
12	No manure ..	No manure. ..	7	7	..	14	224
13	53 " green cotton S.	848 " green cotton s'ed	17	8	⅛	25⅛	404
14	53 " green cotton S 15 " Floats.....	848 " " " " 240 " Floats	17	10½	½	28	448
15	265 " stable manure	4240" stable manure..	18	8	½	26½	424
16	15 " acid phosphate 15 " cotton seed M.	240 " acid phosphate. 240 " cotton seed meal	23	7	1	31	496

EXPERIMENT MADE BY MR. T. A. SNUGGS,

HOLLY POND, CULLMAN COUNTY.

Soil, Sandy and Gravelly—Sub-soil, Yellow Sandy.

Average yield per acre of unmanured plots 347 pounds. Mr. Snuggs writes in making his report, that he carefully carried out all instructions as to preparation of ground and cultivation of crop, and that great good is being done to the farmers of Cullman county from these experiments, that they are watched with great interest and that the bulletin containing his report is anxiously looked for. Special attention is called to the uniform fertility of the soil selected for this experiment. It will be seen that this soil is deficient in the three main elements of plant food, and while each gives its proper proportion, as is shown in plots 1, 2 and 3, and 5, 6 and 7, yet a culmination is found in the combined efforts of all in plot No. 9, giving 1,120 lbs., an increased yield of 773 lbs. over no manure. By carefully studying this report, the results are so plainly seen, that further comment seems unnecessary.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Sept. 25th.	Lbs. cotton, 2nd picking. Oct. 8th.	Lbs. cotton, 3rd picking. Oct 23rd.	Lbs. cotton, 4th picking Nov. 7th.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda	96 lbs nitrate soda	4	10½	10½	9½	34½	552
2	15 " acid phosphate	240 " acid phosph	16	21	13	8	58	928
3	4 " muriate potash	64 " muriate pot.	..	8	8	9	25	400
4	No manure.	No manure......	..	6	6	8½	20½	328
5	6 lbs nitrate soda 4 " muriate pota.	96 lbs nitrate soda 64 " muriate pot.	..	7	9	13	29	464
6	6 " nitrate soda 15 " acid phospha	96 " nitrate soda. 240 " acid phosph.	10½	22	19	16	67½	1080
7	4 " muriate pota. 15 " acid phospha	64 "muriate pota, 240 " acid phosph	7	18	18½	12½	56	896
8	No manure.....	No manure.....	..	8	8	8	24	384
9	6 lbs nitrate soda 4 " muri'te pot'sh 15 " acid phospha.	96 lbs nitrate soda 64 " muriate pot. 240 " acid phospha	9½	23½	21½	15½	70	1120
10	15 " Floats	240 " Floats	4	12	14	11½	41½	664
11	15 " Floats. .. .. 6 " nitrate soda..	240 " Floats ..... 96 " nitrate soda.	5	13½	13	12½	44	704
12	No manure	No manure ...	..	6	6	8½	20½	328
13	53 lbs green cotton S.	848 lbs green C. S.	4½	14	14½	13	46	736
14	53 " " " seed 15 " Floats	848 " green C. S. 240 " Floats	9	19	17	12½	57½	920
15	265 lbs stable manur.	4240" stable m'ure	16½	26	18½	12	73	1168
16	15 " acid phospha. 15 "cotton S. meal	240 "acid phosph. 240 "cotton S M.	13½	24	19	12	68½	1096

EXPERIMENT MADE BY MR. W. H. SELLERS,

GENEVA, GENEVA COUNTY.

Soil, Sandy—Sub-Soil, Red Clay and Sand Mixed.

Average yield per acre of unmanured plots, 730 lbs. Mr. Sellers writes, that the sack containing the acid phosphate for plot 2 was lost and that he was unable to obtain any green cotton seed. Therefore the experiments for plots from 1 to 9 inclusive, are vitiated. The absence of green cotton seed also vitiates the experiments with floats. It can be seen however, by reference to plot 9, a complete fertilizer, that the soil is deficient in the three main elements of plant food, No. 9 giving the greatest yield over the average of unmanured plots.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs Fertilizers per Acre.	Lbs. cotton, 1st picking Aug. 22.	Lbs. cotton, 2nd picking Sept. 17th	Lbs. cotton 3rd picking. Oct. 2.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda...... ..	96 lbs nitrate soda	7½	25	9	41½	664
2	15 " acid phosphate	240 " acid phosph.	....	.	..		
3	4 " muriate potash	64 " muriate pot.	13	27	8	48	768
4	No manure	No manure	9	28	9	46	736
5	6 lbs nitrate soda 4 " muriate potash .	96 lbs nitr'te soda 64 " muriate pot	8	27	12½	47½	760
6	6 " nitrate soda. ... 15 " acid phosphate ..	96 " nitrate soda 240 " acid phosp.	31	26	3½	60½	968
7	4 " muriate potash .. 15 " acid phosphate..	64 " muriate pot 240 " acid phosph	28½	29	2½	60	960
8	No manure.....	No manure	8½	27½	9½	45½	728
9	6 lbs nitrate soda ... 4 " muriate potash.... 15 " acid phosphate ..	96 lbs nitrate soda 64 " muriate pot. 240 " acid phosph	35	31	4	70	1120
10	15 " Floats	240 " Floats	20	25	6	51	816
11	15 " Floats .. .... 6 " nitrate soda......	240 " Floats ..... 96 " nitrate soda	23	23	5	51	816
12	No manure	No manure.......	9	28	8½	45½	728
13	53 lbs green cotton seed.	848 lbs green C. S.	.....	......	.....	..	...
14	53 " green cotton seed 15 " Floats	848 " green C. S. 240 " Floats	.	.....	..	...	. . .
15	265 " stable manure ..	4240" stable m'nu.	35½	27	5½	68	1088
16	15 " acid phosphate .. 15 " cotton seed meal	240 " acid phosp 240 " cotton S. M.	35	28½	5	68½	1096

EXPERIMENT MADE BY PROF. DAN GILLIS,

In Charge of South East Alabama Experiment Station,

ABBEVILLE, HENRY COUNTY.

Soil, Sandy—Sub-soil, Sand and Clay Mixed.

Average yield of unmanured plots per acre, 485 lbs By noticing the yield of unmanured plots 4, 8 and 12, the uniform fertility of the soil is satisfactory. It is seen by comparing plots 1, 2 and 3 with the average of no manure, that plot 1, nitrate soda gives no increase, while plot 2 acid phosphate gives 363 lbs. increase and plot 3, muriate potash, 67 lbs. In plot 5, nitrate soda and muriate potash, the increase over average of unmanured plots is 267 lbs. while plot 6, nitrate soda and acid phosphate, gives 443 lbs. and plot 7, muriate potash and acid phosphate, gives 411 lbs. It will be observed by comparing these plots among themselves, that acid phosphate is the leading element for producing the increased yield; but in plot 9, complete fertilizer, the increase over unmanured plots is 635 lbs. These results are very decided and satisfactory.

Floats in plot 10, increases the yield over average of unmanured plots, 187 lbs., while in combination with nitrate soda, in plot 11, the increase is only 91 lbs. Still floats in combination with green cotton seed in plot 14, increases the yield over no manure, 443 pounds.

Why floats alone in plot 10 should give better results than in combination with nitrate soda in plot 11, we cannot explain. The increased yield in plots 10 and 14, is very satisfactory. Plot 15, stable manure, gives the largest yield, and while the increase in plot 16, acid phosphate and cotton seed meal, is not so large as in plot 9, complete fertilizer, yet the result is quite satisfactory.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking Aug. 24	Lbs. cotton, 2nd picking. Sept. 10.	Lbs. cotton, 3rd picking Oct. 8.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda..	96 lbs nitrate soda ..	10	12	8	30	480
2	15 " acid phosphate	240 " acid phosphate...	22	22	9	53	848
3	4 " muriate potash	64 " muriate potash..	11	14	9½	34½	552
4	No manure .	No manure.	9	15	8	32	512
5	6 lbs nitrate soda 4 " muriate pota	96 lbs nitrate soda, 64 " muriate potash...	17	16	14	47	752
6	6 " nitrate soda 15 " acid phospha	96 " nitrate soda, 240 " acid phosphate...	26	21	11	58	928
7	4 " muriate pota. 15 " acid phospha	64 " muriate potash, 240 " acid phosphate..	28	18	10	56	896
8	No manure..	No manure......	11	10	6	27	432
9	6 " nitrate soda.. 4 " muriate pota. 15 " acid phospha.	96 " nitrate soda, 64 " muriate potash, 240 " acid phosphate..	36	22	12	70	1120
10	15 " Floats.	240 " Floats,..........	12	23	7	42	672
11	15 " Floats...... 6 " nitrate soda	240 " Floats, 96 " nitrate soda	17	13	6	36	576
12	No manure..	No manure.	18	14	5	32	512
13	53 " green cot'n S.	848 " green cotton seed	24	18	6	48	768
14	53 " green C. S... 15 " Floats.	848 " green cotton seed, 240 " Floats	29	20	9	58	928
15	265 lbs stable m'nure	4240" stable manure ...	42	25	7	74	1184
16	15 " acid phosphat 15 " cotton S. meal	240 " acid phosphate, 240 " cotton seed meal..	40	22	6	68	1088

EXPERIMENT MADE BY MR. W. L. WHITE,

HATTAN, LAWRENCE COUNTY.

Soil, Clay Loam—Sub-soil, Red Clay.

Average yield per acre of unmanured plots, 235 pounds. Mr. White's report shows another instance where nitrate soda and muriate potash applied separately, as in plots 1 and 3, decrease the yield, while in combination one with the other, in plot 5 there is a slight increase; and in combination with acid phosphate in plots 6 and 7, the increase is still greater and in No. 9, a complete fertilizer the best results in this experiment are seen.

The increased yield from use of floats alone in plot 10, and in combination with nitrate soda in plot 11 and cotton seed in plot 14, is very decided and satisfactory. It will be seen by comparing plots 15 and 16, with plot 9 a complete fertilizer, that the results are in favor of No. 9. This acre is not as uniform in fertility as would be desired for an experiment.

No. Plot.	Lbs. Fertilizers per Plot.	Lbs. Fertilizers per Acre.	Lbs. cotton, 1st picking. Oct. 13.	Lbs. cotton, 2nd picking Nov. 16.	Total yield per Plot.	Total yield per Acre.
1	6 lbs nitrate soda........	96 lbs nitrate soda ...	1½	6	7½	120
2	15 " acid phosphate	240 " acid phosphate...	23½	14	37½	600
3	4 " muriate potash.....	64 " muriate potash...	5½	11	16½	264
4	No manure.	No manure......	6½	10	16½	264
5	6 lbs nitrate soda .... 4 " muriate potash ..	96 " nitrate soda, 64 " muriate potash..	7½	14	21½	344
6	6 " nitrate soda. .... 15 " acid phosphate ...	96 " nitrate soda 240 " acid phosphate...	26	28	54	864
7	4 " muriate potash .. 15 " acid phosphate ..	64 " muriate potash, 240 " acid phosphate...	22	30	52	832
8	No manure............	No manure	5½	12	17½	280
9	6 lbs nitrate soda .... 4 " muriate potash .. 15 " acid phosphate ..	96 " nitrate soda, 64 " muriate potash, 240 " acid phosphate...	26½	30	56½	904
10	15 " Floats........	240 " Floats...... ..	10½	16	26½	424
11	15 " Floats............ 6 " nitrate soda..	240 " Floats 96 " nitrate soda	12½	20	32½	520
12	No manure..... .	No manure.	4	6	10	160
13	53 " green cotton seed..	848 " green cotton seed.	20	16	36	576
14	53 " green cotton seed.. 15 " Floats............	848 " green cotton seed, 240 " Float.	19	16	35	560
15	265 " stable manure.....	4240" stable manure ..	37	17	54	864
16	15 " acid phosphate .. 15 " cotton seed meal..	240 " acid phosphate. 240 " cotton seed meal	25	18	43	688

EXPERIMENT MADE BY MR. A. F. CORY,

MULBERRY, AUTAUGA COUNTY.

Soil, Sandy—Subsoil, Clay.

Average yield per acre of unmanured plots 282 pounds. Mr. Cory says unfavorable weather prevented his preparing and planting this ground before the 23rd May, at which time the land was prepared with plows, harrows, &c., fertilizers applied in drill and thoroughly incorporated in soil by running a scooter plow in the furrow. Showery weather delayed the application of fertilizers for intercultural work, from June 15th to June 24th. Fertilizers intended for plot 31, to be used before planting, were overlooked and not put in until June 24th. Mr. Cory says. "Although the experiments are not perfectly accurate, they point to several conclusions with some degree of certainty. Potash does not seem to pay, phosphate applied alone does not have much effect, nitrogenous fertilizers in any form give an increased yield; and only nitrogenous fertilizers increase the yield, when applied interculturally." The following tabulated statement shows the results of Mr. Cory's experiments:

Plot No	LBS. FERTILIZER PER PLOT.	LBS. FERTILIZER PER ACRE.	Lbs. cotton, 1st picking, Oct. 8.	Lbs. cotton, 2nd picking, Nov. 6	Total yield per Plot.	Total yield per Acre.
1	10 lbs acid phosphate .. 4½ lbs nitrate soda. ..	160 lbs acid phosphate, 72 lbs nitrate soda. .	25	24	49	781
2	10 lbs acid phosphate 7 lbs sulphate ammonia.	160 lbs acid phosphate, 112 lbs sulph. ammonia	39	27	66	1053
3	10 lbs acid phosphate 10 lbs cotton seed meal	160 lbs acid phosphate, 160 lbs cotton seed meal.	28½	25	53½	857
4	10 lbs acid phosphate ..	160 lbs acid phosphate	18½	23	41½	661
5	10 lbs acid phosphate . 28 lbs green cotton seed	160 lbs acid phosphate, 448 lbs green cotton seed.	20	22	42	672
6	10 lbs acid phosphate 150 lbs gr. stable manure.	160 lbs acid phosphate, 2400 lbs gr. stable man're	21	21½	42½	679
7	No manure	No manure	4½	14	18½	297
8	10 lbs acid phosphate.... 4½ lbs nitrate soda.... 3 lbs muriate potash ..	160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash.	15	23	38	609
9	10 lbs acid phosphate.... 7 lbs sulphate ammonia. 3 lbs muriate potash....	160 lbs acid phosphate, 112 lbs sulph ammonia, 48 lbs muriate potash..	23	23½	46½	747

EXPERIMENT MADE BY MR. A. F. CORY—CONTINUED.

Plot No.	LBS. FERTILIZER PER PLOT.	LBS. FERTILIZER PER ACRE.	Lbs cotton, 1st picking, Oct. 8.	Lbs. cotton, 2nd picking, Nov. 6	Total yield per Plot.	Total yield per Acre.
10	10 lbs acid phosphate 10 lbs cotton seed meal 3 lbs muriate potash	160 lbs acid phosphate, 160 lbs cotton seed meal, 48 lbs muriate potash	16	15	31	494
11	10 lbs acid phosphate	160 lbs acid phosphate,.	7	16	23	368
12	10 lbs acid phosphate 28 lbs green cotton seed. 3 lbs muriate potash	160 lbs acid phosphate, 448 lbs green cotton seed. 48 lbs muriate potash	20	19	39	624
13	10 lbs acid phosphate 150 lbs gr. stable manure 3 lbs muriate potash	160 lbs acid phosphate, 2400 lbs gr. stable man're 48 lbs muriate potash	16	22	38	608
14	10 lbs acid phosphate 4½ lbs nitrate soda 3 lbs muriate potash	160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash.	17	19	36	576
15	No manure.	No manure	5	13	18	288
16	10 lbs acid phosphate 4½ lbs nitrate soda. 12 lbs kainit.	160 lbs acid phosphate, 72 lbs nitrate soda, 192 lbs kainit	15	24	39	624
17	10 lbs acid phosphate 4½ lbs nitrate soda. 7 lbs cot'n seed hull ashes	160 lbs acid phosphate, 72 lbs nitrate soda, 112 lbs cot. s'd hull ashes	19	18	37	592
18	**Before Planting.** 10 lbs acid phosphate 4½ lbs nitrate soda 3 lbs muriate potash 5 lbs nitrate soda, June 24 5 lbs nitrate soda, July 15	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 80 nitrate soda, June 24, 80 nitrate soda, July 15.	22	27	19	784
19	**Before Planting.** 10 lbs acid phosphate 4½ lbs nitrate soda 3 lbs muriate potash 5 lbs nitrate soda June 24th.	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 80 lbs nitrate soda, June 24th.	17	27	44	704
20	**Before Planting.** 10 lbs acid phosphate 4½ lbs nitrate soda 3 lbs muriate potash 5 lbs nitrate soda July 15th.	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 80 lbs nitrate soda, July 15th.	18	30	48	768

EXPERIMENT MADE BY MR. A. F. CORY—CONTINUED.

Plot No.	Lbs. Fertilizer per Plot.	Lbs. Fertilizer per Acre.	Lbs. cotton, 1st picking, Oct. 8.	Lbs. cotton, 2nd picking, Nov. 6.	Total yield per Plot.	Total yield per Acre.
21	No manure	No manure..........	6	12	18	288
22	**Before Planting.** 10 lbs acid phosphate... 4½ lbs nitrate soda.... 3 lbs muriate potash....	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash	18	14	32	512
23	**Before Planting.** 10 lbs acid phosphate .. 4½ lbs nitrate soda.... 3 lbs muriate potash .. 3 lbs muriate potash .. June 24th........	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 48 lbs muriate potash, June 24th............	18	14	32	512
24	**Before Planting.** 10 lbs acid phosphate ... 4½ lbs nitrate soda.... 3 lbs muriate potash.... 3 lbs muriate potash .. July 15th	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 48 lbs muriate potash, July 15th............	13	18	31	496
25	**Before Planting.** 10 lbs acid phosphate... 4½ lbs nitrate soda. .. 3 lbs muriate potash .. 3 lbs muriate pot. June 24 3 lbs muriate pot. July 15	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 48 muriate pot. June 24, 48 muriate pot. July 15	18	17	38	560
26	**Before Planting.** 10 lbs acid phosphate .. 4½ lbs nitrate soda.... 3 lbs muriate potash.... 10 lbs acid phosphate.... July 15th..	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 160 lbs acid phosphate, July 15th............	20	19	39	624

EXPERIMENT MADE BY MR. A. F. CORY—CONTINUED.

Plot No.	LBS. FERTILIZER PER PLOT.	LBS. FERTILIZER PER ACRE.	Lbs. cotton, 1st picking, Oct. 8.	Lbs. cotton, 2nd picking, Nov. 6.	Total yield per Plot.	Total yield per Acre.
27	**Before Planting.** 10 lbs acid phosphate... 4½ lbs nitrate soda ... 3 lbs muriate potash ... 10 lbs acid phosphate .. June 24th............	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 160 lbs acid phosphate, June 24th............	17	18	35	560
28	**Before Planting.** 10 lbs acid phosphate... 4½ lbs nitrate soda.... 3 lbs muriate potash... 10 lbs acid phosphate . July 15th............	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 160 lbs acid phosphate, July 15th....... ...	18	20	38	608
29	**Before Planting.** No manure...........	**Before Planting.** No manure..........	4	12	16	256
30	**Before Planting.** 10 lbs acid phosphate... 4½ lbs nitrate soda.... 3 lbs muriate potash.... 12 lbs kainit..... ..... June 24th.	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 192 lbs kainit, June 24th	18	20	38	608
31	10 lbs acid phosphate... 4½ lbs nitrate soda.... 3 lbs muriate potash... 7 lbs cot'n s'd hull ashes All applied June 24th.	160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 112 cotton seed hull ashes All applied June 24th	7	23	30	480
32	**Before Planting.** 10 lbs acid phosphate.... 4½ lbs nitrate soda..... 3 lbs muriate potash... 10 lbs cotton seed meal.. June 24th............	**Before Planting.** 160 lbs acid phosphate, 72 lbs nitrate soda, 48 lbs muriate potash, 160 lbs cotton seed meal, June 24th...........	20	30	50	800

In the Spring of 1891 this Station furnished Mr. A. F. Cory seeds of 14 varieties of cotton for the purpose of comparison. In making his report, Mr. Cory says that the ground was thoroughly prepared, and fertilized with 100 lbs. cotton seed meal, acid phosphate and kainit each per acre, mixed thoroughly and applied in drill, before bedding. Cotton was planted in checks 3½ feet each way. By noticing the number of stalks per plot, it will be seen that an uneven stand was obtained which must be considered in comparing the total yield. The cultivation was made with heel scrape throughout the entire season.

The following is a tabulated statement of Mr. Cory's report:

EXPERIMENT WITH VARIETIES COTTON BY MR. A. F. CORY,

MULBERRY, AUTAUGA COUNTY.

NAMES OF VARIETIES.	No. of Stalks per Plot.	Yield per Plot 1st Picking, Oct. 7th.	Yield per Plot 2nd Picking, Nov. 5th.	Total Yield per Plot, Seed Cotton.	Total Yield per Acre, Seed Cotton.
No. 1. Cook, J. C	187	5	4	9	135
2. Cook, W. A	212	16	20	36	540
3. Gold Dust	187	19½	8	27½	412½
4. Hawkins Improved	201	17	23½	40½	607½
5. Herlong	220	16½	24½	41	615
6. Hunnicutt	199	19	20	39	585
7. Keith	226	23½	18	41½	622½
8. King, T. J.	207	25½	10½	36	540
9. Peerless	201	22½	16	38½	577½
10. Peterkin	234	25½	19	44½	667½
11. Southern Hope	213	18	20	38	570
12. Storm Proof	205	19½	21	40½	607½
13. Truitt	204	24½	20	44½	667½
14. Welborn's Pet.	228	29½	14½	44	660

Bulletin No. 35. January, 1892.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

GLANDERS

C. A. CARY, VETERINARIAN.

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GLANDERS.

C. A. CARY, VETERINARIAN.

Glanders is a specific, contagious disease, most frequently found in the equine species; but may be transmitted (by innoculation or by ingestion of glanderous material) to man, sheep, goats, dogs, cats and some of the rodents. The susceptibility of the hog is yet questionable, but it is certain that horned cattle and domestic fowls are proof against glanders.

Temperate or cool climates appear to be more favorable to its development and maintenance than the hot, torrid zones. As far as known, temperate regions have the greatest outbreaks of this disease. Possibly this may be due to the facts that the temperate countries possess the greater number of domesticated equines, and that the highest civilization of the cooler climates recognizes and records the majority of the cases that occur.

History informs us that the primitive veterinarians of the fourth and fifth centuries recognized glanders in some of its forms. Although it is one of the oldest known diseases, many of its phenomena and conditions are yet unknown. With all the accumulated medical knowledge of the past twelve centuries, no effective remedy has been discovered.

Glanders produces its lesions or morbid processes in the lymphatic vessels and glands and connective tissue adjacent to them, of the skin and subcutaneous connective tissue; of the mucous membrane of the nasal passages and respiratory tract, and of the lungs and spleen. These places or parts are most

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NOTE.—This Bulletin gives the results of the writer's observation on glanders as well as the conclusions of the best American and European authors. It is hoped that the farmers, by its aid, may be able to distinguish glanders from other diseases.

commonly affected in the beginning of the disease but the lesions do not confine their morbid changes to any one part or locality during the progress of the disease.

Gerlach and other authorities have divided glanders into the following classes: Nasal Glanders, Pulmonary Glanders and Farcy Glanders.

Nasal Glanders is the most common and may be recognized by the following symptoms:

1. NASAL DISCHARGE.—This is generally the most prominent of all the symptoms and is of the least diagnostic importance. At first the discharge is thin and watery, gradually becoming thicker, sticky and pasty; it may be greenish yellow, grayish, almost black with dust or streaked with blood—the color usually depends upon the food eaten and the dust in the air inspired by the animal. The discharge from the nose is not as copious in chronic cases as in strangles (distemper) or acute catarrh. However, it is augmented during damp, rough weather and by poor ventilation, bad food, etc. The viscid, tenacious discharge adheres around the external opening of the nose and appears to lessen the diameter of the opening. It is said to occur more frequently from the left than from the right nostril; yet it may appear from both nostrils or from either the right or the left one. The discharge may be almost entirely inodorous, or it may give forth a strong stench. The rank, obnoxious smell does not appear until the ulceration attacks the bone or cartilaginous tissue of the nasal chambers. Many of the foregoing physical characteristics of the nasal discharge are similar to the nasal discharge in strangles, catarrh, caries of the teeth and neoplastic or new dental tissue growths in the sinues or cavities connected with the nasal passages. Hence the nasal discharge can be used as a diagnostic symptom only when associated with other more prominent characteristics.

2. ENLARGEMENT OF THE LYMPHATIS GLANDS IN THE SUBMAXILLARY REGION.—This symptomatic condition of the glands—lying below the base of the tongue between the branches of the lower jaw, near the throat—is produced by the

aborption of glanderous matter by the lymphatics in the mucous membrane of the nasal passages. This absorbed glanderous material, on its way to the general circulation, excites a kind of a chronic inflammatory action in the submaxillary lymphatic glands. The swollen glands are soft and loose at first, but gradually become hard, nodulated and finally become firmly fixed high up on the inside of the jaw-bone, below the base of the tongue. These hard, nodulated glands vary in size from a hazel nut to a walnut, and are distinctly limited. The swollen glands usually appear on the same side upon which the nasal discharge occurs. For instance, if the nasal discharge occurs from the right nostril, the indurated, swollen, lymphatic gland will appear on the inside of the left branch of the submaxillary bone. If the discharge appear from both nostrils the glands may swell on one or both sides. Very rarely do these glands suppurate or form ulcers and are not to be confounded with the puffy, soft swelling of the subcutaneous tissue as is seen so frequently in strangles.

This nodular lymphatic swelling in the submaxillary region is not, by itself, sufficient in importance to determine the presence or absence of glanders. It should be accompanied by a more important symptom than nasal discharge in order to "proclaim" glanders. Hence its characteristic presence is the only real symptomatic indication it possesses.

3. Nodules and Ulcers on the Visable Mucous Membrane of the Nose.—These are found mainly on the septum nasi—the partition between the right and left nasal passage. The tubercles are, at first, red or gray and hard, varying in size from a millet seed to a pea; in a short time they become soft and yellowish; finally break open (erupt) and discharge a brownish yellow, oily liquid which resembles raw linseed oil. This viscid yellowish brown discharge is said to be so acrid that it forms serpentine channels in the mucous membrane as it flows over the surface. On the edges and sides of the ulcers formed by the erupting of the primary nodules, secondary nodules form and erupt. The primary nodules and ulcers may be so near each other that the tissue separating them may soon

become eroded by secondary nodules, and the larger ulcers thus become confluent or united. Thus the "pit like, ragged edged ulcer," or chancres are formed and enlarged. In some instances the resistance of nature or medical agents arrest the development of the chancres, and healing takes place, leaving white scar tissue to mark the spots of ulceration. These scar tissue spots are sometimes star-shaped, but their outlines always correspond to the previous ulcers. By no means does the presence of this scar tissue indicate the complete recovery of the case; for, upon the slightest provocation—as bad hygienic conditions or withholding the medicinal treatment—the ulcers will return or the morbid processes will appear in some other part of the body—in the lungs or subcutaneous connective tissue. The nodules, chancres and scar tissue are not confined to the visable mucous membrane of the nose, but they may be on the mucous membrane of the sinuses of the turbinated bones, of the pharynx, larynx or trachea (windpipe). Nodules or tubercles may also be present in the connective tissue of the lungs. According to Percivall nasal glanders is very frequently accompanied by tubercles in the lungs and they occur on the same (?) side upon which the nasal discharge, ulceration of the septum and the indurated submaxillary glands occur. When the nodules and ulcers are numerous on the nasal mucous membrane, the irritation caused by them may induce an acute inflammation throughout the nasal mucous membrane and a catarrhal exudate will appear on its surface. Hence, the discharge from the nose, during certain stages in glanders, may be composed of the catarrhal exudate from the inflamed mucous membrane, the yellowish, oily eruption from the nodules and ulcers, particles of food from the pharynx (throat) and dust from the air. Ulcers may be found on the visable mucous membrane as a direct result of injuries to the membrane or bones surrounding the nasal chambers—as splinters penetrating the nasal tissues or bruising of the tissues by contact with hard bodies or fractures of facial bones by the falling of the animal and by barbarous use of clubs and whip stocks. In such cases the complete recovery and healing of the wounds readily occur under proper treatment. Yellowish streaks and bluish lead-colored tints are said to be premonitory symptoms of coming nodules and ulcers. These signs are, however, uncertain; and, no doubt, are present in other diseases, as catarrh, pneumonia, etc.

There are a few minor attending indications in nasal glanders that may aid the reader in detecting the disease. A slight hemorrhage (bleeding) may occur periodically from the nose. A small amount of blood may be found on the manger, feed box or on the front legs, left or smeared in such places by the animal rubbing its nose over them. This hemorrhage will appear without any indications pointing to a cause, like heavy pulling, overwork or to bleeding from the lungs in large quantities. Again there may be a dry, soft "heavy" cough with slightly increased rapidity in breathing. The coat or hair may look rough and the animal may present considerable ematiation. One or more of the limbs may swell suddenly and the animal become suddenly lame from some unaccountable cause. Occasionally there is a manifest swelling of the skin and subcutaneous tissue around the external nares, or openings of the nostrils. This indurated swelling and the drying, sticky nasal discharge materially decrease the diameter of the opening.

These minor characteristics are not constant and generally appear when nasal glanders is complicated with one or both of the other forms.

PULMONARY GLANDERS.—The lungs are the chief organs in which this form of the disease occurs. In the acute attack there are small spots, inflamed as in lobular pneumonia; but if the case becomes chronic, small glanderous nodules are formed in the connective tissue of the lungs. These tubercles may undergo resolution or the successive changes known as fatty, cheesy and calcareous conditions, depending upon the duration of the morbid processes. In the chronic form of pulmonary glanders the symptons are indicated by a soft, dry cough, difficult or labored breathing, and a general unthrifty condition of the animal. There are instances, however, where the horse may thrive quite well, presenting only that peculiar cough and breathing common to an animal affected with "heaves;" and yet such an animal may communicate the disease to healthy horses. No doubt this occult form of glanders is responsible for many of the so-called spontaneous outbreaks of the disease. Fortunately, occult or hidden pulmonary glanders is not common, although fewer cases are recorded than actually occur, because this form of the disease cannot be determined, in all instances, prior to the death of the animal. Even the expert veterinarian cannot detect the presence of this occult form of glanders until he holds a *post mortem* examination and finds the tubercle leisons in the lungs or other internal organs. But if horses have contracted glanders from contact with a horse "suspected" of this trouble, it is quite evident that the "suspect" should be isolated and watched for further manifestations; or, better still, hold a *post mortem* examination at once. Pulmonary glanders is very frequently associated with nasal glanders, and in some instances it accompanies farcy glanders. When the visable and external symptons of farcy glanders or nasal glanders have disappeared or have been "hushed" by medical treatment, and the disease has become apparently latent, very often the tubercles in the lungs remain in such a condition as to enable the animal to transfer the virus to healthy horses.

Obviously pulmonary glanders, although very infrequent, is the most dangerous and microbe distributing form of glanders, because of its occult or hidden nature.

FARCY GLANDERS.—The lesions of this kind of glanders are in the lymphatic vessels and glands of the skin and connective tissue lying immediately beneath the skin. The lesions or morbid changes begin by the formation of nodules under the skin; are at first hard, hot and sensitive to the touch, gradually become soft in the center, and finally erupt, discharging a brownish yellow, viscid, sticky liquid similar in appearance and consistency to raw linseed oil, except it is at times, tinged with blood. After a time the discharge becomes more and more purulent (mixed with pus) indicating that nature is trying to heal the ulcers. The tubercles, farcy "buds" or "buttons,' vary in size from a pea or hazelnut to a walnut, and the ulcers formed by the eruption of the nodules are ragged edged with gray, dirty bottoms and with the drying, sticky discharge surrounding their borders and matting the hair. The chancrous ulcers have little tendency to heal; in case they do heal, they leave hard, button-like tubercles which may break open again; or should they disappear entirely, new nodules are certain to appear in the same region or other parts of the body—the lungs or nasal membranes. The inflammation in the lympphatic vessels and glands—caused by the absorption of glandrous material containing the specific microbe—retards or checks the return of lymph to the general circulation, and swelling or œdema of the affected parts is the result. This accounts for the swelling of the limbs when one (most frequently a hind limb) or more of them are affected. Either before the swelling appears, or after it wholly or partially disappears, the thickening and distension of the walls of the lymphatic ducts and valves, make the vessels or ducts appear like knotted cords which are usually hot and sensitive to the touch. [The lympphatic vessels and glands are found in nearly all parts of the body. The lymphatic vessels are about as many in number as there are veins and arteries, and they convey a watery lymph from all parts of the body to the largest veins and to the heart. The lymphatic glands are situated along the course of the ducts or vessels and act as filters or in some way change the lymph of the vessels.] The farcy ulcers and nodules, buds or buttons may appear on any part of the surface of the body; but they are seen most frequently on the inside and outside of the thighs, on the legs below the knee and hock, on the inside of the front limb in the axillary region, on the sides of the neck along the jugular veins, and on the sides of the lips. In nearly every case of farcy which the writer has observed, the location of the nodules, ulcers and swelling was in one of the hind limbs—the ulcers appearing in the region of the hock in some cases, and in others on the inside of the thigh. Generally the nodules or buds precede the swelling, but they may appear after the engorgement, or are not noticed until after the swelling is manifest. The swelling of the limb or limbs resembles the swelling in what is known as "big leg;" but in "big leg" (sometimes called "water farcy") the characteristic buds and ulcers are wanting; also there are no ulcers in the nostrils. In some rare cases the swelling entirely subsides and all that remains to indicate the presence of farcy are the knotted and corded lymphatic vessels with here and there a farcy bud or ulcer, or scars marking the spots where buds and ulcers have been. The nodules and ulcers are the important symtomatic conditions in farcy and they "pronounce" the animal to be affected with farcy glanders.

SYSTEMIC CONDITIONS AND OTHER CHARACTERISTICS.

There are systemic or general conditions which are considered as signs accompanying the foregoing. They may be present in all classes of glanders. In acute glanders the temperature rises to 103°—108° F.; the breathing or respirations are increased; the pulse is quickened, diminished in volume and becomes weak and feeble; the appetite is impaired, and marked debility and emaciation soon appear unless the acute attack is cut short by death or it merges into the chronic form. The acute form may resemble, at first, the first stage of acute pneumonia; but in a few days the nodules, ulcers, etc., appear on the nasal membranes or the characteristic indications of farcy glanders are manifested. Acute glanders is generally found in mules and is rarely found among horses. Chronic cases are by far the most common in the horses of this country. In fact, every authority and every official veterinarian claim that chronic glanders, in all its various manifestations, differs from acute glanders in degree of intensity and duration. An acute case may last from a few days to a few weeks and terminate in death or chronic glanders; but a chronic case, like some tuberculous persons, may live for months or years, passing a sort of a life-in-death existence. And during their prolonged, decaying existence, they may do regular work and communicate the disease to a large number of horses. The intensity of all the morbid conditions in chronic glanders is low; consequently the morbid changes are not rapid. The temperature is variable or periodic; at times, it is normal; but when there are sudden changes in the atmospheric temperature, or rough, damp weather, or the food is poor from partial decay or fermentation, or when bad hygienic conditions exist, the temperature rises a few degrees and other conditions will be present, which generally attend a slight fever. Or, the unhealthy surroundings, poor food, etc., may produce an acute attackin an animal affected with chronic glanders. However, the nodules, ulcers, swellings and corded lymphatic vessels are generally well marked in the chronic form; because they re tain their characteristics longer than in the acute cases. Heavy doses of aloes or hypodermic injections of turpentine, in many instances, will intensify the effects of chronic glanders Nasal glanders and farcy glanders may be present in the same animal. Virus from a farcy case may produce nasal glanders when inoculated into a healthy animal. In truth, the specific microbes may produce any of the various forms and conditions of glanders irrespective of origin. This interchangableness of the partially distinct forms of glanders is due the fact that the same exciting cause produces all forms of the disease.

CAUSES AND TRANSMISSION.

Under this heading we find two classes of causes—predisposing and exciting.

The predisposing causes are variable and are simply preparing conditions that get the system ready for the exciting cause, and thus enable the exciting or disease producing microbes to gain admission to the system and intensify their destructive work. Anything which lowers the vitality and resisting power of the system acts as a predisposing cause. Sudden changes in the weather with respect to moisture, temperature and light —as hot, sultry, damp, cloudy weather—lower the vitality and resistance of the body tissue and liquids. Bad drainage, ill ventilation, coarse, rough and partially decayed hay, damaged food, impure water, strangles, catarrh, carious teeth, bronchitis, pneumonia and many other debilitating diseases, are predisposing causes. Hereditary causes are likewise predisposing in their influence. It is still a question as to whether the offspring may receive the microbes of glanders during fœtal life; but it does inherit a predisposed tendency—a prepared condition of cell, of organic structure which admits the germ into the body more readily and feeds the microbe upon more of its favorite food than the system otherwise not predisposed by an inherited tendency. The writer has heard veterinarians and stock raisers claim that farcy glanders was not transmitted from dam to offspring. That may be true in regard to the microbe or its spores; but the strong predisposing tendency is inherited and the constant contact after birth of the colt with its dam affords ample opportunity for the transmission of the germs. In all the cases which the writer has observed, the offspring has developed glanders (sufficient for a distinct manifestation) before maturity, and in one case before the weaning of the colt.

In giving a definition of glanders the writer stated that it was a *specific contagious* disease. By specific I mean that the exciting cause is a definite micro-organism, a parasitic microbe, The definite germ that causes glanders is the *bacillus mallei* and was discovered in 1882 by Loffler and Schutz. This germ is found in the tissues of the nodules and ulcers and in the yellowish, viscid discharge from them. Pure cultures are obtained from unbroken farcy buds and from tubercles in the lungs and spleen. The nasal discharge contains this microbe, but the discharge is also thronged with numerous air germs which makes the cultures from that source impure and of no value unless the *bacillus* of glanders can be isolated and cultivated separately. The glanders microbe in the nasal discharge may be isolated by inoculating a guinea pig with a small amount of the discharge. The glanders microbe is the only germ that will develop in the body of the guinea pig, showing peculiar enlargement of the lymphatic glands from which pure cultures of the *bacillus mallei* may be obtained. Thus the guinea pig acts as a perfect natural culture media for the specific microbe, and at the same time resists the development or growth of the air germs. The microbe of glanders is also found in the lymph of the lymphatic vessels in the neighborhood of glanderous ulcers and nodules, but before the lymph reaches the general circulatin the lymphatic glands have separated the germs from the lymph by filtration. However, when the tissues have become greatly ulcerated it is quite probable that the capillaries and smaller blood vessels absorb some of the glanderous material and the microbes are then found in the blood. In acute cases some authorities claim that the germ is found in the blood during the stage of excessively high temperature or early fever. This microbe will also grow on some of the artificial culture media—as sterilized potato, blood serum, etc.

The contagion or germs of glanders are transferred chiefly by the nasal discharge. It is scattered about promiscuously—in feed boxes, over mangers, stalls and floors, on buckets, bridles and harness, in watering troughs, etc. The discharge from the farcy ulcers is likewise a source of contagion; however, it is small in quantity and does not become so profusely and generally distributed as the nasal discharge. The germs may gain entrance to the system by way of the digestive tract when the discharge is present in the drinking water or in the food. It thus encounters the action of the fluids of digestion and must be absorbed by the blood vessels or lymphatics. It is quite certain that the spores of the bacilli could thus enter the system by way of the alimentary canal. This is, no doubt, the source of many cases of glanders where the mesentary lymphatics and the lungs are the chief or beginning seats of the nodules or tubercles. The discharge may become dry, float about in the air of the stable and enter the nasal or respiratory passages; along with the dust the particles of dry discharge settle upon the mucous membrane and the bacilli penetrate the tissues or gain entrance into the tissues by uncommon abrasions. In the time of Percivall glanders was transmitted by spreading the nasal discharge from a glandered horse over the septum of healthy horses and mules. This method acted with perfect or absolute certainty. Therefore, it is not improbable that glanders may be communicated by dried discharge as above described. The certainty of the transmission of glanders by inoculation is too evident to be questioned. In such cases the glandered material is introduced into an ulcer, a wound, or injected beneath the skin, into veins or arteries. The disease is, however, not transmitted by a healthy animal breathing the exhaled air from a glandered horse. This has also been demonstrated by actual experiment. The germs do not come from the living animal in a volatile form.

It is with pleasure we learn that Pearson, Hellman, Kalming, Preusse, and other European investigators, have obtained gratifying results with *glander lymph* or *mallein*. The lymph is prepared from artificial cultures (growing on potatoes, &c.) of glanders bacilli. The mallein or lymph is used to diagnose or determine cases of glanders where the seats of the disease or the diseased places are hidden from view and are without definite manifestations, or where the disease has not progressed sufficiently to admit of diagnosis. The lymph is introduced into the system by hypodermic injection ; and, if glanders be present, the specific reaction is indicated by a rise of temperature. The glander lymph acts very like the Koch lymph in tuberculosis.

THE VITALITY OF GLANDERS BACILLI OR VIRUS.

Bouley, Gerlach, Renault, Cadaec, Malet and other authorities, have demonstrated the following facts:

1. By slowly drying (artificially or in sunshine) the nasal discharge or virus, exposed to free air, the bacilli lose their virulency. 2. The bacilli lose their virulency very slowly if exposed to damp, cool weather. 3. If the nasal discharge or virus be rapidly dried the bacilli retain their activity longer than when slowly dried. In some instances rapidly dried virus remained virulent for three months. 4. Glandered matters or nasal discharge dropped into water, or kept in an atmosphere saturated with moisture, remain virulent for a long time.

Moreover, many authorities claim that thirty days of ordinary weather will entirely destroy exposed bacilli; but the foregoing conclusions of eminent authorities will not corroborate the thirty days limit. In truth, the bacillus of glanders has its principal place of abode—its natural home or habitation—in the fluids and tissues of the body of the mule or the horse; and all the facts, relating to the life of the bacillus outside of the animal body, have not been discovered. But since the germ or bacillus lives under unfavorable conditions outside of the animal body, it becomes less difficult to destroy the bacilli in infected barns, stalls, etc. Proper disinfection will effect this result.

DISINFECTION.

What should one do with stalls, harness, etc., which have come in contact with a horse affected with glanders? If the stable, etc., are old, and not very valuable, it is safest and best to burn them. However, complete disinfection is possible without burning. Remove all filth and dirt from the stalls, and clean them by washing and otherwise as thoroughly as possible; then white-wash all the wood work, mixing one ounce of carbolic acid with every bucket of white-wash. After all the stalls, etc., are white-washed, fumigate the entire barn with sulphur fumes. This may be done by purchasing commercial sulphur brick, especially prepared for disinfecting purposes; or you may burn one pound of sulphur in a kettle of live coals, closing the doors, windows, etc., to keep the sulphur fumes in the barn. For very thorough disinfection one pound of sulphur may be thus burned in every stall. The harness should be thoroughly cleansed in boiling water, and oiled with hot oil. Finally, the stable, stalls, etc., should be ventilated; sunshine and fresh air are natures best disinfectants. The stalls, harness, etc., should not be used for one month or more after the above mentioned disinfectants have been applied.

SUSPECTED AND EXPOSED CASES.

Horses or mules that have been "exposed" to glanders, by working with, or coming in contact with, glandered animals, or by being stabled in infected stalls or barns, should be isolated and watched closely for (six to eight) weeks, until certain that such exposed animals are or are not affected. Every exposed animal will not contract the disease. The writer has known instances where one horse in a stable had contracted glanders, while the remaing horses of the same stable failed to take the disease. The writer can also recall an instance where one horse had been affected for some time, and during this time had been worked with its mate; yet the mate failed to contract the disease. This does not mean that glandered animals may be carelessly thrown in contact with healthy horses or mules, without spreading this fearful disease. It does mean that a healthy animal can resist for some time the attacks of the glanders virus or bacillus.

TREATMENT.

It is useless, dangerous and expensive to attempt to treat glanders in the horse or the mule. I know medicine venders and empirics will attempt treatment of anything; but the very best and most reliable authorities are unanimous in declaring that glanders in the horse or mule is practically incurable. The danger of contracting the disease is far greater than one would suppose when one sees men so reckless and knowingly careless in handling glandered horses. Recently a farmer gave the writer an idea of the expense incurred by handling and retaining a glandered horse on his farm, in the following words: "Had I destroyed the first case of farcy that appeared on my farm I would have saved hundreds of dollars." Hence, when you are certain that one of your animals is affected with glanders, destroy it at once and burn or deeply bury the carcass.

GLANDERS IN MEN.

The human family may be attacked by this loathsome disease. In man it appears in any of the three forms and the symptoms are somewhat similar to those in the horse. Glanders in man, in its acute stage, may be mistaken for *typhoid fever*, *rheumatism*, *pyœmia* (blood poisoning), or *erysipelas ;* and chronic cases in man simulate chronic *syphilis* or *tuberculosis* (consumption). The *occupation* and *history* of the afflicted person must always be thoroughly considered; since man contracts this disease by carelessly handling glandered animals. The microbes or bacilli gain admission to the system through ulcers or broken places in the skin of the hands and face. The nasal discharge may be blown into the face or get on the hands. Moreover, filthiness or uncleanliness of person, make such an one more susceptible or more liable to become infected. As we have previously stated, glandered animals should be destroyed and deeply buried with as little handling as possible.

The following is the only law in Alabama relating to the disposal of glandered animals:

[From Acts 1886-7, page 95.]

AN ACT

For the Prevention and Suppression of Infectious and Contagious Diseases of Horses and other Animals.

SECTION 1. *Be it enacted by the General Assembly of Alabama,* That it shall be the duty of any person, who is the owner or possessor of a horse, mule, or other animal having the glanders, or other fatal contagious or infectious disease, to keep such diseased animal away and removed from any public or other place where horses, mules or other animals are usually kept in said counties, and also to keep such diseased animals at a distance from any common rendezvous for animals therein, whether such rendezvous or place of resort be maintained for public or private use and conveniences; and any person refusing or wilfully neglecting to obey this provision of law, by bringing such diseased horse, mule, or other animal, or causing the same to be brought to any rendezvous of animals or other place where the same shall be usually kept, shall be deemed guilty of a misdemeanor, and may be indicted therefor; and upon conviction thereof by or before any court of this State competent at this time to try and punish misdemeanors committed in said counties, shall be fined not exceeding fifty dollars, nor less than five dollars, for any violation of this law; *Provided,* That the prosecution and conviction of any person under this statute shall not be a bar to an action for civil damages against said person for loss or injury incurred by reason of the violation thereof.

Approved February 28, 1887.

The station solicits correspondence upon all diseases of live stock—especially upon all forms of contagious, infectious or spreading diseases.

In writing the station regarding diseases, direct all communication to the veterinarian, and briefly state the conditions as follows:

1. History of affected animals.
2. Conditions before becoming sick.
3. How fed; source and kind of water; kind of pasture, &c.
4. Give age, sex and breed.
5. Are all sick at one time? How long affected?
6. Give symptoms—how sick animals act, &c.
7. Examine animals thoroughly after death and give the results.
8. Send specimens of desease tissues or organs and of parasites (worms, &c.) in alcohol, by express, (prepay express).

RECAPITULATION.

I. Nasal Glanders is recognized chiefly by the ulcers on the visable lining membrane of the nose. The ulcers are generally accompanied by a nasal discharge, and by a small, hard, deep seated swelling under the lower jaw, high up near the throat, under the base of the tongue; this swelling, or enlarged lymphatic gland, rarely suppurates or discharges pus.

II. Farcy Glanders is manifested by the presence of hard buds or buttons and ulcers or chancres, found most frequently on the inside of the thigh, or on the inside or outside of the hind leg below the hock joint, but may occur on any part of the surface of the body.

III. Pulmonary Glanders manifests itself by a dry, rough coat, indigestion, ematiation, and by that irregular breathing exhibited in a horse with the heaves ("Bellows"). But a case of pulmonary glanders can not be diagnosed with certainty until the suspected animal dies or communicates the disease to another horse or mule, or glanders becomes apparent in one or both of the other forms of the disease.

IV. Any one, or any two or all three of the foregoing forms of glanders may appear in a single animal.

V. Glanders in any or all of its forms is caused by a plant parasite—the *bacillus mallei.*

VI. The germs or microbes are transmitted from the diseased to the healthy animal by direct or immediate contact of the healthy with the diseased; or by the healthy horses or mules coming in contact with the virus, the nasal discharge, in watering troughs, buckets, mangers and stalls, infected by a glandered animal.

VII. Man may become inoculated in sores or broken places in the skin and thus contract glanders. This occurs not infrequently with men who carelessly handle glandered horses.

VIII. All animals afflicted with glanders should be destroyed and their carcasses should be deeply buried in some out of the way place. Never throw the carcass of any animal into the river to breed disease and filth.

IX. Disinfect thoroughly all infected stables, watering troughs, buckets, harness, stable utensils, &c.

X. Strictly and completely quarantine or isolate all exposed or suspected animals until certain they are, or are not, glandered.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

BULLETIN No. 36, : : : : MARCH, 1892.

SOME LEAF BLIGHTS OF COTTON,

GEO. F. ATKINSON, BIOLOGIST.

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☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

All communications should be addressed to
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I. YELLOW LEAF BLIGHT.

Several of the maladies of the cotton plant are indiscriminately termed "rust" or "black rust." As I have repeatedly taken occasion to remark it is very unfortunate that the name "rust" was ever applied to any disease of the cotton plant at present known in the United States.

Unfortunate in the first place because none of the true rusts are yet known to attack cotton in the United States, although recently a true rust has been found to attack cotton in certain parts of South America.* In the second place as a popular name it carries with it such indefinite and variable characteristics as to be applied to nearly every diseased appearance of the plant. In one locality it means one thing, and in another locality quite a different thing. Again, in the same locality different diseases at successive periods in the same season are often termed "rust." It is obvious that with this confusion existing it is nearly or quite impossible to discuss intelligently any one of the so-called "rusts." So we frequently find that much of the discussion of "cotton rust" is contradictory.

For these reasons I have decided to speak of the disease of cotton fully described below as yellow leaf blight, and I urge upon all who observe closely enough to distinguish it

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NOTE.—In a study of this disease in all of its phases the writer has found it necessary to give considerable attention to the effects produced by soil conditions. Acknowledgments are due to the following gentlemen who aided him by the loan of literature not easily accessible: Hon. Edwin Willits, Assistant Secretary of Agriculture, Washington, D. C.; Dr. Wiley, Chemist of the Department of Agriculture, Washington; Mr. Harris, Director of the Office of Experiment Stations, Washington; and Prof. A. N. Prentiss, Cornell University, Ithaca, N. Y.

* Lagerheim. Journal of mycology, Vol. VII, No. 1, Washington, D. C.

from other diseases to adopt this name and use it under all circumstances when speaking and writing of it. We can thus do away with the present confusion, reach a position from which we can intelligently experiment, and finally successfully treat it. There will be this advantage in diagnosing the disease, that the first part of the name has some reference to the appearance of the leaf in its earlier stages, while blight is a very appropriate word to express the final stages of the disease when it proves fatal.

I shall use the term yellow leaf blight here in all cases where I am satisfied the disease spoken of is that one, even though it may have been reported to me under another name. My correspondents will therefore understand why it is if that term is thus used.

It is not without some misgivings that just at this time I should undertake to lay before the cotton planters of the State the results of this year's experiments in preventing the disease, and recommend a careful and intelligent trial, on a small scale the first year, in preventing it. For, considering the present over-production of cotton compared with the small production of food stuffs in the Southern States, it might seem an idle thing to do. Especially so since it has been several times suggested to me, by some who have looked at the matter hastily and superficially, that instead of desiring to know how to prevent the diseases of cotton now, we would do better to discover some new enemies of the plant. It is not likely such persons would view with alarm the destruction of a sufficiently large portion of the cotton crop to insure a good price provided they knew their own crop was secure and the yield would be abundant. But would they regard the matter in the same light if their own crop should be injured to the extent of 25 to 50 per cent. while their neighbors produced full crops, even though the price of cotton should be low?

The fair way to look at the matter is, that with the increasing competition in cotton culture through the increased acreage of the past few years and the constantly decreasing productiveness of many soils, we should take advantage of the results of research which show that judicious fertilizing, more careful preparation and cultivation of the land, proper means for preventing loss by disease or insects, will more than counterbalance the cost of their use. Those who endeavor to do these things well, and plant less cotton in order that they may do it well, and at the same time raise more of their own food stuffs, are the ones who will reach the greatest success in cotton culture in the future.

According to the plan proposed in Bulletin No. 27, May, 1891, entitled "Black Rust" of Cotton, and here treated of as yellow leaf blight, an extended series of investigations have been carried on during the past summer to determine more fully the nature of this widespread disease, and if possible, a remedy. In that bulletin were described several fungus organisms which "play an important part in the disease." *The late time in the season at which the investigations were begun that year (July) prevented a thorough consideration of the etiology of the disease. It could only be noted that these organisms were present and that their growth hastened the destruction of the plant. The investigations this year confirm that view of the case. But at the same time they have demonstrated that the organisms do not initiate the disease, they only aggravate it.

A Physiological Disease.—It is a physiological disease, the condition of the plant being one of imperfect nutrition or assimilation. We are not at present in a position to say with certainty whether it is induced by the lack of some nutritive element in the soil, or whether the physical condition of the soil has become deranged either by long cultivation, by washing away of the surface soil, or in some cases an original detrimental physical condition of the soil, when

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*See, also, Botanical Gazette, Vol. XVI, March, 1891.

the disease is said to appear any year under all conditions. It is certainly not exclusively due to an impoverished condition of the soil, for it appears in some of the richest lands of the State. It may be that both of these conditions are more or less responsible for the trouble.

To appreciate the peculiar appearance accompanying the first stages of the disease, when it can quite readily be recognized in comparison with other affections of the leaf, one must note the general form of the leaf as well as the venation, the courses through which nutriment is distributed and the final areas through which it is diffused in reaching the ultimate units or cells of the leaf. The leaf is palmate, the main ribs, or veins, radiating from a common point at the junction of the petiole to several points on the leaf circumference, so that the leaf is either undivided, as in the case of the first few leaves developed after the cotyledons and the young leaves in the axils of the branches; or three to four or five lobed or pointed, one of the main veins extending into the corresponding lobe of the leaf. From these few main veins smaller ones branch in a monôpodial fashion nearly at right angles, reaching out into the triangular area lying between. From these again still smaller branches extend which themselves are branched, and so on until all parts of the leaf are at last intersected by the final smallest veinlets. This network of veins is the medium through which the minute channels course that conduct water and nutritive solutions absorbed by the roots and transported through the circulatory passages of the stem to all parts of the leaf.

It will be seen that the ultimate ramifications of this network of veins divides the leaf tissue into quite small angular areas and that the circulatory channels in the veinlets lie along the borders of these areas. Now it is clear that as the nutritive substance pass by diffusion from the channels in the veinlets to the areas between them, that the cells of these areas lying closest to the ribs will be the first to obtain nourishment, and the cells toward the centre of these small angular areas will be the last. When there is an abundance of the nutritive solution, containing all the necessary elements, all the cells of these areas will be well supplied, and, other things being equal, will remain healthy and green. But if the supply is deficient either in quantity or quality the first cells to feel this deficiency will be those in the centre of these angular areas, while all the cells lying along the track of the distributing channels may be well supplied for a time. The effect of this deficiency, either in nutrition or assimilation, is shown in a partial disorganization of the chlorophyl, or green substance, which causes it to become yellow in color. At first this change in color is quite indistinct, but gradually becomes more marked until it is plainly seen. Where this takes place it gives to the leaf a checkered appearance, the cells along the channels in the veinlets which bound the yellowish areas remaining quite green for sometime. Sometimes the disease progresses more rapidly so that the smaller veins are also yellow and it is only along quite close to the larger veins and their branches that the green color is present. *In the farther progress of the disease, if the weather continues quite dry, the leaf after awhile will gradually dry, become shriveled, and fall off. If rain and hot weather succeed each other, semi-parasitic fungi grow in the leaf, absorbing the living substance for their own growth.

These fungi are microscopic plants, but when produced in great numbers they give a dark brown or black appearance to the leaf. When the plant is badly diseased it will die without the injuries produced by these organisms if the weather is not suitable for their production and dissemina-

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*Cotton frequently has a yellow cast affecting all parts of the leaf, as well as the tender parts of the stem, even when fertilized with Kainite. This yellow cast is quite different from the yellow leaf blight. Nitrogenous fertilizers will usually prevent this yellow cast.

tion, but the attacks of the fungi always hasten the disease and increase the injury.*

While the question of the etiology of the disease was a matter of doubt, the experiments were arranged so that careful tests could be made of fungicides in three different places in the vicinity of Auburn, one at Mathews Station, and another at Hope Hull. In three cases liquid applications were made, the fungicides used being the well known Bordeaux mixture and the Eau celeste. In the other cases four different powders were used, the fungicide ingredients in all being copper sulphate and the menstrum varying to test the adhesive property of several substances. In all cases where the disease appeared in the experiment tracts, not the least benefit was derived from the application of fungicides. It would be, therefore, quite superfluous to enter into a detailed statement of their application, their only value being in the nature of confirmatory evidence of the conclusion arrived at from an entirely different standpoint, that the disease is a physiological one.

EXPERIMENTS WITH FERTILIZERS.

The experiments with fertilizers produced results which indicate that with some experimentation for different soils and careful preparation of the proper fertilizers planters will be able to control the disease, or at least to check it, or to reduce the annual loss sustained on its account, to a minimum.

Three experiment tracts were employed, one on the station farm at Auburn, one at Mathews Station, and one at Hope Hull.

Experiments at Mathews Station.—These were conducted on the farm of S. B. Mathews, who very kindly attended to the application of the fertilizers according to directions.

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*For a description of the fungi referred to here, see Bulletin No. 27, Ala. Agricultural Experiment Station, May, 1891.

There were fourteen plats, all treated in the same manner as the first fourteen plats on the experiment tract at the college farm, in Auburn, to which the reader is referred for the arrangement. As the disease did not appear in this tract, any further discussion is unnecessary.

Experiments at Hope Hull.—These were conducted on the farm of A. H. Clark, to whom the writer is very grateful for the special care given in carrying out the plan as well as for the valuable information given from several years intelligent observation of the disease. The experiment was conducted in what is known as black land, and has the reputation of being liable to the disease.

The kind of soil, manner of preparation, and time of application of the fertilizers is thus described by Mr. Clark:

"The experiment was made on black land with a little admixture of gray, washed from an adjacent hill.

"The land was prepared about 1st April, 1891, by running a deep centre furrow and then bedding out in five feet rows—the basis fertilizer, 667 lbs. phosphate and 333 lbs. cotton seed meal being applied on each side of list, that is, the first two furrows we make in bedding. The other fertilizers were applied on each side of the drill where the plants stand, 9th June, 1891.

"The first cultivation was given with a solid sweep, thus thoroughly distributing the basis fertilizers—the subsequent cultivations were all given with a flat sweep barely scraping the surface.

"The land is very fine corn land, not adapted to cotton, but well suited as an experiment tract for yellow leaf blight."

There were twelve plats, consisting of .three rows each. The plan for the intercultural application of kainite, nitrate of soda, and salt with the checks is shown in Table I. Plats 4, 8 and 12 were treated with fungicides, but as stated above, they had no effect, and these plats are, therefore, treated as checks.

In the same table will be found the number of stalks diseased in the middle row of each plat on Sept. 6, as counted by Mr. Clark, also the percentage of disease in each middle row, as well as the yield per acre of seed cotton, as determined later :

TABLE I.

Fertilizer, lbs. per Acre.	No. stalks diseased in middle row, Sept. 6.	Per cent. of disease in middle row.	Seed cotton per Acre.
No. 1. Kainite 200 pounds	24	13.33	1088
" 2. " 400 "	8	4 44	1291
" 3. Check..............................	39	21.67	1104
" 4. "	47	26 11	1048
" 5. Nitrate of soda 200 pounds...........	54	30 00	959
" 6. " " 400 "	64	35 56	1040
" 7. Check..............................	62	34.44	711
" 8. "	66	36.67	784
" 9. Salt 200 pounds	53	23.33	1015
" 10. " 400 "	34	18.89	1186
" 11. Check..............................	68	32 22	931
" 12. "	73	40 56	997

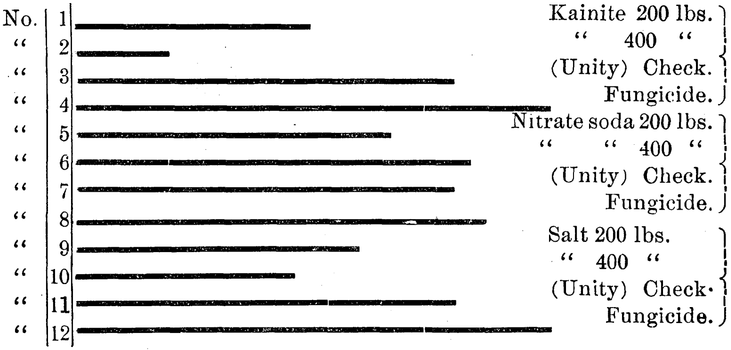
The following is quoted from Mr. Clark's letter of September 6th :

"Plainly there is a lack of homogeneity in the tract as a whole, regarding the liability of the plant to rust. Nos. 3, 7 and 11, all checks, show this, and Nos. 4, 8 and 12, all treated with fungicides, but which can be considered almost as checks, show the same thing. Hence we can only compare applications with checks close at hand, and say—

Nos. 1, 2 and 4 with No. 3.
Nos. 5, 6 and 8 with No. 7.
Nos. 9, 10 and 12 with No. 11.

Making this comparison, the actual number of stalks on each row averaging 180 we find." (See Table I for per cent. of disease.) "Now taking groups of four plats, check rows representing unity, and comparing with each other, the resultant diagram will give probably a fair comparison of the whole tract." (See Diagram I for comparative amount of the disease.)

DIAGRAM I.



"Showing general result in their order of benefit at this day to be—

400 lbs. Kainite 1st.
400 " Salt. 2nd.
200 " Kainite 3rd.
200 " Salt. 4th.

Nitrate of soda either detrimental or of no benefit."

Also from Mr. Clark's letter of November 9th, I quote the following :

"I have gathered the cotton from our experiment tracts—the weights are as below stated. " (See Table I.) " The results are not a fair indication of what we might expect another year, as the season was bad for cotton production—too wet in the early part, with no rain for the past two months. My crops on these lands is 25 per cent. less than last year.

"If we could throw out No.'s 7 and 8 the results would be satisfactory and intelligible. I cannot account for the product from these two tracts being so small, but they were as reported and one checks the other. I recall that some eight or ten years ago my ditch bank that protects this plot broke, several rows were badly washed, but that it was exactly at this place I cannot say. It was somewhere on this experiment tract and it was not at either end.

"Referring to my report of September, as to the condition of the plats with regard to the yellow leaf blight—you will see that the scales show about the same result as the eye did at that date, that is to say, a comparison of the yield from No 2, kainite, with the average of checks 3 and 4 shows about the same increase as a comparison of No. 10, salt., with the average of checks 11 and 12; but if we compare the total increased yield from the two kainite tracts with that from the two salt tracts, the latter shows better results.

"There can be no doubt as to the effect of kainite, as my former experience is the same as that of this year, but I think to thoroughly prevent the disease would require not less than 500 or 600 lbs. per acre, or possibly a smaller quantity confined to the drill. The action of salt this year invites further experiments with larger quantities applied in the same way, and smaller quantities applied in the drill."*

Experiments on the station farm, Auburn. Table I exhibits the arrangement of the plats, yield of seed cotton per acre, and the condition of the plant on September 12. Plats 1–16 were arranged by myself, after consultation with Prof. J. S. Newman to determine the amount of the fertilizers to be used. Plats 17–20 were added by Prof. Newman. The plats consist of three rows each, ex-

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*NOTE.—The nitrate of Soda would probably produce better results when applied earlier. According to Dr. McBryde the yield is as great when applied with tho other fertilizers as when applied as a top dressing. (South Carolina Agricultural Exp. Station, Clemson Agricultural College, July, 1891.)

tending a distance of 35 yards. The land was fertilized the previous year with compost consisting of stable manure, cotton seed meal and acid phosphate.

TABLE II.

1891—COTTON EXPERIMENTS WITH FERTILIZERS.

Plats 1-35 of an Acre, 3 rows to plat, planted May 6th, 1891.

Plat No.	FERTILIZERS USED PER ACRE, WHEN AND HOW APPLIED.	Seed cotton, lbs. yield per acre	SEPTEMBER 12.
1	200 lbs kainite May 6	973	Healthy.
2	400 lbs kainite May 6	850	Healthy.
3	200 lbs kainite May 6, 200 lbs nitrate soda July 3	801	Healthy, Very green.
4	400 lbs kainite May 6, 100 lbs nitrate soda July 3, 100 lbs nitrate soda July 14	924	Healthy, Very green,
5	No manure	465	All diseased.
6	No manure—fungicide, wet	430	All diseased.
7	200 lbs kainite May 6, 200 lbs cotton seed meal May 6..............	871	Little diseased.
8	200 lbs kainite May 6, 200 lbs cotton seed meal May 6, 200 lbs acid phosphate, May 6...............	955	Little diseased.
9	No manure	532	Badly diseased.
10	No manure—fungicide, wet................	591	Badly diseased.
11	“ “ dry..................	542	Badly diseased.
12	200 lbs acid phosphate May 6	640	Badly diseased.
13	200 lbs acid phosphate May 6, 66⅔ lbs nitrate soda July 3, 66⅔ lbs “ “ July 14, 66 3-3 lbs nitrate soda August 10...........	637	Badly diseased.
14	200 lbs acid phosphate May 6, 200 lbs kainite May 6.......	931	Little diseased.
15	No manure	521	Badly diseased.
16	No manure—fungicide	553	Badly diseased.
17	200 lbs blood and bone meal May 6..........	696	Badly diseased.
18	200 lbs bone meal May 6....................	605	Badly diseased.
19	1000 lbs compost May 6......................	661	Badly diseased.
20	75 lbs nitrate soda May 6, 200 lbs acid phosphate May 6.	966	Little diseased.

The results are very satisfactory as well as interesting. September 12th, plats 1, 2, 3 and 4 were perfectly healthy, every stalk by actual observation being free from the disease. In plats 5 and 6, the checks, every plant was diseased. Plats 3 and 4 were greener than plats 1 and 2, showing the effect of the intercultural application of nitrate of soda. Plats 7, 8, 14, and 20 while little diseased, were far healthier than the remaining ones. In all of these plats, 1, 2, 3; 4, 7, 8 and 14, it was easy to see, by comparison with the others, that the entire or partial prevention of the disease was due to the kainite. The partially diseased condition of plats 7, 8 and 14 might be accounted for on the ground that the acid phosphate and cotton seed meal may to a limited extent inhibit the action of the kainite,* while it can be readily seen by comparison that they do increase the yield. 400 or 500 lbs. of kainite would probably have prevented the disease altogether up to that date, and with the other fertilizers have increased the yield still more.

Plat 13, which was very badly diseased, shows that the nitrate of soda applied interculturally produces very little effect. Plat 20 was very little diseased, but here the nitrate of soda was applied May 6th, when the cotton was planted. It may have a beneficial effect when applied early, while all the experiments this year show that interculturally, or late as July, it produces no effect as a preventative of the disease. However, plats 1 and 20 should be thrown out of consideration as we will find it necessary to do when we consider the yield. On either side of the experiment tract the cotton in the field was planted in rows which ranged down to a sloping hill-side, so that the outside rows in plats 1 and 20 received some of the fertilizers washed down during rains. This was

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*Note.—The cotton seed meal might inhibit to a certain extent the action of the kainite, since it probably decreases the surface tension of the film of surface water, and makes the plant more susceptible to drought, while the acid phosphate probably hastens maturity.

quite evident to the eye, these rows being much more vigorous than any others on the entire tract. The other plats were not vitiated, however, for at the ends of the plats the field cotton was rowed transversely, or across the ends, so that no wash would be carried on to the tract at the ends. By a study of the table it is noted that the nitrate of soda applied interculturally, practically did not influence the yield. Plat 1, by comparison with the effect of kainite in the other plats at the rate of 200 lbs. per acre, shows an increase in yield of about 100 lbs. of seed cotton per acre. Allowing the same increase from field wash for plat 20 that has been allowed for plat 1, there is left to the credit of the 75 lbs. nitrate of soda applied at the time of planting, about 150 lbs. seed cotton per acre. This is based, however, on a single plat and does not offer such reliable testimony as if based on several.

The yield on the kainite plats is increased from 70 to 100 per cent. above that where no fertilizer was used, and an average of 40 per cent. increase over that of any other single fertilizer or combination, without the kainite used.

During the latter part of September I photographed plats 4 and 5. The result is reproduced in Plate I.

These experiments indicate then that with such a season as the past one, and where the other nutritive matters are present, kainite not only tends to prevent the disease, but also increases the yield.

It is claimed by many that, during seasons when rains are abundant and well distributed through the season, so that there is no period of drought, the kainite does not increase the yield. Such seasons are usually quite free from the disease. This tends to show that the disease is due to a detrimental physical condition of the soil, inducing improper circulation of water in the soil, and will be referred to again under the discussion of the physical condition of the soil.

NOTHING. KAINITE.

PLATE I.

Kinds of Soils on Which the Disease is Likely to Appear, The disease is liable to occur on many soils where the surface soil has largely been washed away by rains; on very porous soils, whether sandy or lime lands, and on poorly drained low ground. It is of more frequent occurrence in what is known as the prairie section, but in years like the past one it occurs in the sandy uplands as well.

At my request Mr. Clark has prepared the following statement of lands in the prairie section which according to his observations are subject to the disease.

"As regards the liability of different soils in my section to produce the disease called yellow leaf blight in cotton—

1st. If the surface soil is washed away, and the subsoil of whitish color filled with particles of lime is exposed—the cotton will always blight.

2nd. If the soil is black gunpowder or loose gray—cotton will blight more or less every year.

3rd. Good, heavy, well-drained clays seldom blight, in fact last year was the only one in eleven years that clay lands blighted with me, and it was not developed even then as much as on other soils.

In the first case the land is very poor—bad for any crop. Second case—fine for corn, and good for cotton in a year when it does not blight. Third case—if gray or black, good for corn and cotton—if red, better adapted to cotton."

NOTES ON THE HISTORY OF KAINITE AS A PREVENTIVE OF THE DISEASE.

For a number of years kainite has been regarded by some as a preventive of the disease, or at least as beneficial in prolonging the life of the plant, so that it is better enabled to hold its leaves. It would be well nigh impossible to review all the evidence on this topic which has been presented in various agricultural, or non-agricultural papers. Therefore I shall confine myself to a presentation of the facts gathered from the most trustworthy sources which have come to my notice.

It is impossible for me to say whether or not all the diseases referred to below are the same as yellow leaf blight. I am quite confident, however, that some of them are. I am sure that the disease does exist to some extent in North Carolina, for I have had it described to me by very intelligent men. However, I will follow the course I proposed at the beginning, and only use the term, yellow leaf blight, when I have myself seen the disease, or I am convinced that the party reporting it knows how to distinguish it from the other affections of the cotton plant.

In the treatment of all diseases we expect some failures, and it would be a most remarkable fact if kainite was a preentive of the disease in all cases. Some of the reported failures are undoubtedly due to a failure to properly diagnose the disease. For example, kainite will not prevent what I have been accustomed to term a bacterial disease. I noted that in my experiment tract at Mathews Station. In one case where kainite has been reported to me as a failure to prevent "rust," I found on sending for specimens of the disease that it was not yellow leaf blight, but the disease spoken of above.

The first experiments with kainite as a preventive of the disease, of which I have knowledge, were conducted in North Carolina and reported by Dr. Dabney, then Director of the North Carolina Agricultural Experiment Station.* In this connection the following quotations from that report will be found interesting. P. 68. "Not infrequently it (kainite) has been used entirely alone, so applied it did well in special cases. For example, in soils good in all other respects, but upon which cotton would be invariably destroyed by rust without it, it has been very often used with most satis-

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*Annual report of North Carolina Agricultural Experiment Station for 1882.

factory results." From pages 71–73. "So far as our experiments go, kainite appears to be the most effective agent which has ever been used against those destructive and mysterious diseases of cotton which we call 'rust' and 'blight.' Thorough draining, liming or marling, and good general manuring, have all cured stubborn cases of rust. But they have all failed in many other cases. It is now the quite general opinion that kainite will prevent the rust in cotton, in a great majority of cases at least. The illustrations of this are very numerous, and there is hardly a dissenting voice. One farmer says a certain amount of kainite prevented the rust on a certain soil a dry season, while the same amount failed to do it a second and very wet season. Otherwise there is hardly a doubt expressed that kainite can be used in combination with other manures in such a way as to effectually prevent rust aud the shedding of bolls. . . . One farmer says 'kainite is to rust what quinine is to chills—a specific.'

"We can cite only a few illustrations. Mr. A. F. McCallum, Roberson county, says his first trial of kainite was upon a ten acre lot upon which cotton always rusted. 'In 1880 I planted the lot in cotton, using 200 lbs. per acre of a good ammoniated superphosphate and pine straw. Made an average of 260 lbs. per acre. The rust commenced July 1, and almost ruined the cotton. In 1881 (a dry season, as was 1880) I used the same amount of ammoniated superphosphate and pine straw, with the addition of 200 lbs. of kainite per acre. Cultivated in the same manner as in 1880. I gathered an average of 700 lbs. seed cotton per acre.'

"A striking instance is reported by Mr. J C. Wooten, Sr., Lenoir county. 'The land had been well prepared,' he writes, 'and manured with compost, the cotton came up and did very well until June; it commenced rusting or frenching at this time and looked very badly. I applied on the 3rd and 4th of July, on top of the cotton bed, by sprinkling it along the row on the cotton plants, 200 lbs. per acre of kainite. Soon after this was applied it changed color and commenced growing and has made a fine weed, well filled with cotton. I am now picking the cotton and it is very good. Without the kainite it would not have made one-half that is now matured. I think if I had applied the kainite sooner the cotton would have been still better.'

"Mr. H. M. Johnson, Johnston county, reports some experiments with kainite on typical cotton-rusting soil. He says: 'The experiment was conducted on cold, damp pond land, where cotton invariably took the rust early in the season. In all such cases the kainite causes the cotton plants to retain their leaves until the latest time in the fall, thus developing the largest amount of fruit.'"

In 1887 Mr. Clark, of Hope Hull, Ala., published a note on some experiments with kainite*, which led him to believe that it would prevent the yellow leaf blight in cotton. I quote from that note as follows: "The whole field blighted in August and September (1886) with the exception of the three rows where the kainite was applied."

Prof. J. S. Newman tells me that in some experiments on cotton with different fertilizers about 1885 or 1886 he noted that where kainite or muriate of potash was used the plant held its leaves longer than where it was not used. I regret that I cannot have access to the bulletins published on the subject at that time. The bulletins preserved in the library were destroyed by fire at a later period. As a result of some experiments in 1890†, he says: "Kainite causes the cotton plant to retain its leaves after they have blighted where none is used." This disease was the yellow leaf blight as I know from actual observation.

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* Southern Agriculturist, December, 1887.

† Bulletin No. 22, New Series, Ala. Agr. Exp. Station, page 24.

UNFAVORABLE PHYSICAL CONDITION OF THE SOIL MAY CAUSE THE DISEASE.

It is well known that the physical, or mechanical, condition of different soils varies greatly not only with reference to the coarser or finer subdivision of its constituent particles, but also with reference to the amount of vegetable matter or humus which it contains. It is also well known that plants are greatly influenced by the physical character of the soil. The same soil is even subject to great physical variations during short periods of time, as shown by the different relations of its constituent particles with the varying quantities of water in it, or during longer periods by continual cultivation, removal of vegetable matter, exposure to heat, the washing of rains, etc. It is now believed by some that in many cases the physical condition of the soil can be changed for good by the application of certain chemicals which change the inter-relation of the constituent particles of soil and influence the circulation of water. Plants suffer greatly from improper circulation of water in the soil. There are cogent reasons for believing that the yellow leaf blight of cotton is more or less due to defective circulation of soil water. This is apparent to a greater or less degree from a consideration of the following topics:

Hydrostatic Water in Soils.—When the soil contains an excess of water so that it exists as a liquid, as in low or poorly drained land, the absorptive activity of roots of other than aquatic plants is greatly interfered with, since this excess of water excludes more or less of the oxygen which is necessary for root absorption.* The roots of land plants usually obtain their moisture† from either *capillary* water (when the water exists as a thin film around the soil particles, giving them a moist appearance) or *hygroscopic* water

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* Goodale, Physiological Botany, pp. 244–245.
Johnson, How Plants Feed, p. 199.

† Ibid, p. 242.

(that which adheres to particles of air-dry soil and does not affect their appearance).

Frequently cotton grown in soil possessing *hydrostatic* water has every appearance of yellow leaf blight. Assimilation is probably disturbed much in the same way as in a soil which is too dry; in the one case the excess of water prevents the absorptive activity of the roots, so that the plant is powerless to take up the necessary elements of nutrition in the soil; in the other case the soil is too dry and therefore lacks a sufficient supply of moisture to provide for the solution of nutritive matters held in the soil. In wet seasons, or wet periods of a season, the injurious effects of hydrostatic water in the soil is more wide spread than in ordinary or dry seasons. It may happen that during frequent and excessive rains the hydrostatic water in the soil is so abundant as to exclude an amount of oxygen sufficient to seriously interrupt root absorption on soils ordinarily well drained. This would explain why both in excessively dry, or wet, weather, or in dry or wet soils, the disease is more apt to make its appearance.

Summer Droughts.—During summer droughts when usually excessive heat prevails throughout the cotton belt, evaporation of the capillary water in the soil takes place rapidly and the absorptive activity of the roots is increased, thus making a greater drain upon the moisture in the soil. In very porous soils, or those not retentive of moisture the capillary water in the layer of soil occupied by the roots of the plant is soon exhausted. If the physical condition of the soil is good, the evaporation will be less rapid and at the same time the tension of the film being greater more water is lifted up from the subsoil, thus prolonging a favorable condition of things for root absorption, and lessening the possibility of disease.

In 1887 Mr, Clark, of Hope Hull, writing in regard to the relation of the physical condition of soils in the prairie lands to the yellow leaf blight, says :*

"In my seven years' experience in planting on this place, yellow leaf blight has been with us every year but one, although some years it is more destructive than others. It comes in a dry spell of weather following a wet or a wet spell following a dry—my experience is that it matters not which—the disease follows. Only one year have we been free from it and that was in 1882. A phenomenal year in which we had a light shower almost every week.

"Taking into consideration the fact that it never attacks clay lands which retain the moisture long after the other lands are dried up (my plows have turned up moist soil in clay lands when the porous lands were thoroughly parched) and always attacks porous soils excepting in a year that is phenomenal in maintaining in the soil an equilibrium of water, makes me believe that the "hydrostatic" condition of the soil has much to do with inviting the disease.

"In clay lands which retain the moisture longer, the wet and dry extremes are not so sharply defined and the cotton does not blight.

"Finally, I will add, that land on which cotton blights is not always poor, but on the contrary it may be quite productive. If the yellow leaf blight does not attack the plant until late it may produce a large crop. My experimental tract of 1886 showed a product on land that blighted cotton, and on which the cotton blighted badly that year, of about 1600 lbs. seed cotton per acre, same land when the yellow leaf blight was prevented about 1800 lbs.

How Unfavorable Conditions of the Soil May be Changed.

For quite a number of years it has been known that certain physical conditions of soil detrimental to plant growth

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*Southern Agriculturist.

can be artificially changed. Some of the means of improving the mechanical condition of soils whereby proper circulation of soil water is brought about are enumerated below. No claim is made of a complete reference to all that has been written upon this exceedingly interesting and very important topic. Only such references are cited as have come to the writer's notice.

The effect which these substances have is not only to increase the surface tension of the film of water surrounding the soil particles, but to so arrange the constituent particles of porous or light soils that the area of the free surfaces of the soil particles shall be increased, thereby increasing not only the power of soils in dry weather to absorb moisture from the atmosphere at night, but also increasing the capillary power of the soil. This not only lessens the rapidity with which evaporation takes place from the surface soil, but exerts a greater influence in lifting up water from the subsoil.

Prof. Wagner,* Director of the Agricultural Experiment Station at Darmstadt, Germany, says:

"Unfavorable physical conditions of the soil diminish the guarantee of a satisfactory effect from commercial manures; and yet, in the use of these it is possible to check the interference of the former with plant development."

Alkaline Lyes Make Soils Cohere.—In reference to the action of these, Storer† says:

"One peculiarity which ashes owe to their alkaline quality is worthy of special attention, since it must often exert a very decided influence on the capillary power of the soils to which the ashes are applied. It is a well established fact, that alkaline lyes, that is to say, either the caustic alkalies, or solutions of the alkaline corbonates, viz., carbonate of

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*Hatch Experiment Station, Mass. Special Bulletin. Translation and reprint, May, 1890.

†Agriculture, Vol. II, page 114,

potash, such as is got by leaching wood ashes, and carbonate of soda also, make clay and loam more plastic and adhesive than simple water can. Both carbonate of potash and carbonate of soda tend to keep clay in a 'puddled' or 'tamped' condition, as the terms are. A ball of moist clay or loam thus charged with an alkaline carbonate does not tend to crumble or fall to powder during the process of drying; but remains a hard lump."

Thus potash would not affect favorably the physical condition of heavy clay soils, but would act favorably on the loose soils where cotton is liable to yellow leaf blight more or less every year. In confirmation of this is the observation of some planters in the prairie soils that plowing or bedding such cotton lands while the soil is wet causes it to cohere more closely in drying and tends to prevent the disease.

*Rolling Loose Soils.**—"It seems plain, on the face of the matter, that the tilth of many a porous open soil might be improved if its particles could only be held together a little more tightly than they are held naturally, so that the capillary water may be lifted more freely and retained more forcibly. It was for the sake of securing this result that the Norfolk County farmers laid such stress on having their light soils trampled down firmly by means of cattle and sheep that were fed upon the land, and that the Scotch long since resorted to the use of heavy rollers upon their light lands."

Wood Ashes.†—"I have in fact found, by experiment upon light land, that this very advantage was obtained by the application of wood ashes to the soil. A plat of land dressed during several years with what any farmer would have considered a large quantity of wood ashes became so firmly bound that a yoke of heavy oxen had some difficulty in

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*Storer, Agriculture, Vol. II, page 115.

† Storer, Agriculture, Vol. II, page 115.

dragging a plough through the soil in dry summer weather. The furrow where it crossed this plat was a mere mass of clods. Yet through all of the years of the experiments that plat had manifestly been better supplied with water from below than any of the adjacent plats."

*"It was noticed long ago by Lorain that the ground where the log heaps were burned seemed to be moister than the surrounding soil."

It is important to note in this connection what Mr. Clark told me the past summer of an experiment of his with wood ashes. A quantity were scattered about on a plat of gray land where the cotton became diseased (yellow leaf blight) every year. Since the application of ashes the cotton has been healthy, except at the border of the plat where the ashes were applied thinly.

Planters have also told me that sprinkling wood ashes on the leaves when they show the first signs of the disease will prevent it. It is not likely that the effect is through the leaf, but it might happen that a sufficient quantity would thus be applied to the soil to produce the effect.

Muriate of Potash.—"Muriate of potash used with lime forms some " chloride of calcium† which is hurtful to some plants, and which, as Mayer has urged, may 'bind' the land in some cases. It has not yet been determined whether this particular form of binding would always be hurtful for all kinds of soils."

Salt.—Prof. Wagner‡ says in regard to the action of salt: "Common salt (sodium chloride) of the crude preparations has a binding effect on the soil and increases its power to retain water. It is this effect of crude salts which improves the character of light soils, but which, on the other hand,

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* Storer, Agriculture, Vol. II, page 116.

† Storer, Agriculture, Vol. II, page 125.

‡ Wagner, Agr. Exp. Station, Darmstadt, Germany.

Hatch Exp. Station, Mass. Translation and reprint. Special bulletin, May, 1890.

deteriorates heavy soils already possessed of too much binding quality. It is not advisable, therefore, to manure heavy soils with kainite or common salt."

In this connection see the effect which salt has in preventing yellow leaf blight as determined by the experiments at Hope Hull detailed above. It is also interesting to note that for many years salt has been regarded by some planters as a preventive of the disease.

Humus.—This also has its advocates as a preventive of disease, while the testimony of others is against it. It is very important to observe, however, that so far as I have heard, failures have been reported where there was an abundance of humus in heavy soils; but where the soil was sandy, the effect was beneficial. Humus alone, as is well known, is more retentive of moisture even than clay, and when mixed with porous sand* it greatly improves its capillary power. Aside from its possessing nutritive properties, it tends to prevent this disease of cotton when developed in sandy soils. This may be done by dressing with vegtable composts, or by the growth of "cow peas," allowing the vines to rot on the soil. In this connection farmers will do well to refer to a recent bulletin by Dr. N. T. Lupton, entitled Pea Vines as a Fertilizer.†

Too much organic matter, however, so lessens the capillary power of soils that they dry out quickly.

Kainite.—On the effect of kainite the following quotation is of interest: "Upon heavy impenetrable soils kainite should be used with caution since it renders the ground in the highest degree damp, and this result in such soil is not desirable, while in light dry soil it is of the greatest importance."‡

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* See Johnson. How crops feed, p. 162.

† Ala. Agr. Exp. Station, Bulletin No. 14, 1890.

‡Ratschläge für die zweckmässsige anwendung der Kainite—Düngung, Magdeburg, 1890, p. 5.

Effect of cultivation on the retention of moisture.—The more recent practice followed by many farmers of shallow cultivation of the crops by means of the scrape has the effect to conserve the moisture to a greater extent than deep cultivation would in dry seasons. A careful and thorough preparation of the soil before planting is necessary to prevent a too hardened and compact condition. Shallow cultivation at the proper times will keep down all weeds and also lessen the rapidity of evaporation of water from below, since the pores of the soil being larger in the loose upper layer, the surface tension of the film of water will have little force in pulling water up from the undisturbed layer below, because there is an abrupt transition from a less extent of surface of soil particles in the loose layer to the great extent of surface of soil particles in the undisturbed layer. In other words, the loose soil left by the scrape acts as a mulch to prevent a too rapid drying of the underlying soil.

Plants require more water from poor than from rich soils. While it is probably true to a certain extent, as has been frequently stated, that soils strongly charged with nutritive salts are not required to supply so great an amount of water to the plant as those containing but little of these substances,* yet it is also known that plants have to some extent a selective power in root absorption, so that they select generally those substances required for nutrition.

Since writing the above, I have received the report of the Physicist, Prof. Milton Whitney,† on "Soil Investigations," of the Maryland Agricultural Experiment Station for 1891,

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* Sachs, Textbook of Physiology.

Die Landwirthschaftlische Versuchstationen 1858, I, page 203.

Botanische Zeitung, 1860, No. 14.

Pflanzen Physiologie, Pfeffer's, Bd. I, p. 151.

† Professor Whitney has been engaged for several years in the study of the physical condition of soils as related to water circulation, and already quite important results have been reached.—See Agr. Science, Vol. IV; also Annual Report S. C. Agr. Exp. Station, 1890.

recently published. On page 257, he says: "Salt and kainite, on the other hand, increase the surface tension of water very considerably and raise it far above that of the soil extract. This probably explains the fact, which has often been commented on, that an application of salt or kainite tends to keep the soil more moist. * * * * *

"By increasing the surface tension of the soil moisture they increase the power the soil has of drawing water up from below in a dry season."

The amount of potash which a plant removes from an acre of ground is no indication of the amount of potash that should be applied per acre, for some plants taking from the ground one-sixth as much potash as certain others require an equal amount of potash applied to the ground.*

The best time to apply kainite if there is any danger of its injuring plants is in the autumn or winter months. It should be plowed in. The injurious chlorides leach out while the nutritive salts are absorbed.†

EFFECT OF KAINITE ON THE YIELD OF COTTON.

The influence which kainite exerts upon the yield of cotton varies greatly, depending upon a variety of conditions. In dry seasons the testimony is almost universal that kainite increases the yield, at least where used with a basis fertilizer of the character of cotton seed meal and acid phosphate, to supply phosphoric acid and nitrogen, or even when used alone on some soils which have been treated with such a fertilizer for one or more years previous, or in soils well supplied with those elements. The past season has been a good one for such results, since there were two quite long periods of drought.

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*Dr. Paul Wagner. Kali—Phosphat—Düngung nach Schultz—Lupitz, P. 71.

†Dr. Paul Wagner. Die Rational—Düngung der Landwirtschlaftlischen Kultenpflanzen. Zweite Auflage, Darmstadt, 1891. (See, also,) Maercher. Die Erfolge der anwendung verschiedener Kalisalze unsbesondere der Kainits in der Praxis. Zweiter Bericht, 1891.

The Experiments at Mr. Clark's show the increase when it was used with a basis fertilizer composed of cotton seed meal and acid phosphate. My experiments at Auburn show an increase from kainite alone on soil treated the previous year with compost composed of stable manure, acid phosphate, and cotton seed meal. In any season on very poor soil deficient in phosphoric acid, nitrogen and vegetable matter, potash alone seems to have very little effect in increasing the yield, but its value when used with nitrogen and phosphoric acid is pretty well established.*

Soils of different mechanical condition also respond in a widely different manner to applications of potash. The following notes are taken from Prof. J S. Newman's report on coöperative soil tests.†

At Uniontown in "black slough bottom" kainite alone decreased the yield from 1702¾ lbs. seed cotton per acre to 1518¾ lbs. The yield was also decreased with kainite in combination with sulphate of ammonia, while the latter alone somewhat increased the yield.

At Athens, on "badly worn red land" when kainite was applied alone, the effect, allowing for corrections, is scarcely perceptible, a slight increase to its credit from 150 lbs to 166 lbs. seed cotton per acre. In combination with sulphate of ammonia there was a decrease, while in combination with dissolved bone black there was an increase of 270 lbs. to 630 lbs.

Dadeville, sandy loam with clay subsoil, kainite alone increased the yield from 720 lbs. to 1260 lbs. per acre; kainite and sulphate of ammonia from 720 lbs. to 870 lbs. Kainite and dissolved bone black from 1020 to 1350 lbs; and kainite, sulphate of ammonia, and dissolved bone black, from 1020 to 1830 lbs.

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*McBryde. South Carolina Experiment Station. Bulletin No. 2, New Series, Clemson Agricultural College, 1891.

†Bulletin No. 23, New Series, Ala. Agr. Expriment Station, 1891.

At Aberfoil, on "thin sandy soil . . . . four feet to clay . . . . planted in corn for three years without fertilizer except" the previous year when 100 lbs. cotton seed meal per acre was applied, kainite alone increased the yield from 82½ lbs. to 315 lbs. seed cotton per acre; in combination with sulphate of ammonia and dissolved bone black, from 105 to 768 lbs.

As early as 1882, Dabney* found from coöperative experiments that in some soils kainite decreased the yield, producing weed at the expense of fruit, while in other soils it increased the yield, alone in some cases, in other cases in combination with other fertilizers.

McBryde† has shown (p. 46–47) that as far as yield is concerned the potash can be obtained equally well from kainite, muriate of potash, or sulphate of potash, and that having determined the lowest maximum profitable dose of potash in combination with a certain dose of phosphoric acid and nitrogen, double or quadruple doses of potash without increase of the constants will not increase the yield (p. 38–39).

At my request, S. M. Tracy, Director of the Agricultural Experiment Station of Mississippi, has pointed out the effect of kainite on the yield as determined from several trials on some of the soils of the State. The following quotations are made from publications of that Station:

"In 1888‡ the best results were from the use of cotton seed hull ashes, of which 400 lbs. per acre made an increase in yield of nearly seventy-five per cent. over what was grown on adjoining unfertilized plats, and at a cost of fifty-five cents per one hundred pounds.

In 1889 the greatest increase in yield came from the plats which received 200 lbs. of kainite per acre, and this increase was secured at the smallest expense per hundred pounds,

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*Annual Report, N. C. Agr. Exp. Station for 1882.

†South Carolina Exp. Station, Bulletin No. 2, New Series, Clemson Agr. College. 1891.

‡Third Annual Report, Miss. Agr. Exp. Station, pp. 8-9, 1890.

fifty-three cents. The increased yield of 160 lbs. from the use of ten tons of stable manure per acre, cost sixty-two and one-half cents per one hundred pounds."*

At the Holly Springs Branch Station, 1889, "plat 4, which received 200 lbs. of kainite, gave much the largest as well as the most profitable yield of any plat fertilized with a single ingredient, and a larger yield than plat 6, where acid phosphate was substituted for one-half the amount of kainite applied to plat 4."

"† The Station has been in existence three years, and has tested about fifteen fertilizers each season on the yellow clay soils which are typical of the hill regions of the State. In nearly all cases plats have been duplicated each season, and in many cases three or four plats have been used as duplicates. It has been our uniform experience during three seasons that the purchase of concentrated nitrogenous fertilizers is not profitable; that acid phosphate alone is only occasionally profitable; that potash fertilizers, either in the form of kainite, sulphate of potash, or ashes, have always given a fair profit. We have also found that a fertilizer containing a large per centage of potash with a smaller amount of phosphoric acid has invariably given a greater net profit than has any single commercial salt. While good results have always been obtained by the use of a mixture of potash and phosphoric acid salts, results have been still better when the soil has received a fair supply of vegetable matter in addition. Whether this vegetable matter is derived from composting the commercial salts with meal, cotton seed, or stable manure, seems to make but little difference though if manure is used much more will be required than of the meal or seed. The work has been mainly to determine as far as possible the elements most needed, which, as stated above appear to be a liberal supply of potash, to which should be added some other material which will furnish a smaller amount of phosphoric acid and nitrogen, together with the necessary vegetable matter. At present prices, kainite is the cheapest form in which to buy potash, while the other elements needed may be furnished in cotton seed, cotton

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*This note on cotton seed hull ashes is inserted because of the presence of potash in the fertilizer.

†Ibid, pp. 14-15.

seed meal, or stable manure, the choice depending on the local supply of each available."

The results of experiments for 1891 have not yet been published, and Prof. Tracy has kindly prepared the following statement of those worked out at this writing:

"In 1891 eight plats were fertilized with variations of Furman's formula," and the plats receiving an application of the compost in which the prescribed amount of acid phosphate was replaced with an equal weight of kainite, gave about 30 per cent. heavier yield than did the plats receiving two parts acid phosphate to one of kainite." "At the branch station at Lake, in the pine woods region, acid phosphate gave much better results than did potash, and the potash plats suffered most from 'rust,' if you know what that is."

Prof. Tracy had formerly sent me specimens of the diseased cotton on these potash plots, and I was not surprised that the potash did not prevent the disease. The disease, while called "rust" by nearly all planters, is very different from the disease treated of in this paper. I am not yet certain as to its etiology. In the early stages the leaves have a water soaked appearance in definite areolate spots, which are lighter in color when viewed by transmitted light. The spots soon become black, later brown in centre and black bordered. Sometimes the spot is a long one following one of the main ribs, with a zigzag border. From the earliest appearance of the disease the tissues are swarming with bacteria. By careful attention to my description of the yellow leaf blight treated of here, any one could distinguish it from this bacterial disease. In my own experiments kainite has had no effect in preventing this bacterial disease.

II. RED LEAF BLIGHT.

"Red rust" is a term frequently applied to a reddened condition of the plant often seen on worn-out sandy land, or uplands. It is a hastened maturity of the plant induced by an impoverished condition of the soil, showing a lack of nitrogen and potash, and probably also phosphoric acid. A red coloring substance, known as erythrophyl, is developed in the cell sap of the leaves.* This can be remedied by proper fertilizing.

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* Sometimes a reddening of the leaves is produced by the irritation of mites.—See Bulletin No. 29, New Series, Ala. Agr. Exp. Station, 1891.

At the request of a firm in Baltimore, Boykin, Carmer & Co., I tried a preparation of theirs called "Cerealite" on very poor sandy land, to test its efficacy in preventing this hastened maturity and reddening of the plant. The land was fertilized very lightly with stable manure, about 500 lbs. per acre. As directed by them, the "Cerealite" was applied as a top dressing at the second plowing of the cotton. It effectually prevented the reddening of the plant and prolonged the period of growth and fruiting, also greatly increasing the yield. The contrast was so great between the fertilized plats and the checks that I photographed one average stalk from the former and two average stalks from the latter. They are shown in plate II. The increase in yield of the treated plat over the untreated plat from which the stalks in this photograph were taken was 225 per cent., from 132 lbs. seed cotton per acre on the untreated to 429 lbs. on the treated.

This "Cerealite" was also tried on upland of a better character which was fertilized the present year with compost of stable manure, acid phosphate, and cotton seed meal to determine its value in preventing the yellow leaf blight. There was little of the disease in any part of the tract, but a slight improvement was shown in favor of the "Cerealite." Analysis shows the fertilizing material to be potash and nitrogen.

The same fertilizer was tested on the prairie soils by Mr. A. H. Clark, at Hope Hull. The results were not very marked. The "Cerealite" for all these experiments was in three different forms containing various relative proportions of nitrogen and potash. From other experiments we should expect the potash to show a tendency to prevent the disease. This was the case to a slight degree in two of the forms, while in one there was no improvement. As it was applied inter-culturally we would not expect the nitrogen (probably from nitrate of soda) to produce any effect. Indeed Mr. Clark thinks nitrate of soda applied inter-culturally to the dark prairie soils is really injurious to the cotton plant.

NOTHING.

POTASH AND NITROGEN.

Bulletin No. 37. **March, 1892.**

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

TOBACCO.

A. J. BONDURANT, Agriculturist.

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TOBACCO.

SELECTION OF SEED.

As a staple crop in the United States, good Tobacco pays well; and good seed is considered very essential as regards tobacco.

The seed affect and control the types, grades and prices generally. Soil, climate and the management of tobacco, determine the character of the product.

The variety must be adapted to the type desired to be raised, and the soil adapted to the type, or failure will certainly follow.

Bright, yellow tobacco will not succeed on dark, rich, loamy soil, nor can the rich, dark, English or Continental shipping varieties be profitably produced on poor, gray or white sandy soil.

VARIETIES OF TOBACCO.

No certain guide can be given for the selection of varieties suited to the several types. The difference of soil and climate must be carefully considered in the selection of seed. The seed that may be suitable for some localities, may not be suitable for others, and experimenting must determine what is best for each locality. Experience in some of the large tobacco raising States, justifies a recommendation of the following varieties: For dark, heavy rich shipping, the James River White-stem, the James River Blue Pryor, and the Medley Pryor, and these are regarded as standard varieties.

For sweet fillers, the Sweet Oranoko and Flanagan.

For stemming into strips for the European market, the Hester, Tuckahoe and Big Oranoko.

For mahogany wrappers, the Flanagan, Primus and Long Leaf Gooch.

For Cutters, the Hyco, Yellow Oronoko, Granville Yellow, Yellow Pryor. For Yellow wrappers and fillers, the Sterling, Granville, White Stem, Yellow Oronoko and Yellow Pryor. White Burley, which is grown on the limestone soils of Kentucky and Ohio, is a favorate in those States, but can not be successfully raised on silicious soils, and has not been adopted in the large tobacco producing States other than these.

PLANT BEDS.

The first and most important object towards preparation for. a crop of tobacco, is to prepare a sufficiency of good plant land, as it is impossible to make a good crop without plenty of good plants in time, when the season for planting has arrived. There are several modes for raising tobacco plants, some of which will be stated.

OPEN AIR BEDS.

Where wood is plentiful, the open air beds are the most desirable, as the plants will stand transplanting better, will have stronger roots and usually will grow-off better than plants raised in the hot bed. In the Gulf States, the beds can be burnt at any time from the first of December to the middle of February, and probably late as 15th of April. Select moist spots in the woods, with southern or south eastern exposure, neither too wet nor too dry, as rich naturally as can be found, and free from grass and weeds. Clean off the timber so as to have plenty of wood for burning the bed, and to let in plenty of sun. Measure off the size of the bed desired, lay down small poles parallel with each other, about two feet apart for skids to lay the wood on so it can be moved easily. Place the wood in a pile across the bed, making the piles sufficiently large to make a strong fire, which should be allowed to remain burning from forty-five minutes to an hour, before it is moved; then with long wooden hooks, or iron hooks, fastened to a light pole, stand in front of the fire and draw the wood forward so as to burn the adjacent ground covering about four feet, and continue in this manner until all of the ground laid-off for the bed is burnt. The burning should be long enough to cook the ground half an inch deep—and be careful not to burn when the land is wet. As soon as the earth is sufficiently cool, take off the heavy coals that may be left from burning, allowing the ashes to remain, as they will aid in fertilizing the bed. Then take the farm implement known as the coulter, hitch one or two horses to it, so as to break all the roots, and plough the bed deep and close both ways, taking care not to bring the sub-soil to the surface; pick off all of the roots, and make the soil fine by repeated chopping with grub hoes and hand-rakes; then apply fine hog-pen manure, or any good manure that is certainly free from seeds, or some good fertilizer, chop it in and rake the bed over until it is smooth and level, when it will be ready to sow.

Sowing the Beds.

Mix the seed thoroughly with ashes or sand, which should first be run through a sifter, allowing a tablespoonful o seed for every hundred square yards. Sow once regularly over the bed, reserving seed enough to cross sow to insure regularity. About the time the seed begin to come up, it will be well to re-sow about one-half the quantity of seed, so as to have late plants for replanting, should such contingency exist. The seed can be gotten in by whipping over the bed with a light brush, or raking with a light rake. A small wooden roller, to be pulled by hand, is also sometimes used for this purpose.

Fine brush should be used as a covering after the bed is seeded, and this must be placed thickly over the bed to hold the moisture, and to protect the young plants, when they come up, from the frost. If the plants come up well, there will be a thousand or more for every square yard.

Dig a trench around the bed to keep off water in hard rains. Also run surface drains through the bed, with inclination sufficient for the water to flow off; these should be made with the grubbing hoe, about four inches wide and three or four inches deep.

Canvass Covering For Plant Bed.

As an effectual means of preventing the ravages of the flea bugs, a covering of thin cloth, cheese cloth is now much used on plant beds.

This also makes the bed warm, and acts as a cold frame, the canvass taking the place of glass, hastening the growth of the plants and protects them from freezing.

A cloth for plant beds is prepared by some of the water proofing fibre companies of New York.

Frame for Open Air Beds.

Boards should be placed all around the bed close to prevent the small black beetle, or flea from creeping through.

The boards should be eighteen or twenty inches high on the upper side, sloping to ten, or twelve inches on the lower side.

Prepare small stakes, small round poles, from one and half, to two inches in diameter, will answer for this purpose, sawed into gradual lengths from two feet to eighteen inches long and sharpened at one end.

Drive the stakes six feet apart in rows, through the bed, for the laths, two inches wide and one inch thick to rest upon. The middle lath should be one inch thick and six inches wide. Drive strong nails all around the outside of the boards from five to six inches from the top edge, next drive nails in the middle board, which should be placed in the middle of the bed, also nail the middle board to the stakes. Nail the laths on to the boards and where they rest on the stakes.

Make the canvass covering in two pieces, each the size of half of the bed, and sow on the outer edge, all around each cover, loops of cloth of strong domestic, say eighteen inches apart, to receive a cord, which must pass through loops all around and tie, and the cover is ready to be placed over the bed and fastened by pulling the twine or cord over the nails all around, letting the two covers meet in the middle over the six inch boards, or middle lath.

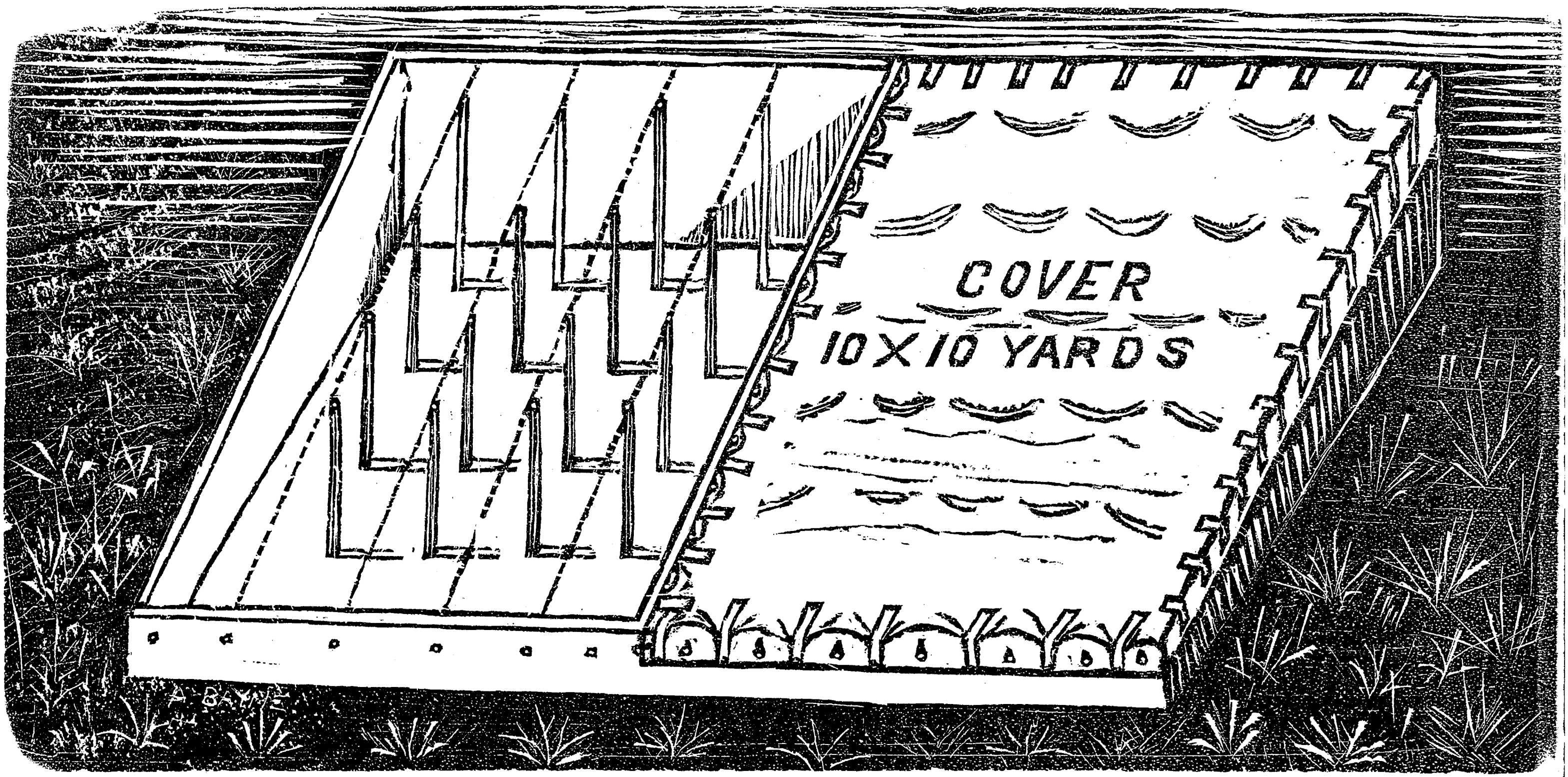
By this arrangement, the cover is made secure over the bed at the right distance above the plants; and can be readily removed from the bed, and replaced when it will be necessary to do so.

With a plant bed protected in this manner, it is probable that plant beds can be prepared in this State as late as the middle of April.

The cut on the following page represents a plant bed prepared for covering with canvass and the canvass covering for the same.

THE HOT BED.

Make a frame of sawed timber say, six feet by twelve, which is given as an example, and increase to any size desired, with a southern or south eastern exposure. Let the frame be eighteen inches or two feet high on the north side to about twelve or fifteen inches on the south, and place in unrotted manure that is free of all seeds, to the depth of about one foot; then cover the manure with soil (woods mould is best) five inches deep. Sow the seed on the bed at the rate of two teaspoonsful to a bed, say six by twelve feet. Cover the bed with thin muslin or cheese cloth, and tack it down.


COVER
10 X 10 YARDS
A. BAYNE

WHEN TO SOW TOBACCO BEDS.

In the old Tobacco raising States, there is difference of opinion on this point. Some contend that it is best to sow as soon as the bed is burnt, as it is in better condition, for receiving the seed at that time than it is likely to be afterwards, and, that the seed will remain sound in the ground and not germinate until the warm days of early Spring. If the bed is well mulched with rotten chaff or pine straw, to the depth of about half an inch, it may be safe to seed the beds at the time of burning, if burnt early.

In portions of Virginia adapted to the dark varieties of tobacco many of the best tobacco raisers contend, that from the 15th to the 20th of February is as early as the seed should be sown. In this State, as well as others, of about the same latitude, where vegetation is usually several weeks in advance of some of the tobacco raising states, it may be well to make the experiment of sowing part of the beds early, and the rest say, about the last of January or early in February, or even on until April.

MANURING THE PLANTS.

As soon as the plants have attained the size of a silver quarter of a dollar, or in agricultural phrase, gotten "square," the brush or canvas should be taken off so as to toughen the plants, and the growth forced by frequent applications of fine stable manure, cow manure or some commercial fertilizer. This will have the effect of preventing the ravages of the pernicious insect called the fly, or flea, and insure such rapid growth of the plant, that, it will soon be out of reach of *the flea.* If these applications do not check the fly or flea, it is well to use insecticides and spray the plants.

Care should be taken not to apply the manure or fertilizers to the plants until all of the morning dew is off, or after rains, until the leaves are perfectly dry.

A good time to make the application is, just before a shower.

In many of the tobacco raising States, the fly will attack the young plants in swarms—principally during the cool days early in the spring, while they are quite small and tender; and if not checked in time, will destroy a plant bed in a few days.

TRANSPLANTING THE PLANTS.

In this State, the plants should be large enough to set-out by the first of May. Showery and cloudy weather is the best time for transplanting.

When the bed is wet or damp in the morning, draw the plants, lay them in straight rows, and protect the leaves from mud and dirt. In setting-out the plants, a sharpenend stick is used for making a hole in the hill. Put in the plants and press the earth firmly about them, and this operation should be performed with care, if you want an even stand.

PREPARATION OF THE LAND.

The preparation of the land for setting-out the plants, depends on a variety of circumstances, whether the land is new or old, clean or covered with vegetation.

The two important essentials in preparation are to make the land rich, and to plough and harrow it until it is well pulverized. Then lay-off the rows three and a half feet wide, and drill in the rows some reliable fertilizer, using from one hundred and fifty, to three hundred pounds per acre, or more, according to the natural strength of the soil. Follow with a one horse turning plow, throwing three or four furrows on the fertilized trench, and then put up hills with the hoe about three feet apart. On light, sandy soils, the plants can be set without hilling.

More tobacco in weight, and a finer quality can be made at the distance indicated on rich land, than any other.

Increase the distance, and the tendency will be to increase the size and coarseness of the plant; vice versa,—reduce the distance to three feet or less, and the size of the tobacco will be diminished, and increased in silkiness and closeness of texture, with dimunition of the weight.

CULTIVATION OF THE CROP.

As this part of the operation is simple, it is unnecessary to treat it much in detail, and only a concise view of the most prominent points will be alluded to.

The first working should be commenced as soon as the plants have taken root sufficiently to bear cultivation with the hoe, which should be used to lighten the ground, and remove all grass or weeds from the plants, and give them a good chance to start off early with their growth.

It is generally unnecessary to plough the land at this working, as the earth should be loose from the recent preparation for planting. Should it prove to be hard, or baked, a condition which may exist on stiff soils, the surface should be well stirred with the hoes and ploughs, and care taken not to pull dirt from the plant.

For the first ploughing, no implement is better than the wing coulter; the next best, double shovel, with the small shovels or coulters, or a light cultivator.

The second ploughing may be done with the turning plow or cultivator.

The last ploughing is most effectually done with three furrows, with the turning plow to each row, or with the single shovel—a furrow on each side and then splitting the middle with the third and last furrow. Short single trees must be used after the plants are half grown, to prevent tearing and breaking the leaves.

The roots of the tobacco plant in rich and well prepared ground, grow rapidly, and the crop for this reason should be well cultivated early in the season; but, if cultivated late, it is best for this to be done with hoes, so as not to disturb the roots of the plant.

CUT AND BORE WORMS.

In the early period of the plants growth, after transplanting, it is important to guard against the ravages of the cut and bore-worms, which feed upon the roots of the young plants about the time they are taking root, and if not destroyed, will give much trouble in getting the plants to take root and grow, and much replanting will have to be done, which, will prove the means of making the crop uneven and irregular in ripening.

TOPPING AND PRIMING.

On this point, there is a difference of opinion. Breaking off the small and inferior leaves, about four near the ground, is called priming or pruning, and this operation is done at the time of topping, if done at all.

All tobacco raisers resort to topping, that is, plucking out the seed or flower bud, which is done when the seed flower begins to form, and before it blossoms.

This operation should not be commenced too early, as the size of the plant will be diminished by premature topping. As a general rule, it is best that the plant be at least eighteen cr twenty inches high before it is topped.

Some successful tobacco planters do not strip-off the lower leaves, called priming, believing, that they can make more tobacco in weight, and as of good quality, by simply topping to twelve or fourteen leaves, four leaves being the number usually taken off in priming, or as some call it, pruning; contending that the lower leaves serve to shade the hill and keep it moist, thereby promoting the growth of the plant, and that the taking of these lower leaves off in priming bleeds the plant and retards its growth. If this plan is followed, it is best to confine it to the silky or bright varieties of tobacco.

To obtain thick, heavy tobacco, it is best that the plant should be primed and topped.

The number of leaves left on the plant after topping, depends on many conditions, namely : the time the topping is done, early or late, the season, strength of the soil and the general appearance and vigor of the plant. On the average soils, in ordinary seasons, the first topping should be from ten to thirteen leaves for bright tobacco—for fillers, from nine to eleven, and for English and Continenal shipping, fron eight to nine. In this crop, quality, more than quantity, largely regulates the price that will be obtained.

THE HORN WORM.

About the time of topping, the tobacco plant is visited by a green worm, called the horn worm, which feeds on the tender leaves, and if not watched. and destroyed, will ruin a plant in a few days. It is well to look after the eggs of this worm, which are about the size of a pins head, and are deposited by the tobacco fly on the underside of the leaf, and when found, destroy them.

TOBACCO MOTH.

This is the moth that lays the egg, that hatches into the horn-worm. The moth usually makes its appearance in May. The eggs deposited by this first moth will hatch out in a few days. The worm commences to feed upon the plant as soon as it is hatched; will get its growth from twenty to thirty days and then gorges itself, and crawls and burrows in the ground, usualy under the growing plant, and in a short time, not longer than twenty or thirty days, is transformed into the moth, and comes forth to lay more eggs on the plant.

This second moth will lay more eggs than the first. It has been computed that the first moth that appears, will lay about one hundred eggs, and the second moth, at least two hundred.

REMEDY FOR THE MOTH.

Every moth should be destroyed as they appear. This can be done with a few drops of sweetened cobalt, by injecting it late in the evening into the flowers of the Jamestown weed, or honey-suckle, as they usually collect at these blossoms. Many other insecticides may be as useful for this purpose as the sweetened cobalt.

In some tobacco raising sections, the artificial flower of the Jamestown weed is used to attract the moth from the fact, that when the blossoms of the natural plant once receives the poison, it will soon decay.

SUCKERS.

Soon after the plant is topped, it begins to put forth suckers, which, together with the worms, which will have hatched-out by this time, must be kept off, by going over the crop at least once in ten days, as negligence at this time is attended with serious injury to the crop by the growth of the suckers, and ravages of the horn-worm.

CUTTING.

Usually in six weeks from the time the plants are topped, they will be ripe and ready for the knife. This can be determined by the condition of the plant. When it has attained its greatest perfection, the leaves will become thick and brittle, and the color changes from dark green to a pale yellowish green.

The process of cutting is simple. The cut consists, in placing the knife to be used (about the size of a butcher's) on top of the stalk in such a direction as to split the stalk about half way to the bottom, without cutting off the leaves.

The stalk is then cut off below the bottom leaf, and the plant is their set upon the ground, with the leaves resting on the ground, and the stalk turned up, so as to expose the stems of the leaves to the sun, that the plant may become wilted and limber to handle without breaking.

It is not advisable to cut early in the morning when the dew is on the plant, as it is liable to become dirty if set on the ground when wet.

As soon as the plant has become sufficiently limber to handle, without breaking, it is ready to be placed on the stick. Pine sticks riven three fourths of an inch, by one and a fourth inch, and four and a half feet long, drawn smooth are used for placing, or hanging the tobacco plants on.

If the weather is hot, the plant must be closely watched to prevent it from scalding, or sun-burning, and for this reason, under these conditions, it should be placed on the stick as soon as it can be well handled. Stick the stick obliquely into the hill under the roots of the stalk, so as to keep the plants off the ground, and place eight or ten plants on each stick.

By this method, the tobacco plants may remain sticking in the hill for a day without injury, if the weather is good and not hot enough to sun burn it on the stick, and then can be placed on plain scaffolds put up in the field, or removed to the tobacco barn as circumstances may admit. If the weather is fair and mild the day after cutting, it is best to scaffold, that the sun may commence the curing process, by yellowing the plants and reducing the sap, which will aid in the curing process, when fire is applied to the tobacco in the barn. Per contra—should the weather be rainy or windy about the time of cutting, it should be removed from the field to the barn, and hoisted up, leaving a space of eight to twelve inches between the sticks, throughout the house, according to the size of the tobacco.

TOBACCO BARNS.

In building the barns, it is best to build small houses, as the loss will be less, should it be burned in curing the tobacco. (On the whole it is better to have small houses.) Log barns, ranging from sixteen to twenty feet square, are good sizes. Build the house twenty feet high in the body, and cover with shingles or boards. If the size is twenty feet, lay off for five rooms, four feet apart, and place tier poles across to form the lower tier. The first row of tier poles should be put in as soon as the house is built up, about five or six feet—this is usually called the ground or lower tier, and is not used generally for curing, but to place the sticks of tobacco on, until it is convenient to hoist it up—regulate, and place it on the tiers higher up in the house.

Next, build with logs three feet higher all around the house, and put in another course of tier poles directly over the first. Continue to build, using smaller logs, place three feet higher all around, putting in the tier poles as before stated, until five tiers are placed in the house; by this means five rooms and five tiers will be secured.

By this arrangement, the tiers are three feet apart vertically, and the body of the house as high as it is wide and deep. The roof is built to conform to the plan of the tiers below, and to have three tiers above the joist, varying in length.

A tobacco barn of this description will hold six or seven hundred sticks of tobacco, with six or eight plants on a stick.

For curing bright tobacco, it is important to have the house closely chinked and daubed throughout.

Curing.

This is one of the most difficult parts of the whole management of the tobacco crop, and requires intelligence and careful watching to carry it to successful completion.

There are many plans followed, as some soils are adapted to the dark tobaccos, and others to the bright, yellow tobaccos, and several modes of curing will be alluded to.

Curing English Shipping.

For dark English shipping, the following plan is quite common and is considered a good and inexpensive one by many good tobacco planters.

When the tobacco barn has been filled with tobacco, and the wood prepared, and it is best to have a mixture of green and seasoned wood, start the fires, and commence with moderate fire, and increase gradually, and in three or four days the tobacco will be sufficiently cured as to require only occasional firing during damp days, or rainy days, or in the morning for a few hours.

When the fire is started, it should be kept up day, and night, until the process of curing is finished. Dark, heavy shipping tobacco is now much cured with flues, as with the flues you get the heat, without the smoke, and get rid of the objection raised against the smoke taste of the tobacco, and run less risk in curing than with the open fires.

BRIGHT, YELLOW TOBACCO.

In curing this class of tobacco, it is very important that the tobacco barn should be closely built ; it should be made as near air tight as possible, and so constructed that ventilation can be easily and quickly controlled.

The curing of this kind of tobacco is done with flues built in the tobacco barn, and this is a difficult process, requiring the exercise of skill, attention and practice to insure the best results. The process is so variable, and dependent on so many conditions, that no certain plan can be followed at all times. Experience, and use of the head, will be the best way to learn this process.

The method that is followed by some of the producers of bright tobacco in Virginia and North Carolina, commonly called the Ragland Method, is as follows :

First—Yellowing process, ninety degrees, from twenty to thirty hours.

Second—Fixing color, one hundred degrees for four hours, increasing two and a half degrees every two hours, and twenty degrees from four to eight hours.

Third—Curing the leaf, from one hundred and twenty degrees to one hundred and twenty-five degrees, six to eight hours.

Fourth—Curing stalk and stem, from one hundred and twenty-five degrees, to one hundred and seventy-five degrees, increasing the heart five degrees an hour, and continue at one hundred and seventy degrees, until stalk and stem are thoroughly killed and dry, which usually requires from twelve to fifteen hours.

The above method of curing bright tobacco has recently been simplified and somewhat improved, and the method now given is followed to a considerable extent. As soon as possible after the tobacco is cut place it in the house, and after warming the barn two or three hours to a temperature of about ninety degrees, increase the heat rapidly up to one hundred and twenty-five degrees, or as high as it will bear without scalding the tobacco, letting the heat remain at one hundred and twenty-five degrees only a few minutes, and then by drawing the fires and turning the dampers, cut off the heat and let the temperature of the house descend to ninety degrees.

SUN-CURED TOBACCO.

If the crop is too thick and of coarse texture, and not strictly suitable for bright yellow, it will be wise to cure it sweet.

For this purpose erect scaffolds at or close by the barn and place the tobacco on it as soon as it is cut and hauled from the field. This is important from the fact that after the tobacco is cut, it should not be caught in the rain during the process of sun-curing. If rain is expected put it in the barn, letting it remain there until all danger of getting it wet is past, and then replace it on the scaffold until it is well cured by the sun, and then place it in the barn and regulate it on the tier poles. Tobacco cured by this method usually sells well if properly managed, and is highly valued by manufacturers for making a fine article of chewing tobacco.

ORDERING.

After the tobacco is cured, it must be taken down out of the barn when the time has come to commence working on it, usually called by tobacco planters "stripping time." This work is usually done during the winter months.

The tobacco should be taken down out of the barn on the sticks, and this taking down process must be done when the leaf of the plant is sufficiently pliant so as not to break the stems of the leaf when packing, or bulking it down in the barn. And judgment must be used in taking it down, guarding against its being in too pliant a condition, or as tobacco raisers say, too high in order. If taken down in too high order, there is danger if the weather gets warm after it is bulked, of its getting sour and moulding in the bulk. This taking down, or commonly called by tobacco raisers "striking process," can be done to best advantage on warm damp days late in the fall, or after a warm rain.

STRIPPING.

Tobacco leaves should be stripped from the stalks in pliable order, and the leaves on every plant should be carefully assorted, and the different grades tied up in separate bundles. Three grades are generally made in stripping, and occasionally as many as four grades are made. The lowest grade known as lugs, which consist of the ground leaves of the plant, after being assorted, are tied up in bundles with ten or twelve leaves to each bundle. The first and second grades, put from six to eight leaves in a bundle. As the tobacco is stripped, either place it on sticks and hoist it up in the house, putting from twenty to twenty-five bundles on a stick, or bulk it down in two layers with the head, or tied end of the bundles facing outward.

The method of replacing it in the house as fast as the stripping is done, is a good one if the crop is not to be sold until late in the winter, or early spring. If the crop is to be marketed soon after stripping, the latter method is a safe one to follow, if it is watched frequently to see that it does not heat in the bulk. If the bulk becomes warm, it must be broken up, aired and rebulked, or placed on sticks and hoisted up in the barn to be dried out, either with moderate fire or windy weather. Tobacco is in safe keeping order for market when the leaf is pliable, and the stem will crack half way down the tie.

MARKETING.

If the tobacco is to be sold without packing in tierces or hogsheads, deliver it to market so the qualities will be uniform from undergoing inspection. Bright tobacco packed in hogsheads or tierces should not be pressed hard enough to bruise, and when packed should weigh about four hundred pounds net for a tierce and eight hundred for a hogshead. Pack each grade separately, uniform in color and length; but if it is necessary to put more than one grade in a tierce, place something between to mark the different grades.

If the crop is adapted to the export trade, that is, dark, thick, shipping, it can be packed in hogsheads to weigh from twelve to fourteen hundred pounds net.

The tobacco will bring a good price if it is of good quality, sound and nicely handled, although poor and nondescript kinds may at the time be selling for less than the cost of production.

The tariff of two dollars a pound, recently placed on foreign tobacco is having a favorable influence on this industry, and should induce land owners who find many other crops unprofitable, to give the tobacco crop a trial.

The tobacco crop has been a leading industry, and its cultivation well understood between the fortieth and thirty-fifth parallels of latitude.

In this State, South Carolina, Georgia and Mississippi, it has been grown to moderate extent for home consumption. Sufficient experiment has not been made to ascertain what varieties will succeed best in these States. It is known that South Carolina has produced some good bright tobacco, and Florida produces a good grade of cigar leaf. It is believed that both, good bright and dark tobacco, can be profitably raised in this State.

The appearance of the soils of many parts of this State is similar to those of the best tobacco districts of Virginia and North Carolina, and impresses one with the belief that fine manufacturing leaf can be grown here, if right methods are followed.

This Station will make experiments in tobacco, and results will be reported.

Bulletin No. 38. **July, 1892.**

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

FERTILIZERS.

N. T. LUPTON, STATE CHEMIST.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

All communications should be addressed to
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FERTILIZERS.

N. T. LUPTON, State Chemist.

THEIR USE AND VALUATION.

The importance of commercial, or manufactured fertilizers, is recognized by all intelligent farmers, and their use is well nigh universal.

The number of tons sold in Alabama during the past five years, according to the record kept in the office of the Commisssoner of Agriculture, is as follows:

Season of 1887–88	62,575	tons.
" 1888–89	71,605	"
" 1889–90	99,818	"
" 1890–91	115,735	"
" 1891–92	83,323	"

The decrease of about 28 per cent. in sales during the present season, as shown in the above statement, is not attributable to a lack of appreciation of the value of fertilizers, so much as to the depreciation in the price of cotton and reduction in the acreage placed under cultivation. In Georgia, over three hundred thousand tons were sold last year, while during the season now closing, the sales have not much exceeded two hundred thousand tons. A similar decrease has prevailed generally in the cotton-growing States.

The market value of manufactured fertilizers has undergone very little, if any, change since last year, and in determining values this year the same figures are used. The law requires the Commissioner to publish annually, an estimate of the commercial value of all fertilizers offered for sale within the State, basing his calculations on the lowest per cent. of each constituent guaranteed by the manufacturer.

The following values have been used in making these calculations:

Water-Soluble Phosphoric Acid........	7½	cents	per pound.
Citrate- " " "	7½	"	"
Nitrogen.............................	19½	"	"
Potash...............................	5	"	"

As stated in a former bulletin, while these figures are only approximate, they will be found useful to the farmer by showing him the relative value of different goods and enabling him to make selections of brands best suited to his wants.

The calculations are easily made, as follows: Multiply the percentage of Water-soluble and Citrate soluble Phosphoric Acid by $1.50; the per-centage of Nitrogen by $3.90; the Potash by $1.00, and add these products together. The sum will be the commercial value of one ton of the goods. Take, as an example, a fertilizer which shows the following composition:

Water soluble Phosphoric Acid..............	7	per cent.
Citrate- " " "	2	"
Nitrogen..................................	2	"
Potash....................................	1½	"

Then, $1.50 multiplied by 9=$13.50
3.90 " 2= 7.80
1.00 " 1½= 1.50

Total value.................$22.80

The valuations adopted by the Commissioner of Georgia are much less than the above, but represent not what the farmer has to pay for his purchases delivered at his nearest depot, but in the language of the Commissioner, "the wholesale cash value in those cities where the goods enter the State or where they are manufactured. Any one buying at a distance from Savannah should add the freight to that point, to obtain its local wholesale price." These goods are as cheap in Alabama as in Georgia.

The schedules of valuations adopted by other States do not differ materially from the valuations in Alabama. A difference is made in values in some States depending on the source from which the important constituents are derived.

Bulletin No. 29, recently issued by the Vermont Agricultural Experiment Station, gives the following trade values for 1892:

Phosphoric Acid, Soluble in Water	7½	cts. per lb.
“ “ Ammonium Citrate	7	“ “
“ Found in Ground fish, bone, etc.	7	“ “
Nitrogen, in Ammonia Salts	17½	“ “
“ Nitrates	15	“ “
“ Fish, Blood and Meat	16	“ “
“ Cotton Seed	15	“ “
Potash as High Grade Sulphate	5½	“ “
“ Kainite	4½	“ “
“ Muriate	4½	“ “

“The above trade values,” says the bulletin, “are the average figures at which in the six months preceding March 1st, the respective ingredients could be bought at retail for cash in the larger markets, *in the raw materials,* unmixed.

NATURAL PHOSPHATES.

The rapidly increasing use of commercial fertilizers, especially of Phosphates, caused serious apprehensions, a few years ago, that the supply of raw material would become exhausted or entirely inadequate to meet the demand. Fortunately for Southern agriculture, new and extensive phosphate deposits have been discovered in Florida in which the supply seems to be practically inexhaustible. A recent work on “Phosphates of America,” by Dr. Francis Wyatt, gives an interesting and reliable account of these deposits.

Speaking of several counties in Southwestern Florida, he says, “this section of Florida is virtually underlaid with a nodular phosphate stratum of a thickness varying from a few inches to thirty feet, and covered by an overburden that may be fairly averaged at about eight feet.” A large number of companies have been formed to work these deposits, but their development is yet in its infancy. A visit was made to some of these localities during the past winter and samples collected near Lacoochee, where the Southern Peninsular and Orange Belt Railroads intersect, and from a deposit on the Withlacoochee river some thirty miles from the town of Lacoochee. These were analyzed with the following results:

Analyses of Natural Phosphates from Florida, recently Made in the Alabama State Laboratory.

From Lacoochee.	Moisture.	Insoluble Matter	Phosphoric Acid	Iron and Aluminium Oxides	Equivalent to Bone Phosphate
Pit No. 1 (hard)	0.25	3.65	37.45	1.95	81.64
Pit No. 2 (hard)	1.45	8.99	34.57	4.01	75.36
Pit No. 3 (hard)	1.27	2.64	38.02	2.62	82.91
From Withlacoochee.					
Pit No. 1 (soft)	2.11	38 67	22.14	4.37	48.26
Pit No. 2 (soft)	2.27	13 32	31.89	5.56	69.52
Pit No. 3 (soft)	3.45	8.39	33.86	9.17	73.81
Pit No. 4 (soft)	2 27	35 77	22.03	4 36	48.02

The Pits mentioned, were sunk to determine the presence and character of phosphates and samples were taken from the sides and bottom of these openings for analysis. No mining, except to a limited extent at Lacoochee, had been done on the property visited. The overburden, or superincumbent mass of sand and earth, is from one to ten or twelve feet thick and the phosphate deposit from a few feet to twenty or even thirty.

The importance of these deposits is so great that speculation has run wild and many companies have been formed with capital stock reaching up into the millions.

The following table from Dr. Wyatt's work on phosphates, above mentioned, gives the average composition of a large number of samples from Florida and is of much interest:

Dr. Wyatt's Table of Analyses of Florida Phosphates.

	Phosphate of Lime.	Oxides of Iron and Alumina.	Silica & Silicates	Carbonic Acid.
Bowlders (carefully selected, 120 samples)........	80.49	2.25	4 20	2 19
Bowlders and debris (237 samples).............	74.90	4.19	9.25	1.90
Soft white phosphate (148 samples)	65.15	9.20	5.47	4.27
Pebble from Peace river (84 samples).	61.75	2.90	14.20	3.60
Pebble from drift-beds, Polk Co. (92 samples)	67.25	3.00	10.40	1 70

These analyses show *high grade* phosphates. Some, especially foreign, manufacturers object to buying phosphates which contain more than three per cent. of Iron and Alumina, and hence a large quantity of this material has not found a market. A few manufacturers, aware of the agricultural value of South Carolina floats, have established mills in Florida for pulverizing these aluminous deposits which are generally soft, and selling them to farmers for use without being converted into acid phosphate. They are very cheap and their use has proved valuable. Experiments are now in progress on the Alabama Experiment Station, under control of the Chemist, to determine by analysis and experiment the agricultural value of these soft Florida phosphates when used alone, with cotton seed, and with cotton seed meal, and the results will be reported in due time.

If decomposing organic matter, as is believed, renders insoluble phosphates available as plant food to any considerable extent, the question of cheap phosphates will be solved and the farmer enabled to purchase fertilizers at a much less cost than at present.

STATE LABORATORY,
AGRICULTURAL AND MECHANICAL COLLEGE,
AUBURN, ALA., July 1st, 1892.

HON. H. D. LANE,
Commissioner of Agriculture,
Montgomery, Ala.

Dear Sir: Enclosed please find tabulated results of Analyses of Commercial Fertilizers, materials used in their manufacture, Natural Phosphates, etc., made in the State Laboratory from April 1st, 1891, the date of my last published report, to July 1st, 1892.

A few of the materials reported were sent directly to this office and may not appear on your books. In such cases, where the results are of general interest, they are included in the list for publication.

Very respectfully,
N. T. LUPTON,
State Chemist.

Analyses Reported by N. T. Lupton, State Chemist, from April 1, 1891, to October 1, 1892.

ACID PHOSPHATES WITH NITROGEN AND POTASH.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble	Citrate Sol'ble	Acid Soluble.			
1963	Potent Pacific Guano……………………	Southern Phosphate Co., Atlanta, Ga..	9.77	0 92	0.69	1.68	1.50	24 08
1965	Potato Fertilizer……………………	J. C. Coleman, Citronville, Ala………	4.41	1.81	2.40	3.04	9.32	30 5
1966	Trucker's Delight…. …. …………	J. W. Clarke, LaFayette, Ala. ………	6.09	0 24	1.56	4.16	3.77	28.7
1968	Waverly Fertilizer……………………	W. & P. Hoffman, Waverly, Ala …….	4.24	3.15	2.30	4.84	1 28	29.83
1971	Soluble Sea Island Guano……………	Howle Bros., Edwardsville, Ala……..	8.10	2 08	2.70	1.89	1.75	24 39
1972	Meryman's A. D. Bone…… …………	" " " …….	9.25	3.79	1 30	1.82	2.52	29.17
1973	Kennesaw H. G. Amd. Fertilizer………	" " " …….	5.76	3 69	4.45	1.61	1.26	21.10
1974	Kennesaw Blood and Bone ……………	" " " …….	7 54	4.31	1.99	1.00	1.10	22.77
1973(b	Ammoniated Dissolved Bone…………	J. C. Johnston, Hanceville, Ala…….	9.29	2.90	1.90	0 56	1.17	21.63
1974(b	Rock City Guano……… …………	" " " …….	8.33	5 26	0.21	1.40	1.33	27.17
1975(b	Complete Cotton Fertilizer……………	J. C. Lee, Midland City, " …….	6 62	2.14	3.16	1.61	2.23	21 6
1976	Aurora Ammoniated Phospho…………	W. J. N. Taylor, Warrior. " …….	7.39	1.81	0.72	1.89	3 20	24 [illegible]

1978	Home Mixture	J. D. Thomas, Columbus, Ga	6 70	0.71	2 38	1.68	1.92	16.69
1979	Fertilizer	J. S. Wooton, Cox's Mill, Ala	9.00	4.95	0 23	1.50	2.16	28.93
1980	Gossypium Phospo	L. L. Rebman, Courtland, Ala	7.25	1.68	1.74	3.78	1.74	29.87
1984	Alliance Dissolved Bone Guano	W. M. Calhoun, Dothan, Ala	7 31	3.64	I.47	1.96	2.61	26.67
1985	Blood and Bone	" " "	7 53	3 22	2 47	1.40	1.93	23 50
1987	W. & A. No. 520	J. C. Cheney, Montgomery, Ala	8.14	4.09	0.26	0.28	1.12	20 55
1988	Furman's H. G. Guano	W. J. Beverly, Rosewood, Ala	6.41	2.57	3 05	2 03	1.14	22.52
1984(b	Guano	N. D. Meharg, Ohatchie, Ala	2.86	4.47	3.60	0.84	9 65	23.91
1989	W. O. C. Blood Guano	W. J. Beverly, Rosewood, Ala	6.47	3.49	0.27	2.24	2.09	25 76
1990	Aurora Ammoniated Phospho	" " "	7.13	0.77	1.22	1.61	2.39	20.51
1991	Buffalo Bone Guano	W. N. Johns, Jemison, Ala	6.98	6.56	0.26	1.96	1.97	29.92
1992	Fertilizer	W. S. Hilburn, Hightogy, Ala	7.14	2.55	0.17	1.26	1.93	21.37
1995	Guano	J. A. Burgess, Edwardsville, Ala	7.33	2.16	2.24	1.61	1.62	21.12
1996	Guano	" " "	6.45	1.19	2 80	1.75	1 48	19 76
1998	Coweta High Grade	E. R. Wood, Bluff Springs, Ala	8 14	2 44	0.74	1.82	2.90	26.80
1999	Blood and Bone	C. O. Beasley, Cohassett, Ala	7.23	2.37	3 24	1.82	2.41	23.40
2000(a	Georgia State Grange Fertilizer.	J. C. Killebrew, Newton, Ala	6.85	1 95	3 37	1 98	1 73	22 65
2001(a	Fertilizer No. 3	" " "	7.48	2 60	0.26	2.19	2.10	25 76
2003(b	Buffalo Bone Guano	R. M. Williams, Arab, Ala	6.50	3.51	3.80	1.68	1.28	22.84

Analyses Reported by N. T. Lupton, State Chemist, from April 1, 1891, to October 1, 1892.

ACID PHOSPHATES WITH NITROGEN AND POTASH.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Nitrogen.	Potash.	Commercial Value.
			Water Sol'ble.	Citrate Sol'ble	Acid Soluble.			
2004	Fertilizer	C. H. Crane, Monterey, Ala	1.01	0.16	0.19	..	0.42	2.17
2011	Fertilizer	M. F. Brooks, Brewton, Ala	....	....	1 45	0.98	0.31	4.13
2032	Fertilizer	G. A. Thornton, Fayette Court House, Ala	8.62	1.06	0.82	2.52	0.89	25.23
2035	Fertilizer A	J. M. Granberry, Brewton, Ala	1.11	1.14	1 68	1.82	0.63	11.09
2036	Fertilizer	" " "	.....	0.75	1.24	1.82	0.50	8.71
2038	Guano	W. S. King, Savannah, Ga	2 23	8 25	1.38	2.17	1.51	25 69

Analyses Reported by N. T. Lupton, State Chemist, from April 1, 1891, to October 1, 1892.

ACID PHOSPHATES.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Commercial Value.
			Water Soluble	Citrate Sol'ble	Acid Soluble.	
1964	Acid Phosphate	C. A. Williamson, Tuskegee, Ala	7.68	2.03	0 46	14 56
1967	Acid Phosphate	Montgomery Fertilizer Co., Montgomery, Ala.	13 63	1.05	5.24	22.02
1969	English Acid Phosphate	McQueen Smith, Prattville, Ala	10 21	4 52	2.22	22.12
1970	XX. Phosphate	" " "	11.44	4.38	1 32	23.73
1975	Kennesaw High Grade Acid Phosphate	Howle Bros., Edwardsville, Ala	8 08	3.61	4.47	17 53
1983	High Grade English Acid Phosphate	G. B. Langford, Dillards, Ala	10.90	3.05	2 88	20.92
1986	Kennesaw High Grade Acid Phosphate	J. W. Beverly, Rosewood, Ala	8 81	6.40	1.51	22.90
2003(a	Acid Phosphate	Montgomery Fertilizer Co., Montgomery, Ala.	11.21	1.95	5 54	19.74
2000(b	Acid Phosphate	C. O. Beasley, Cohassett, Ala	11.30	4 25	2 95	23.32
2007	Acid Phosphate	Imperial Fertilizer Co., Charleston, S. C	12 23	1.50	1.93	20.59
2012	Acid Phosphate	W. P. Barrow, Tuskegee, Ala	6 83	5.78	3 49	18.91
2131	Acid Phosphate	G. A. Thornton, Fayette Court House, Ala	11.53	1 34	0.86	19.30

Analyses Reported by N. T. Lupton, State Chemist, from April 1, 1891, to October 1, 1892.

MISCELLANEOUS FERTILIZERS.

Sta. No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.			Nitrog'n	Potash.	Equiv'lent to Bone Phosph'te
			Water Soluble.	Citrate Soluble	Acid Soluble.			
1977	Natural Phosphate	P. H. Mell, Auburn, Ala	....	....	40.44			
1981	Boulder Phos. Rock	Troy Fertilizer Co., Troy, Ala	....	....	26.95			
1982	Black Creek pebble phos. rock.	" " " " "	....	....	22.63			
1993	Swan Island Guano	A. Adams, Mobile, Ala	....	2.71	16.58			
1994	Swan Island Phosphate Rock.	" " "	....	....	25.03			
1997	Swan Island Guano	" " "	....	2.92	15.12			
2002 (a)	" " "	" " "	....	2.21	17.16			
2001 (b)	Natural Phosphate	F. D. Tinsley, Selma, Ala	....	....	4 39			
2002 (b)	" "	" " "	....	....	1 42			
2005	Phosphate Rock	H. S. Doster, Prattville, Ala	....	....	0.99			
2008	" "	B. S. Burton, Valdosta, Ga	....	....	38.30			
2009	" "	" " " "	......	....	31.39			
2010	" "	" " " "	....	....	36.80			
2013	Cerealite..................	J. S. Newman, Auburn, Ala	....	....	....	7.77	1.10	

2014	Cerealite	J. S. Newman, Auburn, Ala	....	....	....	8 33	6.58
2015 (a)	"	" " "	....	....	....	8.54	3.30
2015 (b)	12 samples "Nat. Phosphates"	John S. Collins, Geneva, Ala	....	....	00–2.15		
2028	Swan Island Guano	A. Adams, Mobile, Ala	....	4.72	12 21		
2029	Tankage	W. C. Tuite, Mobile Ala	....	....	9.15	6.44	
2033	Swan Island Guano	A. Adams, Mobile, Ala	....	3.37	13.73		
2039	Phosphate Rock	Troy Fertilizer Co., Troy, Ala	....	....	21.13		
2040	Cotton Seed Meal	Southern Cotton Oil Co., Montgomery, Ala.	....	....	2.70	7.00	1.47

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES CONTAINING NITROGEN AND POTASH.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble	Citrate Soluble.	Acid Soluble.			
2041	Amd. Raw Bone Super-phosphate. ..	E. A. Thompson, Clayhatchee, Ala.	5.89	2.12	1.32	1.89	2.20	$21.58
2043	Planters' Soluble Guano	Adair Bros. & Co., Atlanta, Ga...........	7.54	2.74	2.20	2.73	2 59	28.65
2044	Buffalo Bone Guano	Adair Bros. & Co., Atlanta, Ga	7.45	3 53	1.86	2 80	3.11	30.50
2045	Furman High Grade Guano	Adair Bros. & Co., Atlanta, Ga	7.46	2 95	1.47	2 80	3.22	29.75
2046	Furman Soluble Bone.....	Adair Bros. & Co., Atlanta, Ga...........	7.16	3 44	2.18	1.47	1.59	23.22
2047	Adair's Ammoniated Dissolved Bone.	Adair Bros. & Co., Atlanta, Ga	7.27	3.09	1.90	2.52	1.67	22.03
2057	Mobile Standard Guano	Mobile Phos. & Chem. Co., Mobile, Ala. ..	8.14	1.87	5.81	1.82	1.19	23.29
2058	Eclipse Soluble Guano	Mobile Phos. & Chem. Co., Mobile, Ala...	8 14	1.89	5 73	1.82	1.11	23.24
2062	Rome C. & C. Guano	Rome Chemical Co., Rome Ga....	10.95	0 36	2.14	2.03	1.75	26.62
2063	Rome Dis. Bone with Potash & Am.	Rome Chemical Co., Rome, Ga	10.06	0.88	3.05	1.54	1.79	22.80
2067	Ammoniated Guano...	Rasin Fertilizer Co., Baltimore, Md.	6 41	2 33	3.62	2.24	1.65	23.49
2069	Soluble Specific Guano	Rasin Fertilizer Co., Baltimore, Md	7.35	2 94	1.82	2 31	1.89	26.39
2071	Fertilizer.........................	W. D. Rowell, Loachapoka, Ala	8.62	2 22	4.30	2.03	1.22	25.39

2073	Orange Fruit Tree Fertilizer......	Stand. Guano & Chem. Mf'g Co. New Orleans	0.38	3.10	14.66	3.22	8.49	26 26
2076	Stern's Amd. Raw Bone Super-phos	" " " " " " "	7.85	0.75	1.40	1.89	2 56	22.72
2077	Champion Farmers' Choice	" " " " " " "	7.25	2.18	0.82	2.10	2 59	24 92
2079	Standard Amd. Soluble Guano....	" " " " " " "	8.33	1.48	1 28	1 79	1.97	23 50
2080	Vegetable Super-phosphate	" " " " " " "	7.58	0 26	0.74	3 50	5.34	26.83
2083	Goulding's Bone Compond........	C. R. McReary, Opelika, Ala	5.64	2.33	1.70	1.96	1.15	20 74
2084	Reliance Ammoniated Super-phos.	Walton Whann & Co., Charleston, S. C	6.20	2.82	4.49	1 96	1.33	22 50
2085	Plow Brand Raw Bone Super-phos.	Walton Whann & Co., Charleston, S. C	6.27	5 00	2.80	2.31	2.26	28.14
2087	Etiwan Ammoniated Dis. Bone....	Etiwan Phos. Co., Charleston, S. C	6.16	4.77	4 01	1.47	1.78	23.90
2088	Ammoniated Dissolved Bone......	Walton Whann & Co., Charleston, S. C	5.79	5 68	3 64	1.54	2.05	25.25
2090	Etiwan Guano	Etiwan Phosphate Co., Charleston, S. C ...	7.27	3.31	2.76	2 03	1 47	25.52
2093	Etiwan Amd. Super-phosphate....	" " " " "	5 35	5.12	3.91	2.10	1.11	26 00
2095	Imperial Fertilizer	Imperial Fertilizer Co., Charleston, S. C ...	9.12	0.64	2.16	2.10	1.06	28.89
2096	Imperial Soluble Guano	Imperial Fertilizer Co., Charleston, S. C....	6.96	2.16	2.89	1 68	1.42	21.65
2099	Vandiver's Ammoniated Dis. Bone.	W. F. Vandiver & Co., Montgomery, Ala....	10.27	2.02	4.99	1 40	1.28	25.31
2101	Mobile Standard Guano...........	Mobile Phos. & Chem. Co., Mobile, Ala	11 21	0.49	2.09	2 38	1.44	28.13
2102	Georgia State Grange Fertilizer....	Baldwin Fertilizer Co., Port Royal, S. C	7.05	2.93	2.76	1 89	2 11	24.45
2103	Baldwin's Ammoniated Dis. Bone..	Baldwin Fertilizer Co., Port Royal, S. C....	8.04	3.02	2.47	2 03	1.80	26 30
2105	Ammoniated Dissolved Bone......	Montgomery Fert. Co., Montgomery, Ala....	8.48	4.01	4.32	1.68	1.22	26.50

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES CONTAINING NITROGEN AND POTASH—Continued.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
2109	Royal Soluble Guano..............	Royal Fertilizer Co., Charleston, S. C.....	8.75	1.52	2.99	1.82	1.26	23.75
2110	Royal Ammoniated Fertilizer.	" " " " "	7.91	3.04	1.47	2.80	1.68	29.02
2112	Troy Perfect Guano	Troy Fertilizer Co., Troy, Ala....	8.04	0.89	0.74	2.66	1.83	25.59
2119	Eutaw Fertilizer....................	Ashepoo Phosphate Co., Charleston, S. C..	7.73	2.47	2.64	2.24	1.64	26.67
2120	Ashepoo Fertilizer	" " " " "	7.83	1.78	2.77	2.17	1.93	24.30
2124	Ammoniated Dissolved Bone.......	N. W. Fertilizer Co., Chicago, Ill.........	4.97	4.44	3.72	1.82	1.48	22.68
2125	Pelican Cotton & Corn Grower	N. W. Fertilizer Co., Chicago, Ill..........	4.55	5.24	4.11	1.82	1.37	23.14
2126	Old Dominion Guano..............	Southern Phosphate Co., Atlanta, Ga......	8.08	1.23	0.55	2.10	2.44	24.59
2127	Potent Pacific Guano.	Southern Phosphate Co., Atlanta, Ga.....	8.04	1.54	0.61	2.00	1.61	23.78
2128	Southern Ammoniated Dis. Bone....	Southern Phosphate Co., Atlanta Ga.....	8.39	1.00	0.76	2.03	1.53	25.52
2129	Etowah Super-phosphate..........	Southern Phosphate Co., Atlanta, Ga......	9.38	2.45	1.68	1.10	0.91	22.94
2130	Ammoniated Guano	Raisin Fertilizer Co., Baltimore, Md	7.56	2.46	2.05	2.24	2.03	25.79
2131	Soluble Specific Guano.............	Raisin Fertilizer Co., Baltimore, Md	8.33	2.27	2.45	3.01	2.73	30.36

2136	Guano..........	Eufaula Oil & Fertilizer Co., Eufaula, Ala.	6.31	2.67	2.13	2.27	2.13	24.45
2148	Soluble Guano	Imperial Fertilizer Co., Charleston, S. C ..	7.92	2.26	2.49	1.96	1.05	24.11
2151	Guano	J. A. Brown & Co., Kellyton, Ala	0.55	11 35	0.96	2.10	1 52	27.56
2150	Fertilizer...........	Columbus Oil Mill, Columbus, Miss........	7.79	2.81	1 38	2 48	2.78	28.20
2154	Atlantic Fertilizer....	Atlantic Phosphate Co., Charleston, S. C..	9 10	0.71	1.72	2.17	2.11	25 28
2156	Lister's Amd. Dissolved Bone.........	Lister's Ag. & Chem. Works, Newark, N. J	6.89	1 82	3.84	2.24	1.38	23.17
2157	"Etowah"	Southern Phosphate Co., Atlanta, Ga......	9.10	2 86	1.74	1.68	1.68	26.18
2160	Soluble Guano	Ashley Phosphate Co., Charleston, S. C...	5.06	4.44	2 13	2.38	1 46	24.99
2161	Cotton and Corn Compound..........	Ashley Phosphate Co., Charleston, S. C...	5 24	3 70	2 09	2.10	1.68	23 28
2166	Our Cotton King Guano.	Montgomery Fert. Co., Montgomery, Ala..	6.23	2 94	3.84	1.82	1.67	27.01
2167	Capital City Standard Fertilizer.......	Montgomery Fert. Co., Montgomery, Ala..	9.30	2.56	4.47	2.10	2.42	28.40
2168	Sea Gull Soluble Guano..............	Montgomery Fert. Co., Montgomery, Ala..	7.85	3.47	3 82	2.48	2 44	29.09
2169	Montgomery Blood and Bone	Montgomery Fert. Co,, Montgomery, Ala..	8.23	2.43	5 06	2.03	2.42	26.32
2170	Monogram Cotton Special............	Larentz & Rittler, Baltimore, Md	6.43	2.51	3.32	0.98	1 45	18.68
2171 (a)	L. & R. Ammoniated Guano	Larentz & Rittler, Baltimore, Md	7.86	2.57	1.28	1.75	1.42	23.88
2172 (b)	Farmers' Friend Fertilizer	Reed Fertilizer Co., Charleston, S. C......	7.20	1.57	1.61	2.10	1.27	22.61
2176	Sub-treasury Guano..................	Reed Fertilizer Co., Charleston, S. C......	6.41	2.07	1 86	1.61	1.05	21.04
2177	Matchless Cotton Grower....	Reed Fertilizer Co., Charleston, S. C......	6.31	3.38	1.33	1.65	1.14	22.10
2183	Reese's Pacific Guano................	C. A. Doolittle, Augusta, Ga....	2.28	8 63	1.09	1.96	1.75	25.75

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES CONTAINING NITROGEN AND POTASH—Continued.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Potash.	Nitrogen.	Commercial Value.
			Water Soluble	Citrate Soluble.	Acid Soluble.			
2184	Alliance Soluble Guano ....,......	Montgomery Fert. Co., Montgomerv, Ala..	9.44	0.95	4.01	1.92	2.47	$25.53
2185	Dowlings Alkaline Guano	Montgomery Fert. Co., Montgomery, Ala..	8.85	2.29	3.91	1.96	2.36	26.71
2186	East Alabama Fertilizer............	East Alabama Fertilizer Co., Clayton, Ala.	6.89	2.90	2.38	2 45	2.20	26.43
2190	Alabama Fertilizer.................	Alabama Fert. Co., Montgomery, Ala......	8.48	2 33	1.70	2.43	2.03	27.71
2191	Kennesaw Amd. Dissolved Bone....	Kennesaw Guano Co., Atlanta, Ga...	8.50	3.86	1.97	2.59	2.45	31.09
2192	Kennesaw High Grade Amd. Guano.	Kennesaw Guano Co., Atlanta, Ga	6.97	4.66	1.63	3.22	2.25	32.24
2194	Kennesaw Blood & Bone Compound.	Kennesaw Guano Co., Atlanta, Ga	7.08	2.93	3.60	2.03	1.61	24.53
2195	Fertilizer................	South Ala. Oil & Fert. Co., Ozark, Ala.....	10 63	1 50	0 94	1.54	1.13	25.32
2196	Golden Rod Guano No. 2...........	South Ala. Oil & Fert. Co., Ozark, Ala....	9.29	1.10	0.88	2.31	2.35	26.93
2197	" " " " 3...........	South Ala. Oil & Fert. Co., Ozark, Ala.....	8.92	1.35	0.94	2.38	2.61	27.29
2199	Elephant Guano	Albany Fert., Farm & Imp. Co., Albany, Ga	7 28	3.24	0.96	2.59	2.11	27.99
2200	Standard Guano	Albany Fert., Farm & Imp. Co., Albany, Ga	7.94	1.97	1.47	2.10	2.32	25.37
2202	Dixie Soluble Guano................	Troy Fertilizer Co., Troy, Ala	8.33	1.02	1.61	1.82	6.43	22.54

2203	Farmers Alliance Guano	Troy Fertilizer Co., Troy Ala	9.40	1.44	0.61	1.82	1.76	25.11
2205	Stono Soluble Guano	E. H. Frost & Co., Charleston, S. C.	8.26	1.28	3.13	1.82	1.21	23.15
2208	Amono Alkaline	Chesapeake Guano Co., Baltimore, Md.	7.39	1.08	1.68	1.96	1.34	21.68
2209	Southern Standard Amd. Bone	C. L. Montague, Savannah, Ga	7.73	1.87	2.66	2.76	1.41	25.45
2210	State Alliance Favorite	C. L. Montague, Savannah, Ga	9.52	2.83	0.84	0.98	1.25	23.59
2211	Fertilizer No. 1	Savannah Guano Co., Savannah, Ga	9.23	1.15	2.31	2.45	1.64	26.76
2212	Fertilizer No. 2	Savannah Guano Co., Savannah, Ga	9.33	1.13	1.92	0.98	1.23	20.74
2216	Ammoniated Dissolved Bone	Bradley Fertilizer Co., Boston, Mass	6.49	3.25	2.72	2.10	1.10	23.80
2217	Carolina Fertilizer	Bradley Fertilizer Co., Boston, Mass	6.73	3.10	2.82	2.31	1.23	24.97
2218	Eagle Ammoniated Bone Super-phos.	Bradley Fertilizer Co., Boston, Mass	6.95	1.73	3.18	2.31	1.10	23.12
2219	"Sea Fowl"	Bradley Fertilizer Co., Boston, Mass	7.73	1.72	3.74	2.38	1.75	25.20
2220	"B. Patent"	Bradley Fertilizer Co., Boston, Mass	6.93	2.44	3.45	2.24	1.25	24.03
2222	Home Mixture Guano	Meridian Fertilizer Co., Meridian, Miss	9.50	1.29	1.76	2.03	2.42	26.51
2223	Southern Soluble Guano	Meridian Fertilizer Co., Meridian, Miss	7.98	2.77	1.74	1.82	2.94	26.15
2225	Edistone Soluble Guano	Jno. M. Greene, Atlanta, Ga	8.02	1.16	2.74	2.03	1.59	23.27
2226	Rainbow Soluble Guano	Jno. M. Greene, Atlanta, Ga	8.21	3.97	3.00	0.91	2.43	23.24
2229	"W. & C. Americus"	Americus Guano Co., Americus, Ga	6.85	2.94	1.05	2.31	1.26	24.93
2230	Southern Amd. Bone Super-phos	Crocker Fert. & Chem. Co., Buffalo, N. Y.	6.41	2.55	2.90	2.03	1.63	22.99
2231	Southern Dis. Bone Super-phosphate	Crocker Fert. & Chem. Co., Buffalo, N. Y.	7.21	1.12	3.57	1.82	1.62	21.20

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ACID PHOSPHATES CONTAINING NITROGEN AND POTASH—Continued.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Nitrogen.	Potash.	Commercial Value.
			Water Soluble.	Citrate Soluble.	Acid Soluble.			
2232	Jno. M. Green's Formula.............	Americus Guano Co., Americus, Ga.......	6 48	3 91	1.13	2 03	1 82	$25 21
2234	"Edistone".........................	Americus Guano Co., Americus, Ga......	9 17	0 22	1.82	1.68	1.52	22 15
2235	Americus Guano......................	Americus Guano Co., Americus, Ga.......	8.42	2 20	1.33	1.75	1.79	24 54
2237	Wando Amd. Dissolved Bone.........	Wando Phosphate Co., Charleston, S. C...	8.44	2 73	5.45	0 98	1 46	22.03
2243	Wando Soluble Guano...............	Wando Phosphate Co., Charleston, S. C..	7.27	1 99	4.41	1.96	1.56	23 09
2259	Buffalo Bone Guano.................	Joseph Smith, Guntersville, Ala..........	6 31	2 79	2 80	2 03	1.66	23.22
2265	Soluble Guano.........................	E. H. Frost & Co., Charleston, S. C.......	8.40	2 33	3.24	2 03	1.83	25.83
2269	Pollard's Pacific Guano.	Bradley Fertilizer Co., Augusta, Ga	6 91	0 72	4.37	1.89	1.33	20 24
2270	Cumberland Bone Super-phosphate....	Bradley Fertilizer Co., Augusta, Ga........	7.85	2.61	2 57	2.03	1 27	24 85
2271	Ammoniated Dissolved Bone...... ...	Royal Fertilizer Co., Charleston, S. C. ...	8.20	2 89	1.76	2.10	1.62	26 44
2272	Adair's Ammoniated Bone...........	W. S. Webb, Columbia, Ala...	7 06	0.21	3 39	2.10	1.46	20 55
2273	Planter's Soluble Guano.....	W. S. Webb, Columbia, Ala............	6.77	2.81	2 57	1.68	1.62	22.54
2274	Pure Ani. Bone H. G. Veg. Fertilizer..	Comer, Hull & Co., Savannah, Ga	6.27	1.16	1 92	5 63	5 08	37 78
2277	South Carolina Amd. Dis. Bone......	Comer, Hull & Co., Savannah, Ga.........	8.54	0.44	1 90	1.96	0 98	22.09

2278	Georgia State Stand. Amd. Super-phos.	Comer, Hull & Co., Savannah, Ga.	7.29	2.39	3.14	1.82	3.05	24.66
2279	Farmers' Amd. Dissolved Bone	Comer, Hull & Co., Savannah, Ga.	10.84	0.09	1.68	1.82	2.89	26.37
2276	B. Patent	Bradley Fertilizer Co., Boston, Mass	6.87	3.82	2.23	2.31	1.48	26.51
2280	Pollard's Pacific Guano	Pacific Guano Co., Boston, Mass	6.47	3.13	2.34	2.24	1.53	24.66
2281	Tuskaloosa Guano	D. H. Caswell, Tuskaloosa, Ala	10.15	1.10	2.20	1.68	1.85	25.37
2284	Buffalo Bone Guano	Hill, Jones & Co., Roanoke, Ala	7.89	2.65	2.70	2.03	1.54	25.26
2285	Furman's High Grade Guano	Hill, Jones & Co., Roanoke, Ala	7.87	1.08	4.14	2.17	1.57	23.46
2286	Furman's Soluble Guano	Hill, Jones & Co., Roanoke, Ala	7.91	4.15	1.76	1.40	1.33	24.88
2287	Eutaw Fertilizer	Hill, Jones & Co., Roanoke, Ala	6.00	2.89	1.70	1.89	1.40	22.00
2290 (a)	Complete Cotton Fertilizer	Hill, Jones & Co., Roanoke, Ala	6.31	1.91	5.22	2.17	1.49	22.38
2290 (b)	Rome Dis. Bone with Am. and Potash.	W. H. Simpson, Rome, Ga.	11.38	0.74	3.24	1.33	1.73	25.09
2291 (b)	Rome C. & C. Guano	W. H. Simpson, Rome, Ga.	8.23	1.73	4.49	2.03	2.00	24.85
2297	Crown Guano	Treadwell, Abbott & Co., Atlanta, Ga.	9.52	0.20	1.70	1.75	2.00	23.40
2299	Guano	J. B. Wilder, Coaling, Ala.	7.21	1.79	1.15	2.33	1.81	2 31
2303	Georgia State Grange Fertilizer	O. W. Cooper & Co., Oxford, Ala.	9.13	1.36	2.93	1.75	2.22	24.77
2304	Fertilizer	Montgomery Fert. Co., Montgomery, Ala.	4.80	5.47	2.03	2.10	2.44	26.03
2308	Ashepoo Fertilizer	J. B. McMillan & Co., Talladega, Ala.	7.39	2.27	1.97	2.24	1.81	25.03
2310	Edisto Soluble Guano	J. B. McMillan & Co., Talladega, Ala.	8.33	1.65	1.96	1.94	1.59	24.12
2311	Soluble Sea Island Guano	J. B. McMillan & Co., Talladega, Ala	8.25	1.16	2.45	2.03	1.79	23.81

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES CONTAINING NITROGEN AND POTASH—Continued.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid. Water Soluble.	Phosphoric Acid. Citrate Soluble.	Phosphoric Acid. Acid Soluble.	Nitrogen.	Potash.	Commercial Value.
2312	Cotton King Guano..................	Noah Carroll, Ozark, Ala................	5 56	3 73	4.11	1.82	2 29	23.11
2315	Crocker's Dis. Bone Super-phosphate.....	Hill, Jones & Co., Roanoke, Ala	4 57	3.88	2.76	1.47	1.61	20 01
2316	Home Mixture.........	D. Gillis, Jr., Abbeville, Ala............	7.88	2.05	2.05	2.38	1.78	25.96
2319	Guano.........	H. I. Steed, Haw Ridge, Ala...........	11.38	0.30	1.76	1.12	1.98	23.8
2321	Crocker's Sou. Dis. Bone Super-phosphate	F. M. Merritt, Abbeville, Ala	7.30	2.51	0.99	1.54	2.22	22.9
2322	Sea Fowl Guano.......................	Bradley Fertilizer Co., Boston, Mass...	6.68	3 99	1.84	2.31	1.89	26.89
2325	Blood & Bone Fertilizer	B. J. Lunday, Andalusia, Ala	7.91	3 44	3.22	2.17	2 62	28.10
2331	Guano No. 1......................	W. W. Morris, Daleville, Ala	5.81	3.19	2.80	1.47	2 09	22.74
2332	Guano No. 2..........................	W. W. Morris, Daleville, Ala	2.15	7.33	3.11	1 61	2.80	23 29
2335	Blood & Bone Compound................	W. J. Beverly, Rosewood, Ala...	6.20	4 99	1.92	1.68	1.04	24.36
2339	Ammoniated Dissolved Bone.............	J. C. Akin & Son, Notasulga, Ala	7.10	2.08	2.61	1.40	1.40	20.63
2340	Soluble Sea Island.....................	J. C. Akin & Son, Notasulga, Ala........	7.71	2.01	2 18	2.24	2 28	25.59
2341	Patapsico Guano....	J. C. Akin & Son, Notasulga, Ala........	8 14	1.94	1 67	2 17	1.53	25 11
2342	Fertilizer..............	J. R. McLendon, Naftel, Ala............	7.25	3.16	1 55	1.82	2 40	25.10

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES CONTAINING POTASH.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Potash.	Commercial Value.
			Water Soluble	Citrate Sol'ble	Acid Soluble.		
2048	Farish Furman Formula	Adair Bros. & Co., Atlanta, Ga	9.29	4.61	1.70	3 10	$23 95
2089	Etiwan Acid Phosphate	Etiwan Phos. Co., Charleston, S. C.	9 86	4 06	0.94	3.54	24.33
2098	Imperial Acid Phosphate with Potash	Imperial Fertilizer Co., Charleston, S. C	8 60	3 57	1.30	2.15	20 40
2109	Royal Acid Phosphate with Potash	Royal Fertilizer Co., Charleston, S. C	11 31	2.73	1.32	1 19	22.25
2123	Ashepoo Bone Ash	Ashepoo Phos. Co., Charleston, S. C.	11.21	3 52	1.80	2.99	25 08
2152	Atlantic Acid Phosphate	Atlantic Phos. Co., Charleston, S. C.	9 67	2.06	1.51	1 20	18 89
2162	Acid Phosphate	Ashley Phos. Co., Charleston, S. C	6.24	5.99	2.51	2 58	20.92
2171	Potash Acid Phosphate	Lorentz & Ritter, Baltimore, Md	7.64	4 44	1.82	2 37	20.49
2206	Stono Acid Phosphate	E. H. Frost & Co., Charleston, S. C.	9 19	2 96	1 90	1 19	19 41
2224	Adair's Formula	Adair & McCarty Bros., Atlanta, Ga	10 08	2.91	3 82	3.30	22 78
2236	Americus Bone and Potash	Americus Guano Co., Americus Ga	5 23	4.44	4 4[illegible]	1 69	16.19
2244	Wando Acid Phosphate with Potash	Wando Phosphate Co., Charleston, S. C.	8 12	2 49	3 84	1.17	17 08
2296	"Fertilizer"	J. Wesley Brown, Gravilla, Ala.	9 27	1.87	2.30	1 61	18 32

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Commercial Value.
			Water Sol'ble.	Citrate Sol'ble.	Acid Soluble.	
2049	Dissolved Bone..............	Adair & McCarty Bros., Atlanta, Ga.	12.03	4 26	1.25	$24.43
2050	Furman Acid Phosphate.....................	Adair & McCarty Bros., Atlanta, Ga..........	11 88	3 57	0 88	23.17
2051	Adair's Acid Phosphate......................	Adair & McCarty Bros., Atlanta, Ga.........	12.13	3 90	0 55	24.04
2054	I. X. L. Acid Phosphate......................	Mobile Phosphate & Chem. Co., Mobile, Ala..	11.96	0 99	3.47	19 42
2056	Mobile Standard Acid Phosphate............	Mobile Phosphate & Chem. Co., Mobile, Ala.	12.7(	1 16	2 82	20.88
2059	Edisto Acid Phosphate.......................	J. S. Newman, Auburn, Ala.................	9.1(	2 94	2.32	18 06
2061	Rome Acid Phosphate	Rome Chemical Co., Rome, Ga	11 69	5.46	0 36	25 78
2068	Acid Phosphate.....	Raisin Fertilizer Co., Baltimore, Md....	9.46	4 77	1.11	21 34
2075	Acid Phosphate.....	Stand. Guano & Chem. M'f'g Co., New Orleans	13.82	2 79	0.03	24 91
2078	Pure Dissolved Bone.........................	Stand. Guano & Chem. M'f'g Co., New Orleans	14.93	0 49	0.4:	23 13
2081	Acid Phosphate No. 1......	McMillan & Harrison, Mobile, Ala..........	14 51	1 83	1.32	24 51

2082	Acid Phosphate No. 2	McMillan & Harrison, Mobile, Ala	9.45	4.83	0.81	21.57
2086	Etiwan Dissolved Bone	Etiwan Phos. Co., Charleston, S. C	10 13	3 85	2 03	20.97
2091	Diamond Soluble Bone	Walton Whann & Co., Charleston, S. C	10 73	5.10	1 13	23.74
2092	XX Acid Phosphate	Walton Whann & Co., Charleston, S. C	11.02	4.11	1.07	22.69
2094	Georgia State Grange Acid Phosphate	Baldwin Fertilizer Co., Port Royal, S. C	11 38	3 98	1 49	23 04
2097	Imperial Dissolved Bone	Imperial Fertilizer Co., Charleston, S. C	13.29	2.03	2 01	22.98
2100	High Grade English Acid Phosphate	W. F. Vandiver & Co., Montgomery, Ala	13 47	2 87	4.22	24.51
2104	High Grade Acid Phosphate	Montgomery Fert. Co., Montgomery, Ala	13 67	1.40	4 24	22 60
2106	Acid Phosphate	A. P. Richardson, Forney, Ala	13.61	5 54	1.51	25 72
2108	Royal Dissolved Bone	Royal Fertilizer Co., Charleston, S. C	14 09	2 52	1 61	24 01
2113	Acid Phosphate	Troy Fertilizer Co., Troy Ala	13 5	1 47	1 22	22.47
2121	Eutaw Acid Phosphate	Ashepoo Phosphate Co., Charleston, S. C	10 09	5 19	2.40	22.92
2122	Ashepoo Acid Phosphate	Ashepoo Phosphate Co., Charleston, S. C	11.21	3 96	2 57	23 95
2132	Southern Acid Phosphate	Southern Phosphate Co., Atlanta, Ga	11 61	4 43	0 99	24 06
2133	Acid Phosphate	Capital Fertilizer & M'f'g Co., Jackson, Miss	14 88	1 75	1 72	24.94

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES—Continued.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Commercial Value.
			Water Sol'ble.	Citrate Sol'ble	Acid Soluble.	
2137	Acid Phosphate	Eufaula Oil and Fertilizer Co., Eufaula, Ala.	7.36	4.96	3.30	18.48
2153	Atlantic Dissolved Bone	Atlantic Phosphate Co., Charleston, S. C	10.50	3.21	1.61	20 56
2155	Acid Phosphate	L. G. Patterson, Starkesville, Miss	11.67	2.16	1.05	20.74
2158	Acid Phosphate	Davis, Marshall & Co., Mobile, Ala	10.19	3.28	4.72	20 20
2159	Magnet Acid Phosphate	Davis, Marshall & Co., Mobile, Ala	14.20	2 29	0 85	24.73
2163	Dissolved Bone	Ashley Phosphate Co., Charleston, S. C	10.59	2.53	1.70	19.68
2165	High Grade English Acid Phosphate	Montgomery Fertilizer Co., Montgomery, Ala.	13.03	3.37	2 87	24.60
2173	High Grade Acid Phosphate	Reed Fertilizer Co., Charleston, S. C	13.51	1.75	0.69	22 89
2175	New York Soluble Bone	Reed Fertilizer Co., Charleston, S. C	14.71	0.43	1.15	22.71
2178	Leader Acid Phosphate	Reed Fertilizer Co., Charleston, S. C	14.51	0.51	2.14	22 53
2179	Florida Acid Phosphate	Troy Fertilizer Co., Troy, Ala	14.26	0 33	0.65	21.88
2180	Acid Phosphate	Marks & Gayle, Montgomery, Ala	12.65	1 87	4 37	21.78
2187	East Alabama Dissolved Bone	East Alabama Fertilizer Co., Clayton, Ala	10.06	3 77	2 95	20.74

2193	Kennesaw High Grade Acid Phosphate	Kennesaw Guano Co., Atlanta, Ga	16.26	1.28	0.71	26 31
2198	Acid Phosphate	South Ala. Oil & Fertilizer Co., Ozark, Ala	11.90	2.33	0 64	24 34
2201	Acid Phosphate	Albany Fert., Farm & Imp. Co., Albany, Ga	11.88	3.71	1.61	23 28
2207	Stono Dissolved Bone	E. H. Frost & Co., Charleston, S. C	10.94	5.12	0.26	24.09
2221	Palmetto Acid Phosphate	Bradley Fertilizer Co., Boston, Mass	12.74	1.26	3.20	21.00
2227	Atlanta Soluble Bone	John M. Greene, Atlanta, Ga	12.67	0.15	3.20	19.23
2233	Americus Dissolved Bone	Americus Guano Co., Americns, Ga	10.21	2.89	0.97	19.65
2238	Wando Dissolved Bone	Wando Phosphate Co., Charleston, S. C.	9.84	1.18	5.89	16 53
2239	Wando Acid Phosphate	" " " "	9 13	2.20	5.71	16 99
2245	Steiner's High Grade English Acid Phosphate.	J. Steiner & Sons, Greenville, Ala	8.81	6.24	3.01	22.57
2246	Standard Acid Phosphate	Tinsley Fertilizer Co., Selma, Ala	14.22	2.56	0.96	25.17
2258	Wappoo High Grade Acid Phosphate	J. N. Leary, Montgomery, Ala	11.76	2.61	1.95	21 55
2263	Acid Phosphate	D. W. Caswell, Tuskaloosa, Ala.	13.80	1.70	2.22	23.25
2267	Wando Dissolved Bone	Wando Phosphate Co., Charleston, S. C	12.84	0.41	3.18	19.87
2268	Wando Acid Phosphate	" " " "	12.15	1.09	3.65	19.86
2275	Georgia State Standard Acid Phosphate	Comer, Hull & Co., Savannah, Ga	10.11	1.01	1.99	16.68
2288	Eutaw Acid Phosphate	Hill, Jones & Co., Roanoke, Ala	12.28	0.91	3.22	19.88
2291 (a	Our Dissolved Bone	" " " "	10 92	1.83	6.96	19.12
2292	Rome Acid Phosphate	Rome Chem. Co., Rome, Ga	12 28	1.62	3.74	20 85

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

ACID PHOSPHATES—Continued.

Station No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.			Commercial Value.
			Water Soluble	Citrate Soluble.	Acid Soluble	
2294	No. 1 Acid Phosphate	J. M. Ellis & Sons, Union Springs, Ala	10.79	4 84	1.65	$23 44
2295	No. 2 Acid Phosphate	J. M. Ellis & Sons, Union Springs, Ala	11.14	5 35	2 80	24.73
2298	Georgia State Standard Acid Phosphate	Comer, Hull & Co., Savannah, Ga	12 22	1 70	1.05	22 88
2300	Acid Phosphate	Schloss & Kahn, Montgomery, Ala	13.19	4 39	3.11	26.37
2301	High Grade Acid Phosphate	O. W. Cooper & Co., Oxford, Ala	12 72	4.10	3.07	25 23
2302	XX Phosphate	" " "	10.19	4.04	2 36	21.34
2309	Eutaw Acid Phosphate	J. B. McMillan, Talladega, Ala	9 81	3.96	2 07	20 65
2324	High Grade Acid Phosphate	G. F. C. Moore, Andalusia, Ala	10 40	3 11	5 26	21.26
2327	No. 1	N. W. Lord, Columbus, Ohio	1 70	8 01	7.41	....
2328	No. 2	" " "	2 41	6 60	5.39	....
2329	No. 3	" " "	2 26	10.68	9 50	.....
2330	No. 4	" " "	0 77	8.20	10 27	.....
2333	English Phosphate	W. W. Morris, Daleville, Ala	12.59	2.71	4 80	22 95
2336	Phosphate	T. A. Byrd, Andalusia, Ala	10 79	4.10	4.81	22.33
2337	Southern Acid Phosphate	W. J. Beverly, Rosewood, Ala	9.65	2.81	3.18	18.70
2338	High Acid Phosphate	J. C. Akin & Son, Notasulga, Ala	9.81	4.67	3.01	21 73
2344	Americus Dissolved Bone	C. P. Payne, Ozark, Ala	9.17	5.37	2.41	21.81

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

MISCELLANEOUS FERTILIZERS.

Sta. No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID.					
			Water Soluble.	Citrate Soluble	Acid Soluble.	Nitrog'n	Potash.	Equiv'lent to Bone Phosph'te
2052	Swan Island Guano	A. Adams, Mobile, Ala	....	3.31	12.70	.....	.....	34 90
2053	Swan Island Phosphate Rock	" " "	....	....	21.61	.....	.....	47.10
2055	Kainite	Mobile Phos. & Chem. Co., Mobile, Ala	....	....	....	.....	13 15	....
2060	Cotton Seed Meal	J. S. Newman, Auburn, Ala	....	....	3.13	6 86	1.69	....
2064	Black River Phosphate Rock.	Troy Fertilizer Co., Troy, Ala	....	....	22 44	.....	.....	....
2065	Concentrated Tankage..	" "	....	....	1 23	11.13	.....	....
2066	Cotton Seed Meal	" "	....	....	3 16	7.56	1 85	....
2072	Pure Ground Bone	Stand. Guano & Mfg. Co., New Orleans.	....	....	23 25	4 34	....	....
2074	Kainite	" " "	....	....	....	....	11.74	....
2114	Florida Phosphate	Troy Fertilizer Co., Troy, Ala	....	....	35.67	....	.....	....
2115	Sulphate of Potash	" "	......	......	....	....	47 92	....
2116	Florida Phosphate Rock (1)..	A. J. Phares, Yalaha, Fla	......	1 57	36.86	....	....	....

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

MISCELLANEOUS FERTILIZERS.

Sta. No.	NAME OF FERTILIZER.	BY WHOM SENT.	PHOSPHORIC ACID. Water Soluble.	PHOSPHORIC ACID. Citrate Soluble	Acid Soluble	Nitrog'n	Potash.	Equiv'lent to Bone Phosph'te
2117	Florida Phosphate Rock (2)	A. J. Phares, Yalaha, Fla	....	1.63	36.63	.....	.....	....
2118	" " " (3)	" "	....	2.21	36 40	.....	.....	....
2134	Cotton Seed Meal	Eufaula Oil & Fert. Co., Eufaula, Ala	....	....	3.01	7 07	1.32	....
2135	Cotton Seed Hull Ashes	" " "	....	....	12 65	....	33.12	....
2138	Muriate Potash	" " "	....	....	....	.....	......	51.62
2140	Natural Phosphate (1)	J. C. Killebrew, Newton, Ala	....	....	18 98	.....	......	....
2141	" " (2)	" "	....	....	24.46	.....	......	....
2142	" " (3)	" "	....	....	23.78	.....	......	....
2143	" " (4)	" "	....	....	21.13	.....	......	....
2144	" " (5)	" "	....	....	23 63	.....	......	....
2145	" " (6)	" "	....	....	21.86	.....	....	....
2146	" " (7)	" "	....	....	27 41	....	....	....
2149	Kainite	Royal Fertilizer Co., Charleston, S. C	....	....	....	.....	15.82	....
2174	Kainite	Reed Fertilizer Co., Charleston, S. C	....	....	....	.....	12.37	....

2181	Muriate Potash.............	Marks & Gayle, Montgomery, Ala.	....	....	....	.....	52.28	....
2182	Kainite	“ “	....	....	....	.....	12.41	....
2188	Cotton Seed Meal............	East Alabama Fert. Co., Clayton, Ala.	....	....	3.25	7.42	1.76	....
2189	Muriate Potash.............	“ “ “	....	....	....	....	51.96	....
2204	Ground Phosphate Rock	Troy Fertilizer Co., Troy, Ala.........	....	....	21.50	....	......	....
2213	Cerealite No. 1........	G. F. Atkinson, Auburn, Ala	....	....	....	7.84	0.27	....
2214	“ 2	“ “	....	....	....	7.28	4.45	....
2215	“ 3	“ “	....	....	....	7.28	2.74	....
2247	Natural Phosphate...........	Dr. N. T. Lupton, Auburn, Ala	....	....	26.64	....	......	58.07
2248	Phosphate..................	“ “	....	....	1.30	....	......	....
2264	Kainite....................	D.W. Caswell, Tuskaloosa, Ala	....	....	....	.....	16.64	....
2266	Natural Phosphate......	G. A. Stuck, Selma, Ala...............	....	....	26.07	....	......	....
2282	Bone Meal..........	Armour & Co., Birmingham, Ala	....	....	23.88	3.50	......	....
2283	Blood and Bone.............	“ “	....	....	14.38	6.51	......	....
2289	Natural Phosphate	C. A. O’Neal, Andalusia, Ala.........	....	....	1.11	....	.....	....
2293	Natural Phosphate...........	G. A. Stuck, Selma, Ala...............	....	....	18.10	....	......	39.45
2305	Nat. Florida Phos. Blitch No. 1	N. T. Lupton, Auburn, Ala............	....	....	38.47	.....	.....	83.86
2306	Stevens No. 1...............	“ “	....	....	31.27	31.27	......	68.16
2307	Nat. Florida Phosphate, Kline.	“ “	....	....	33.00	33.00	.....	71.94

Analyses Reported by N. T. Lupton, State Chemist, from October 1, 1891, to July 1, 1892.

MISCELLANEOUS FERTILIZERS—Continued.

Sta. No.	NAME OF FERTILIZER.	BY WHOM SENT.	Phosphoric Acid.		Acid Soluble	Nitrogen	Potash.	Equiv'lent to Bone Phosphate
			Water Soluble.	Citrate Soluble.				
2313	No. 2 Soft Stevens...........	N. T. Lupton, Auburn, Ala...........	....	....	27.64	......	....	60.25
2314	No. 2 Hard Stevens..........	" "	......	....	33.36	...	......	72.71
2320	Castor of Pumace	Troy Fertilizer Co., Troy, Ala..... ...	......	.....	0.67	5 25	0 78	......

MARLS.	Silica.	Oxides of Iron and Al.	Lime Cart.	Mag. Cart.	Phos. Acid.	Potash.
2030—Wat Henderson, Magnolia, Ala....................................	......	22 38	8 22	Trace.	0 86	0 39
2111—O. D. Kilebrew, Newton, Ala..	41 88	2 22	54 33	Trace.	None.	....
2343—Vincent Bell, Calhoun, Ala	62 30	17.28	14.16	3.32	....	....

CLAYS.	Moisture.	Water of Combi-tion.	Silica.	Iron and Al. Ox.	Lime.	Magne'a	Soda.	Potash.
2042—Burch & Wyatt, Decatur, Ala	4.35	4.50	72.84	14.70	1.38	Trace.	2.18	0.16
2139—Burch & Wyatt, Decatur, Ala	1.64	.. ....	87 12	4 63	0.28	0 07	4.17	0.01
2261—G. Riley & Co., Gadsden, Ala	1.56	......	64.81	29 91	0.54	0 64	....	.....
2317—W. A. Steadham, Isbell, Ala	1.89	5.64	63.94	25.89	0 36	Trace..	2.26	0 29

In addition to the above, a large number of qualitative determinations of minerals were made, also analyses of a few samples of minersl waters, iron ores, pig iron, earthy matters, etc.

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTURED	Weight of Package.	GUARANTEED ANALYSIS.					Commercial Value.
	NAME.	ADDRESS.				Nitrogen.	Phosph'ric Acid			Potash.	
							Water Soluble.	Citrate Soluble.	Acid Soluble.		
Buffalo Bone Guano	Adair & McCarty Bros	Atlanta, Ga.	Furm'n F'm Im. Co	Atlanta, Ga	200	1.75	6	3	2	1	$21 33
Farmer's High Grade Guano	“ “ “	“ “	“ “ “ “	“ “	200	2	6	3	2	1	22 30
Furm'n's sol. bone with am. & pot.	“ “ “	“ “	“ “ “ “	“ “	200	.85	8	3	2	1	20 82
Farish Furman Formula	“ “ “	“ “	“ “ “ “	“ “	200	..	8	3	2	2	18 50
Furman Acid Phosphate	“ “ “	“ “	“ “ “ “	“ “	200	...	10	2	2	....	18 00
Dissolved Bone	“ “ “	“ “	“ “ “ “	“ “	200	...	10	2	2	.....	18 00
Adair's Ammo. Dissolved Bone	“ “ “	“ “	Adair & McC. Bros	“ “	200	1 75	6	3	2	1	21 33
Planters' Soluble Guano	“ “ “	“ “	“ “ “	“ “	200	1 75	6	3	2	1	21 33
Adair's Acid Phosphate	“ “ “	“ “	“ “ “	“ “	200	...	10	2	2	.....	18 00
Adair's Formula	“ “ “	“ “	“ “ “	“ “	200	...	8	3	2	2	18 50
Elephant Guano	Alb'ny Fert.& F.I.Co	Albany, Ga	Alb'ny Ft.&F.I.Co	Albany, Ga	200	1.90	7	3	½	1 90	22 81
Standard Guano	“ “ “ “	“ “	“ “ “	“ “	200	1 90	7	2	½	1.30	22 20
Acid Phosphate	“ “ “ “	“ “	“ “ “	“ “	200	...	11	3	2	.....	21 00
Ashepoo Fertilizer	Ashepoo Phos. Co	Charleston, S. C	Ashepoo Phos. Co.	Charleston, S. C	200	1.85	6 25	2 25	2	1	20 97
Eutaw Fertilizer	“ “ “	“ “	“ “ “	“ “	200	1.85	6.25	2 25	2	1	20 97
Ashepoo Acid Phosphate	“ “ “	“ “	“ “ “	“ “	200	...	8.50	2	1	....	15 75
Eutaw Acid Phosphate	“ “ “	“ “	“ “ “	“ “	200	...	8.50	2	1	....	15 75
Ashepoo Bone Ash	“ “ “	“ “	“ “ “	“ “	200	...	8 50	2	1	1	16 75
Kainit	“ “ “	“ “	Imported...	....	200	...	.....	...	...	11	11 00
Americus Guano	Americus Guano Co,	Americus, Ga	Americ's Guano Co	Americus, Ga	200	2	7	2	2	1	22 30
Eddystone Soluble Guano	“ “ “	“ “	“ “ “	“ “	200	2	7	2	2	1	22 30
John M. Green's Formula	“ “ “	“ “	“ “ “	“ “	200	2	7	2	2	1	22 30
Americus Dissolved Bone	“ “ “	“ “	“ “ “	“ “	200	...	10	2	2	.....	19 50
Americus Dis. Bone with Potash	“ “ “	“ “	“ “ “	“ “	200	...	10	3	2	1	20 50
Eddystone Soluble Guano	Atlanta, Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga	200	2	7	2	2	1	22 30
John M. Green's Formula	“ “ “	“ “	“ “ “	“ “	200	2	7	2	2	1	22 30
Rainbow Soluble Guano	“ “ “	“ “	“ “ “	“ “	200	1	8	2	2	1	19 90

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers—Cont'd.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTURED	Weight of Package.	GUARANTEED ANALYSIS.					Commercial Value.
	NAME.	ADDRESS.				Nitrogen.	Phosph'ric Acid			Potash.	
							Water Soluble.	Citrate Soluble.	Acid Soluble.		
tlanta Soluble Bone	Atlanta Guano Co	Atlanta, Ga	Atlanta Guano Co.	Atlanta, Ga	200	...	10	3	2	.....	19 50
unny South Acid Phosphate	"	" "	" " "	" "	200	...	10	3	2	.....	19 50
eece's Soluble Bone	"	" "	" " "	" "	200	...	10	3	2	.....	19 50
tlantic Fertilizer	Atlantic Phos. Co.	Charleston, S. C	Atlantic Phos. Co.	Charleston, S. C	200	2	6	2	2	1	20 80
tlantic Dissolved Bone	"	"	"	" "	200	...	10	2	2½	.....	18 00
tlantic Acid Phosphate	"	"	"	" "	200	...	9	2	1½	1	17 50
oluble Guano	Ashley Phos. Co	"	Ashley Phos. Co.	" "	200	2	4	4	2	1	20 80
otton and Corn Compound	"	"	"	" "	200	1¾	4	4	2	1	19 82
mall Grain Specific	"	"	"	" "	200	1¾	4	4	2	1	19 82
mmoniated Dissolved Bone	"	"	"	" "	200	1	4	4	2	1	16 90
oluble Fish Guano	"	"	"	" "	200	2½	4	4	2	1	22 75
cid Phosphate	"	"	"	" "	200	...	6	4	2	1	16 00
issolved Bone	"	"	"	" "	200	...	7	5	2	.....	18 00
ainit	"	"	Imported	.....	200	...	.....	...	...	13	13 00
labama Fertilizer	Alabama Fert. Co	Montgom'ry, Ala	Ala. Fertilizer Co.	Montgom'ry, Ala	200	2	7	2	1	2	23 30
elican	"	"	"	"	200	2	6	2	1	1	20 80
cid Phosphate	"	"	"	"	200	...	10	3	1½	.....	19 50
ainit	"	"	Imported	"	200	...	.....	...	...	13	13 00
uriate Potash	"	"	"	"	200	...	.....	...	...	83	83 00
rairie Fertilizer	"	"	Ala. Fertilizer Co.	"	200	3	6	2	1	3	26 70
ried and Ground Blood	"	"	Armour Pack'g Co	Kansas City, Mo	200	10	.....	...	...	.....	39 00
oncentrated Tankage	"	"	"	"	200	8½	.....	...	...	.....	33 15
one Black	"	"	Phil'a Sugar Ref'y	Philadelphia, Pa	200	....	18	6	...	.....	36 00
cid Phosphate No. 2	"	"	Imported	.....	200	...	16	5	...	....	31 50
appoo High Grade Acid Phos.	"	"	Wappoo Mills	Charleston, S. C	200	...	12	1½	...	.....	20 25
erkeley's Dissolved Bone	Berkeley Phos. Co	Charleston, S. C	Berkeley Phos. Co	Arkley, near Charleston, S. C	200	...	10	2	2	.....	18 00

rkeley Acid Phosphate.........	"	"	"	"	200	...	9	1	2	1.5	16 50
rkeley Soluble Guano	"	"	"	"	200	2.06	7	1	2	1.5	21 53
rkeley's Ammo. Dissolved Bone.	"	"	"	"	200	1.05	7	1	2	1.5	17 60
ldsmith Stand. C. & C. Guano	"	"	"	"	200	1.65	6	2	2	1	19 44
id Potash............	"	"	"	"	200	...	8	2	2	.....	15 00
ldwin's Ammoniated Dis. Bone.	Baldwin Fert. Co...	Savannah, Ga..	Baldwin Fert. Co.	Port Royal, S. C	200	1.75	8	2	1.50	2	23 83
orgia State Grange Fertilizer. ..	"	"	"	"	200	1.75	8	2	1.50	2	23 83
orgia State Grange Acid Phos..	"	"	"	"	200	...	10	2	2	.....	18 00
ne and Potash	"	"	"	"	200	...	9	2	1.50	4	20 50
ne Compound....	"	"	"	"	200	1.75	8	2	1.50	.....	21 83
wker's Cotton Fertilizer........	Bowker Fertilizer Co	"	Bowker Fert. Co..	Elizabeth Pt.N.J & Charlest'n,S.C	200	1 ¾	7	2	2	1¼	21 58
wker's Nassau Guano..........	"	"	"	"	200	1 ¾	7	2	2	1¼	21 58
wker's Crown Guano...........	"	"	"	"	200	1 ¾	7	2	2	1¼	21 58
wker's Dis. Bone Phosphate. ..	"	"	"	"	200	...	9	2	2	1¼	17 75
ssau Dis. Bone Phos. with Pot'sh	"	"	"	"	200	...	9	2	2	1¼	17 75
own Dis. Bone with Phosphate,.	"	"	"	"	200	...	9	2	2	1¼	17 75
ssau Dissolved Bone Phosphate.	"	"	"	"	200	...	10	3	2	.....	19 50
rman Kainit.....	"	"	Imp.from Germany		200	...	.....	...	...	12	12 00
wker's Soluble Pacific Guano...	"	"	Bowker Fert. Co.	Charleston, S. C	200	1.65	6	2	1	1	19 44
wker's Sol. Pac. Dis. Bone Phos.	"	"	"	"	200	...	9	2	2	1¼	17 75
D. Sea Fowl Guano...........	Bradley Fert. Co...	Boston, Mass. ..	Bradley Fert. Co..	Boston, Mass...	200	1.85	6.50	2 50	2	1	21 71
adley's Patent Super Phosphate.	"	"	"	"	200	1.85	6.50	2 50	2	1	21 71
adley's Ammo. Dissolved Bone..	"	"	"	"	200	1.65	6	2	2	1	19 43
gle Ammo. Bone Super Phos. ..	"	"	"	"	200	1.65	6	2	2	1	19 43
olina Fertilizer...	"	"	"	"	200	1.85	6.50	2 50	2	1	21 71
metto Acid Phosphate	"	"	"	"	200	...	9	3	1	.....	18 00
dmont Acid Phosphate...... ...	J. A. Brown & Co...	Kellyton, Ala ..	Marietta GuanoCo.	Atlanta, Ga....	200	...	9	4	2	.....	19 50
G. C. Guano	"	"	"	"	200	1	7	2	2	1¼	18 65
bama Fertilizer...	J. W. Bledsoe......	Three Notch,Ala	Alabama Fert. Co.	Montgomery,Ala	200	2	7	2	1	2	23 30
orite Formula Fertilizer......	"	"	"	"	200	2	6	2	1	1	20 80
e Acid Phosphate	"	"	Edisto Phos. Co .	Charleston, S. C.	200	...	10	3	1½	.....	19 50
St. Stanp. Ammo. Sup. Phos .	Comer, Hull & Co ..	Savannah, Ga..	Comer, Hull & Co.	Savannah, Ga. & Port Royal, S. C.	200	1 65	7	1	1	2	20 44
Royal Cotton Fertilizer	"	"	"	"	200	1 65	7	1	1	2	20 44
ethorpe Ammo. Dissolved Bone.	"	"	"	"	200	1 65	7	1	1	2	20 44
est City Ammo. Dissolved Bone	"	"	"	"	200	1.65	7	1	1	2	20 44

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	NAME.	ADDRESS.				Nitrogen.	Phosph'ric Acid			Potash.	
							Water Soluble.	Citrate Soluble.	Acid Soluble.		
ırdie's Cot. Boll Am. Sup. Phos.	Comer, Hull & Co..	Savannah, Ga..	Ga. Fert. Co. & Pt. Roy'l Fert Co. S. C	Port Royal, S. C	200	1.65	7	1	1	2	20 44
escent Bone Fertilizer........	"	"	Comer, Hull & Co.	"	200	1.65	7	1	1	2	20 44
rmers Ammo. Dis. Bone.......	"	" "	Ga. Fert. Co. & Pt. Royal Fert.Co.S C	" "	200	1.65	7	1	1	1	19 44
liance Ammo. Dis. Bone........	"	"	"	"	200	1.65	7	1	1	1	19 44
uth Carolina Ammo. Dis. Bone.	"	"	"	"	200	1.65	4	1	1	.10	18 54
d Reliable....	"	"	"	"	200	1.65	7	1	1	.10	18 54
ımmond & Hull's Pure Animal..		"									
ne High Grade Vegetable Fert..	"	"	Comer, Hull & Co	"	200	5	7	1	1	5	36 50
orgia Fertilizer......	"	"	"	"	200	1.65	7	1	1	2	20 44
nly, Handl'y & Co Am. Dis. Bone	"	"	Ga. Fert. Co. & Pt. Royal Fert. Co.S.C	"	200	1.65	7	1	1	1	19 44
lis English Acid Phosphate.	"	"	Comer, Hull & Co.	"	200	...	10	2	1	.....	18 00
. State Standard Acid Phosphate	"	"	"	"	200	...	10	2	1	.....	18 00
escent Bone Acid Phosphate....	"	"	"	"	200	....	10	2	1	.....	18 00
rest City Acid Phosphate.......	"	"	"	"	200	...	10	2	1	.....	18 00
rt Royal Acid Phosphate.	"	"	"	"	200	...	10	2	1	.....	18 00
lethorpe Acid Phosphate.	"	"	"	"	200	...	10	2	1	.....	18 00
tton Boll Acid Phosphate	"	"	"	"	200	...	10	2	1	.....	18 00
. State Stand. & Dis. Bone Phos..	"	"	"	"	200	...	10	2	1	....	18 00
rt Royal Dis. Bone Phosphate...	"	"	"	"	200	...	10	2	1	.....	18 00
lethorpe Dis. Bone Phosphate ..	"	"	"	"	200	...	10	2	1	.....	18 00
orgia Acid Phosphate....	"	"	"	"	200	..	10	2	1	.. .	18 00
ınly, Handley & Co. XX Ac. Phos.	"	"	"	"	200	...	10	2	1	.....	18 00
nuine German Kainit..........	"	"	Imp. by C. H. & Co	from Germany.	200	...	.....	...	...	11	11 00
me C. & C. Guano............	"	"	Rome Chemical Co Pur. by C. H. & Co	Rome, Ga.....	200	1.65	6	2	1	1	19 43

ome Sol. Bone with Am. & Potash	“	“	“	“	200	1	6	2	1	1	16 90
ome Dis. Bone with Am. & Potash	“	“	“	“	200	1	6	2	1	1	16 90
ome Acid Phosphate	“	Savannah, Ga..	“	“	200	...	10	2	1	....	18 00
ome Bone and Potash...........	“	“	“	“	200	...	8	2	1	1	16 00
omplete Cotton Fertilizer........	Commerc'l Guano Co	“	Com'al Guano Co.	Savannah, Ga .	200	1.65	7	1	2	1	19 44
hatham Guano....	“	“	“	“	200	1.65	7	I	2	1	19 44
omona Guano....	“	“	“	“	200	1.65	7	1	2	1	19 44
herokee Ammoniated Bone.....	“	“	“	“	200	1.65	7	1	2	1	19 44
limax Guano.....	“	“	“	“	200	1.65	7	1	2	1	19 44
ld Time Guano.....	“	“	“	“	200	1.65	7	1	2	Trace.	18 44
eorgia Bone Compound....	“	“	“	“	200	...	8	2	2	2	17 00
ur Dissolved Bone Phosphate	“	“	“	“	200	...	10	2	2	Trace.	18 00
hatham Acid Phosphate........	“	“	“	“	200	...	10	2	2	Trace.	18 00
omona Acid Phosphate.........	“	“	“	“	200	...	10	2	2	Trace.	18 00
hatham Vegetator	“	“	“	“	200	2.50	8	2	2	3½	28 28
xcelsior Fruit Grower	“	“	“	“	200	1.25	4	1	2	8	20 38
eorgia Bone Guano............	“	“	“	“	200	1.65	7	1	...	.....	18 44
rocker's South Dis. Bone Sup. Pho	Crocker Fertilizer & Chemical Co. ...	Bufialo, N. Y..	Crocker Fertilizer & Chemical Co.	Buffalo, N. Y...	200	1.23	4	4	1	1½	18 30
rocker South. Am. Bone Sup. Pho.	“	“	“	“	200	1.64	4	4	1	2	20 40
tandard.....	Columbus Oil Mill...	Columbus, Miss.	Columbus Oil Mill	Columbus, Miss.	200	1.90	6.67	3.20	1.18	1.89	24 10
ome Mixture.....	Columbus Fert. Co..	Columbus, Ga..	Columbus Fert. Co	Girard, Ala....	200	2	6	2	2	1½	21 30
oluble Bone....	“	“	“	“	200	...	10	3	2	.....	19 50
ommon Cotton Fertilizer.... ...	Cincinnati Dess. Co.	Cincinnati, O..	Cincinnati Dess.Co	Cincinnati, O..	200	1.85	2	7	1	1	21 72
otato Fertilizer.....	“	“	“	“	200	4.15	4	4	4	5	33 18
hicora Dissolved Bone	Chicora Fertilizer...	Charleston, S. C	Chicora Fert. Co.	Charleston, S. C	200	1.75	7	2	1	2	22 32
hicora Acid Phosphate...... ...	“	“	“	“	200	...	11	1	1	.....	18 00
hicora Acid Phosphate......	“	“	“	“	200	...	9	1	1	1	16 00
hicora Soluble Guano	“	“	“	“	200	1.75	6.50	1.50	1.50	1	19 82
mmoniated Alkaline Phosphate..	Cheasp'ke Guano Cc	Baltimore, Md..	Chesp'ke Guano Co	Baltimore, Md..	200	2	4	4½	2	1½	22 05
mmoniated Dissolved Bone.....	“	“	“	“	200	2	4	4½	2	1½	22 05
tonewall Guano..	“	“	“	“	200	2	4	4½	2	1½	22 05
V. O. C. A. Pure Blood Guano...	Coweta Fertilizer Co	Newnan, Ga....	Coweta Fert. Co..	Newnan, Ga...	200	2¼	7.50	2.50	1	2	25 77
oweta High Grade....	“	“	“	“	200	2	7	2	1	2	23 30
urora Ammoniated Phosphate...	“	“	“	“	200	1.75	6½	1½	1	2	20 82
oweta Animal Bone	“	“	“	“	200	1.75	6½	1½	1	2	20 82
oweta H. G. Acid Phosphate.....	“	“	“	“	200	...	10	2	1	.....	18 00

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	NAME.	ADDRESS.				Nitrogen.	Phosph'ric Acid			Potash.	
							Water Soluble.	Citrate Soluble.	Acid Soluble.		
umberland Bone Super Phos	Cumberland Bone Phosphate Co ..	Portland, Me...	Cumberland Bone Phosphate Co.	Portland, Me..	200	1.65	6	2	2	1	$19 43
uskaloosa Guano...............	D. H. Caswell.....	Tuscaloosa, Ala.	D. H. Caswell ...	Tuscaloosa, Ala.	200	2	8	1	1	1	22 30
agnet Guano	Davis, Marshall & Co	Mobile, Ala	Davis, Marshall & Co.........	Mobile, Ala.....	200	.25	4	4	1	1	13 98
cid Phosphate	"	"	National Acid Co..	New Orleans, La	200	...	6	6	1	.....	18 00
erman Kainit..................	"	"	Imported.........	....	200	...	......	...	....	10	10 00
tiwan Guano...................	Etiwan Phos. Co....	Chaleston, S. C.	Etiwan Phos. Co..	Charleston, S. C.	200	1¾	5	2	2	1¼	18 57
tiwan Ammo. Super Phosphate..	"	"	"	"	200	1½	5	2	1	1	17 35
tiwan Ammo. Dissolved Bone....	"	"	"	"	200	⅞	7	2	1	1	17 91
tiwan Acid Phosphate	"	"	"	"	200	....	8	3	1	1	17 50
tiwan Dissolved Bone	"	"	"	"	200	...	10	1	1	.....	16 50
ast Alabama Fertilizer........	East Ala. Fert. Co...	Clayton, Ala. ..	East Ala. Fert. Co	Clayton, Ala...	200	1.85	7.75	1 75	.50	1.75	23 21
ast Alabama Dissolved Bone	"	"	"	"	200	....	10	3½	1	.....	20 25
ufaula Fertilizer	Eufaula Oil & Fer. Co	Eufaula, Ala....	Eufaula Oil & Fertilizer Co......	Eufaula, Ala....	200	2¼	6	2½	2	2	23 53
cid Phosphate	"	"	Comm. Guano Co.	Savannah, Ga ..	200	..	12	2	2	.....	21 00
disto Dissolved Bone	Edisto Phosphate Co	Charleston, S. C	Edisto Phos. Co ..	Charleston, S. C.	200	..	9	3	1½	.....	18 00
disto Acid Phosphate...........	"	"	"	"	200	..	8	2	1	1	16 00
disto Ammo. Dissolved Bone ...	"	"	"	"	200	1.64	6	2	1	1	19 39
disto Soluble Guano	"	"	"	"	200	1 64	6	2	1	1	19 39
disto Ammoniated Fertilizer....	"	"	"	"	200	2.06	6	2	1	1	21 03
disto Ammo. Dissolved Bone ...	"	"	"	"	200	1.23	6	2	1	1	17 80
urman's High Grade	Furm'n Fa'm Im. Co	Atlanta, Ga	Furman Farm Improvement Co.	Atlanta, Ga. ..	200	2 25	7 50	2.50	2	1.50	25 28
arish Furman's Formula.........	"	"	"	"	200	....	8 54	3 27	2 24	3.32	21 03
oulding Bone Compound	Gould'g Fer. Co. L'd	Pensacola, Fla..	Goulding Fert. Co.	Dublin, Ireland, & Pensacola, Fla	200	1 75	7	2	1	1	21 33

Goulding's St. George......	"	"	"	"	200	1	5	2	1	2	16 40
Goulding's Super Phosphate......	"	"	"	"	200	...	10	2	1	.....	18 00
Goulding's Vegetable Compound..	"	"	"	"	200	3.50	5	2	1	3	27 15
Goulding's Special Compound....	"	"	"	"	200	1.75	7	2	1	1	21 33
Goulding's Seminole Fertilizer....	"	"	"	"	200	1	5	2	1	2	16 40
ull & Lancaster's H'h Gr.Ac. Phos	"	"	"	"	200	...	10	2	1	....	18 00
Furman's Acid Phosphate	Fur. Farm Imp. Co .	Atlanta, Ga.....	Fur. Farm Imp.Co	Atlnnta, Ga ...	200	...	11	2	2	.....	19 50
Mastodan Ammo. Sol. Phosphate..	Ga. Chemical Works.	Augusta, Ga....	Ga. Chem. Works.	Augusta, Ga...	200	2	6¾	2¼	1½	1	22 30
Georgia Formula................	"	"	"	"	200	1¾	6¾	2¼	1½	1	21 32
Acid Phosphate	"	"	"	"	200	...	9	3	1	1	19 00
Acid Phosphate	"	"	"	"	200	...	10	3	1	.....	19 50
Waverly Fert. Season of 1890-91..	Paul Hoffman	Waverly, Ala...	W. & P. Hoffman.	Waverly, Ala..	200	2.50	4.50	2.25	1.25	1	20 88
Waverly Fertilizer, this Season....	"	"	"	"	200	2.50	4.50	2.25	1.25	1	20 88
Acid Phosphate	"	"	"	"	200	...	6	4	2	1	16 00
Wando Acid Phosphate	"	"	Wando Phos. Co..	Charleston, S.C.	200	...	10	1	½	.....	16 50
Imperial Ammoniated Fertilizer...	Imperial Fert. Co...	Charleston, S. C	Imperial Fert. Co.	"	200	2.06	6	2	2	1	21 03
Cte. Cte. Ammoniated Fertilizer ..	"	"	"	"	200	2.06	6	2	2	1	21 03
Cte. Cte. Soluble Guano	"	"	"	"	200	1.65	6	2	1½	1	19 44
Imperial Soluble Guano	"	"	"	"	200	1.65	6	2	.½	1	19 44
XXX Blood and Bone	"	"	"	"	300	1.65	6	2	1½	1	19 44
Imperial Ammo. Dissolved Bone ..	"	"	"	"	200	.82	8	2	1½	1	19 20
Imperial Acid Phosphate	"	"	"	"	200	....	9	2	1½	1	17 50
Cte Cte. Acid Phosphate	"	"	"	"	200	...	9	2	1½	1	17 50
XXX Ammo. Phosphate	"	"	"	"	200	...	9	2	1½	1	17 50
Imperial Dissolved Bone.........	"	"	"	"	200	....	10	2	2	....	18 00
Cte. Cte. Dissolved Bone.........	"	"	"	"	200	...	10	2	2	..	18 00
Lockwood Cotton Grower.........	"	"	"	"	200	1.65	6	2	1½	1	19 44
Sterling Guano..................	"	"	"	"	200	1.65	6	2	1½	1	19 44
Sterling Acid	"	"	"	"	200	..	9	2	1½	1	17 50
Lockwood Acid..................	"	"	"	"	200	.	9	2	1½	1	17 50
ee Fertilizer......	Jernigan & Lipscomb	Opelika, Ala....	Jerni'n & Lipsc'mb	Opelika, Ala....	200	2.25	8	1	1	2	24 27
armer's Club Guano.......	"	"	"	"	200	1.67	8	1	1	2	22 01
. & L. Dissolved Bone..........	"	"	"	"	200	....	11	2	2	.....	19 50
Kennesaw High Grade Ammonia .	Kenesaw Guano Co.	Atlanta, Ga	Kenesaw GuanoCo	Clifton, Ga	200	2½	6	3½	1	1¾	25 75
enesaw Ammo. Dissolved Bone.	"	"	"	"	200	2	6	3½	1	1½	23 55
lood & Bone Compound.	"	"	"	"	200	1½	6	3½	1	1	21 10
igh Grade Acid Phosphate......	"	"	"	"	200	....	10	3½	1	.....	20 25

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of Commissioner of Agriculture by Dealers and Manufacturers—Cont'd.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTURED.	Weight of Package.	GUARANTEED ANALYSIS.					Commercial Value.
	NAME.	ADDRESS.				Nitrogen.	Phosph'ric Acid			Potash.	
							Water Soluble.	Citrate Soluble.	Acid Soluble.		
mmo. Dissolved Bone Phosphate.	Lister's Agricultural Chemical Works.	Newark, N. J...	Lister's Agricul'ra Chemical Works.	Newark, N. J..	167	1.65	6	2	...	1	$19 44
. & R. Ammoniated Guano......	Lorentz & Rittler...	Baltimore, Md..	Lorentz & Rittler.	Baltimore, Md.	200	1.64	6	2	2	1	19 39
onogram Cotton Special........	"	"	"	"	200	.83	6	2	2	1	16 24
otash Acid Phosphate....	"	"	"	"	200	....	8	2	2	1¾	16 75
'appoo High Grade Acid Phos...	J. F. Leary.........	Montgom'y, Ala	Wappoo Mills...	Charleston, S. C	200		12	1½		..	20 25
ust Proof............	Luverne Fert. Co...	Luverne, Ala..	Luverne, Fert. Co.	Luverne, Ala..	200	1 65	7	1	1	1	19 43
anter's Pride Guano............	Marietta Guano Co..	Atlanta, Ga...	Marietta Guano Co	Atlanta, Ga....	200	1.75	7	2	2	1.50	21 82
lid South Guano................	"	"	"	"	200	1 75	7	2	2	1 50	21 82
. G. C. Dissolved Bone.........	"	"	"	"	200	1	7	2	2	1 25	18 65
iedmont Acid Phosphate.	"	"	"	"	200	...	9	4	2	....	19 50
eef Blood and Bone Compound...	"	"	"	"	200	1	7	2	2	1.25	18 65
lliance High Grade Guano......	"	"	"	"	200	1.75	7	2	2	1 25	21 57
lid South Guano...............	"	"	"	"	200	1.75	7	2	2	1.25	21 57
eef Blood and Bone Compound...	"	"	"	"	200	1	7	2	2	1.25	18 65
. G. C. Dissolved Bone.........	"	"	"	"	200	1	7	2	2	1.25	18 65
iedmont Acid Phosphate...... ..	"	"	"	"	200	...	9	4	2	.....	19 50
arietta High Grade Acid Phos...	"	"	"	"	200	..	7	4	2	...	19 50
anters Pride Guano	"	"	"	"	200	1.75	7	2	2	1.25	21 57
obile Standard Guano...........	Mobile Phosphate & Chemical M'fg Co.	Mobile, Ala....	Mobile Phos. & Chemical M'fg Co.	Mobile, Ala....	200	1.86	8	2	2	1	23 25
lipse Guano....................	"	"	"	"	200	1.65	7	2	2	1	20 93
X. L. Acid Phosphate..........	"	"	"	"	200	...	10	2	2	.....	18 00
obile Standard Acid Phosphate..	"	"	"	"	200	...	11	2	2	.....	19 50
ainit...	"	"	Imported........	"	200	..	.....	...	...	11	11 00
obile Standard Guano	"	"	"	"	200	1.86	8	2	1	1	23 25
X. L. Acid Phosphate.....	"	"	"	"	200	...	10	2	2	.....	18 00
ontgomery Blood and Bone Fert.	Montgomery Fer. Co	Montgom'ry, Ala	Montgom'y Fer. Co	Montgom'ry, Ala	200	2	7	2	1	2	23 30

ea Gull Soluble Guano...........	"	"	"	"	200	2	7	2	1	2	23 30
mmoniated Dissolved Bone......	"	"	"	"	200	1	7	2	1	1	18 40
High Grade Acid Phosphate......	"	"	"	"	200	...	10	2	1	.....	18 00
Vandiver's Ammo. Dissolved Bone.	"	"	"	"	200	1.05	8	1	1	1	18 59
Vandiver's High Grade Acid Phos.	"	"	"	"	200	...	11	1	1	.....	18 00
Eng. Acid Phosphate, High Grade.	"	"	"	"	200	...	11	1	1	.....	18 00
ea Gull Soluble Guano....	"	"	"	"	200	2	7	2	1	2	23 30
Montgomery Blood & Bone Fert...	"	"	"	"	200	2	7	2	1	2	23 30
Capital City Standard Fertilizer...	"	"	"	"	200	1.50	7	2	1	2	21 35
Our Cotton King Guano....	"	"	"	"	200	1	7	2	1	1	18 40
High Grade English Acid Phos....	"	"	"	"	200	...	11	1	1	.....	18 00
Dowling Alkaline Guano.. ...	"	"	"	"	200	1.23	7	1	1	2	18 79
Alliance Soluble Guano....	"	"	"	"	200	1.50	7	2	1	2	21 35
Tariff Reform Soluble Guano.....	"	"	"	"	200	1.50	7	2	1	2	21 35
A. S. & Co. High Grade Acid Phos	"	"	"	"	200	...	11	1	1	.....	18 00
English Acid Phos. High Grade...	"	"	"	"	200	...	11	1	1	....	18 00
English Acid Phosphate....	"	"	"	"	200	...	11	1	1	.....	18 00
South. States Stand. Ammo. Bone.	C. L. Montaigue & Co	Savannah, Ga.	C.L.Montaigue&Co	Savannah, Ga.	200	1.65	5	3	1	1	19 44
Favorite Fertilizer....	Marks & Gayle.	Montgom'ry, Ala	Alabama Fert. Co.	Montgom'ry, Ala	200	2	6	2	1	1	20 80
Acid Phosphate......	"	"	Edisto Phos. Co..	Charleston, S. C	200	...	10	3	1½	.....	19 50
Kainit..	"	"	Imported........	....	200	...	.....	...	...	13	13 00
Muriate Potash....	"	"	Imported........	....	200	..	....	...	.	82	82 00
Southern Soluble Guano	Meridian Fert. Fac'y	Meridian, Miss..	Meridian Fert. Co.	Meridian, Miss	200	2	8¾	1¾	1	2¼	25 80
Standard Home Mixture Guano...	"	"	"	"	200	2	8½	1¾	1	2¼	25 43
Perfection Guano..............	McMillan & Harris'n	Mobile, Ala....	McMil'n &Harris'n	Mobile, Ala....	200	2¼	7½	1	½	1½	23 02
No. 1 Acid Phosphate............	"	"	Imported......	....	200	...	14	1	..	....	22 50
No. 2 Acid Phosphate......... ...	"	"	Imported...	....	200	...	9	4	...	..	19 50
Kainit	"	"	Imported...	....	200	...		..	..	12½	12 50
Acid Phosphate...	National Fert. Co...	Nashville, Tenn.	National Fert. Co	Nashville, Tenn	200	..	10	2	2	..	18 00
Ammoniated Dissolved Bone......	"	"	"	"	200	1.02	8	2	1	1.25	20 22
Rock City Guano..............	"	"	"	"	200	1.85	6	2	1	1 25	20 46
Tennessee Guano....	"	"	"	"	200	1 85	6	2	1	1.25	20 46
Old Hickory Guano...	"	"	"	"	200	1.85	6	2	1	1 25	20 46
Ammoniated Dissolved Bone.....	Northwest'n Fer. Co	Chicago, Ill ...	Northw'st'nFer.Co	U. S. Yards, Chicago, Ill ...	200	1¾	2.20	5 80	...	.5	18 92
Natural Bone Dust......	"	"	"	"	200	1¾	2 20	5 80		.5	18 92
Ober's Dis. Bone Phos. Soluble....	G. Ober & Sons Co..	Baltimore, Md..	G. Ober Sons & Co	Baltimore, Md..	200	....	10	1	1	....	16 50

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of Commissioner of Agriculture by Dealers and Manufacturers—Cont'd.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTURED.	Weight of Package.	GUARANTEED ANALYSIS.					Commercial Value.
							Phosph'ric Acid				
	NAME.	ADDRESS.				Nitrogen.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Potash.	
ber's Sol. Am. Super Phos. Lime.	G. Ober & Sons Co..	Baltimore, Md..	G. Ober Sons & Co	Baltimore, Md..	200	2	6¾	2	2	1.40	$22 32
ber's Georgia Cotton Compound..	"	"	"	"	200	2	6¾	2¾	2	1 40	22 32
ber's Farmers Stand. Am. Phos..	"	"	"	"	200	1 80	6¾	1¾	2	1.50	21 27
ber's Ammoniated Dis. Bone	"	"	"	"	200	1 80	6¾	1¾	2	1.50	21 27
atapsco Ammo. Soluble Phos....	Patapsco Guano Co.	Augusta, Ga...	Patapsco Guano Co	"	200	2	6¾	2¼	1⅓	1	22 30
mmoniated Dissolved Bone......	"	"	"	"	200	1¾	6¾	2¼	1½	1	21 32
atapsco Acid Phosphate..........	"	"	"	"	200	...	9	3	1	1	19 00
atapsco Acid Phosphate..........	"	"	"	"	200	...	10	3	1	.....	19 50
ollard Pacific Guano	Pacific Guano Co....	Boston, Mass...	Pacific Guano Co .	Boston, Mass..	200	1.75	6 50	2	2	I	20 57
ome C. & C. Guano	Rome Chemical Co .	Rome, Ga	Rome Chemical Co	Rome, Ga	200	2	6	2	1	2	21 80
ome Sol. Bone with Am. & Potash	"	"	"	"	200	1	8	2	1	2	20 90
ome Acid Phosphate	"	"	"	"	200	...	8	2	1	..	15 00
mpire Guano	Rasin Fertilizer Co.	Baltimore, Md..	Rasin Fertilizer Co	Baltimore, Md..	200	2	5	4	1	1¾	23 05
oluble Specific Guano.	"	"	"	"	200	3	5	4	1	2	27 20
oluble Sea Island Guano..... ..	"	"	"	"	200	2	5	4	1	1¾	23 05
cid Phosphate	"	"	"	"	200	...	10	4	1	..	21 00
outh American Guano	"	"	"	"	200	2	5	4	1	1¾	23 05
lant Guano	"	"	"	"	200	2	5	4	1	1¾	23 05
ing Guano......................	"	"	"	"	200	2	5	4	1	1¾	23 05
oyal Acid Phosphate	Royal Fertilizer Co.	Charleston, S. C	Royal Fert. Co....	Charleston, S. C	200	...	9	2	1½	I	17 50
oyal Dissolved Bone..	"	"	"	"	200	.	10	2	2	...	18 00
oyal Ammoniated Fertilizer......	"	"	"	"	200	2.06	6	2	2	1	21 03
oyal Soluble Guano.	"	"	"	"	200	1 65	6	2	1½	1	19 44
oyal Ammoniated Dis. Bone.....	"	"	"	"	200	.82	8	2	1½	1	19 20
enuine German Kainit.........	"	"	Imported.........	....	200	...	......	...	.	12	12 00
eese's Pacific Guano..	John S. Reese & Co.	Baltmore, Md...	Jno. S. Reese & Co	Baltimore, Md..	200	1 85	3 50	5	1 20	1.20	21 17
xcellenza Solable Guano.........	"	"	"	"	200	1 85	3 50	5	1 20	1 20	21 17

armers Friend	Read Fertilizer Co.	Charleston, S. C	Read Fertilizer Co.	New York, N. Y	200	2.05	6	2	2	1	21 00
atchless Cotton Grower	“	“	“	“	200	1.64	6	2	2	1	19 42
eader Acid Phosphate	“	“	“	“	200	...	7	3	2	.....	15 00
ıb-Treasury Guano	“	“	“	“	200	1.64	6	2	2	1	19 42
enuine German Kainit	“	“	Imported	“	200	...	.....	...	...	12.44	12 44
igh Grade Acid Phosphate	“	“	Read Fertiiizer Co.	“	200	...	10	3	3	.....	19 50
ew York Soluble Bone	“	“	“	“	200	...	7	3	3	.....	15 00
luble Sea Island Guano	W. C. Robinson	Coffeeville, Ala.	Rasin Fertilizer Co	Baltimore, Md.	200	2	6	3	1	2	23 30
ossypium Phosphate	G. W. Scott Mfg. Co.	Atlanta, Ga.	G. W. Scott Mfg Co	Atlanta, Ga	200	2	6	3	1	1 50	22 80
ott's Animal Ammo. Guano	“	“	“	“	200	1.65	6	3	1	1	20 93
ansell's State Standard	“	“	“	“	200	1.65	6	3	1	1	20 93
ott's Patasso Pbosphate	“	“	“	“	200	...	7	5	1	2	20 00
ott's High Grade Acid Phos	“	“	“	“	200	...	7.50	5.50	1	.....	19 50
teiner's Am. Raw Bone Sup. Phos	Standard Guano & Chemical M'fg Co.	New Orleans, La	Standard Guano & Chemical M'fg Co.	New Orleans, La	200	1¾	4	4	...	2	20 72
tandard Ammo. Soluble Guano	“	“	“	“	200	1¾	4	4	...	2	20 72
hampion Farmers Choice	“	“	“	“	200	1¾	4	4	...	2	20 72
round Bone	“	“	“	“	200	3¼	.....	...	21	.....	12 27
issolved Bone	“	“	“	“	200	...	15	1	...	.....	24 00
cid Phosphate	“	“	“	“	200	...	15	1	...	.....	24 00
ainit	“	“	Imported.	“	200	...	.....	...	...	12	12 00
ruit Tree Fertilizer	“	“	Standard Guano & Chemical M'fg Co	“	200	3¼	.....	...	19		12 27
egetable Fertilizer	“	“	“	“	200	3¼	4	2	...	5	26 27
ono Soluble Guano	Stone Phos. Works.	Charleston, S. C	Stano Phos. Works	Charleston, S. C	200	2	6	2	2	1	20 80
ono Acid Phosphate	“	“	“	“	200	...	8	2	2	1	16 00
ono Dissolved Bone	“	“	“	“	200	...	10	2	2	.....	18 00
olden Rod Guano	So. Ala. Oil & Fer. Co	Ozark, Ala.	South Ala. Oil & Fertilizer Co.	Ozark, Ala.	200	1.88	7.75	1 75	.50	1.75	23 33
issolved Bone	“	“	“	“	200	...	10	3½	...	.....	20 25
ew Issue Guano	“	“	“	“	200	1	7	1	.50	1	16 90
amond Cot. Food Ammo. Bone.	Savannah Guano Co.	Savannah, Ga	Savan'h Guano Co	Savannah, Ga.	200	1.65	5	3	1	1	19 44
r Own Ammoniated Bone.	“	“	“	“	200	1.65	5	3	1	1	19 44
X Stannard Ammoniated Bone	“	“	“	“	200	1.65	5	3	1	5	18 94
celsior Ammoniated Bone	“	“	“	“	200	1.65	5	3	1	1	19 44
glish Dis. Bone Acid Phosphate	“	“	“	“	200	...	8	5	1	.....	19 50
andard Bone Guano	“	“	“	“	200	.82	7	3	1	1	19 22

Guaranteed Analyses of Commercial Fertilizers, Filed in the Office of the Commissioner of Agriculture by Dealers and Manufacturers—Cont'd.

NAME OF FERTILIZER OR CHEMICAL.	BY WHOM REPORTED.		BY WHOM MANUFACTURED.	WHERE MANUFACTURED	Weight of Package.	GUARANTEED ANALYSIS.					Commercial Value.
							Phosph'ric Acid				
	NAME.	ADDRESS.				Nitrogen.	Water Soluble.	Citrate Soluble.	Acid Soluble.	Potash.	
id Phosphate with Potash.	Savannah Guano Co.	Savannah, Ga..	Savan'h Guano Co	Savannah, Ga..	200	...	7	4	1	1	17 50
d Dominion	Southern Phos. Co..	Atlanta, Ga.....	Southern Phos. Co	Atlanta, Ga.....	200	2	8	1½	1	1½	23 55
uthern Ammo. Dissolved Bone..	"	"	"	"	200	2	7	1½	1	1½	22 05
tent Pacific	"	"	"	"	200	2	7	1½	1	1½	22 05
owah Super Phosphate	"	"	"	"	200	85	8	2	1	1	19 31
uthern Acid Phosphate.........	"	"	"	"	200		9	2	1	..	16 50
a Fowl Guano	Jos. Steiner & Sons.	Greenville, Ala.	Bradley Fert. Co..	Boston, Mass...	200	1.85	6 50	2.39	2	1	21 54
lmetto Acid Phosphate..	"	"	"	"	200	...	9	3	1	.....	18 00
glish Acid Phosphate	"	"	"	"	200	...	9	3	1	....	18 00
nkage..	"	"	"	"	200	5 80	.....	...	15	....	15 00
igh Grade Eng. Acid Phosphate.	"	"	Imp. "	"	200	...	9	3	1	.....	18 00
a Fowl Guano B. D	Steiner Bros. & Co..	"	"	"	200	1.85	6.50	2 39	2	1	21 54
lmetto Acid Phosphate	"	"	"	"	200	...	9	3	1	.....	18 00
glish Acid Phosphate	"	"	"	"	200	...	9	3	1	.....	18 00
nkage	"	"	Armour Pack'g Co	Kansas City, Mo	200	5 80	.....	...	15	...	15 00
nmoniated Dissolved Bone	A. J. Soliman & Sons	Charleston, S. C	Royal Fert. Co. ..	Charleston, S. C	200	1.65	1½	2	6	2	19 44
mplete Fertilizer	Scholze & Bro	Chattanooga, T.	Scholze & Bro ...	Chattanooga, T.	200	80	8	3 30	1 40	1 75	25 72
nsley's Standard Fertilizer	Tinsley Fertilizer Co	Selma, Ala.....	Tinsley Fert. Co..	Selma, Ala.	200	2	8	1	2	1½	22 80
nsley's Standard Acid Phosphate	"	"	"	"	200	...	10	3	2	.....	19 50
oy Perfect Fertilizer...........	Troy Fertilizer Co ..	Troy, Ala.......	Troy Fert. Co.....	Troy, Ala.	200	1¾	7	1	...	1	19 82
rmer's Alliance Guano	"	"	"	"	200	1¾	7	1	...	1	19 82
oy Acid Phosphate............	"	"	"	"	200	...	10	2	...	.....	18 00
xie Soluble Guano...........	"	"	"	"	200	1¾	7	1	...	1	19 82
orida Acid Phosphate	"	"	"	"	200	...	10	1	1	.....	16 50
sin Acid Phosphate	Thomas Brothers. ..	Fairfield, Ala...	Rasin Fertilizer Co	Baltimore, Md..	200	...	12	2	1	.....	21 00
luble Sea Island Guano	"	"	"	"	200	2	6	3	1	2	23 30
uble Specific Guano...........	"	"	"	"	200	3	8	2	1	2	28 70

rown Guano......................	Treadw'll, Abb'tt & C	Atlanta, Ga ...	Baldwin Fert. Co. Walton & Whann C	Port Royal, S. C Charleston, S. C	200	1 75	8	2	1.50	2	23 82
andiver's Am. Dissolved Bone...	W. F. Vandiver & Co	Montgom'ry, Ala	Montg'ry Fert. Co.	Montgomery, Ala	200	1.05	8	1	1	1	18 59
igh Grade English Acid Phos...	“	“	“	“	200	.87	7	2	1	1	17 91
iamond Soluble Bone Phosphate.	“	“	“	“	200	....	11	1	1	......	18 00
X Acid Phosphate..............											
andiver's High Grade Phosphate	“	“	“	“	200	....	10	1	1	......	16 50
urman High Grade.............	Vaughn & Robinson	Heflin, Ala.....	Furman Farm Improvement Co.	East Point, Ga..	200	2.25	7 50	2.50	2	1.50	25 27
uffalo Bone....................	“	“	“	“	200	1 75	6	3	2	1	21 33
urman's Soluble Bone	“	“	“	“	200	.85	8	3	2	1	20 80
eef Blood & Bone Compound....	“	“	Marietta GuanoCo.	Atlanta, Ga.....	200	1	7	2	2	....	17 40
iedmont Acid..................	“	“	“	“	200	....	9	4	2		19 50
low Brand Raw Bone Super-phos.	Walton & Whann Co	Charleston, S. C.	Walton & Whann C	Charleston, S. C.	200	2	6	2	2	2¼	22 05
eliance Ammo. Super-phosphate	“	“	“	“	200	1 ½	5	2	1	1	17 35
V. & W. Co. Ammo. Dis. Bone .	“	“	“	“	200	.87	7	2	1	1	17 90
iamond Soluble Bone...........	“	“	“	“	200	....	10	1	1	....	16 50
X Acid Phosphate..............	“	“	“	“	200	...	10	1	1	.....	16 50
Valton Guano	Walton Guano Co...	Social Circle, Ga	Walton Guano Co.	Social Circle, Ga	200	2	7	2	2	1	22 30
Valton Acid Phosphate..........	“	“	“	“	200	....	10	3	2	....	19 50
merican Ammo. Bone Super-phos	William & Clark Fertilizer Co......	New York, N. Y.	Williams & Clark Fertilizer Co ..	New York, N. Y	200	1.65	6	2	2	1	19 43
Vando Soluble Guano............	Wando Phos. Co...	Charleston, S. C.	Wando Phos. Co..	Charleston, S. C	200	1 65	6.50	2	2	1	20 19
Vando Ammo. Dissolved Bone....	“	“	“	“	200	.75	7	3	2	1	18 92
Vando Acid Phosphate...........	“	“	“	“	200	..	0	1	.50	....	16 50
Vando Dissolved Bone..........	“	“	“	“	200	..	10	1	.50	....	16 50
Vando Acid Phosphate..........	“	“	“	“	200	..	9	1	1	1	16 00
Vappoo High Grade Acid Phos. ..	Wappoo Mills	“	Wappoo Mills....	“	200		12	1½	....	....	20 25
. X. L. Acid Phosphate	W. S. Wiggins, Sr..	Monroeville, Ala	Mobile Phosphate & Chem. Co.	Mobile, Ala.....	200	..	10	2	2	....	18 00
Iobile Standard Guano..........	“	“	“	“	200	1.86	8	2	2	1	23 25
ure High Grade Phosphate	Williams Bros......	LaPlace, Ala. ..	Alabama Fert. Co.	Montgom'ry, Ala	200	..	10	3	1½	....	19 50
ainit.......................	“	“	Imported.........	“	200	..	....	..	....	12	12 00
ell Ammo. Bone Super-phosphate	Zell Guano Co......	Baltimore, Md..	Zell Guano Co....	Baltimore, Md..	200	1 87	6	3	1	1¼	22 06
ell Economizer.................	“	“	“	“	200	1 87	6	3	1	1¼	22 06

FERTILIZER LAWS.

SECTION 139. *Sale or exchange of commercial fertilizers.*—Commercial fertilizers must not be sold or exchanged without a license from the Commissioner, authorizing the person making a sale or exchange to deal therein. All sales or exchanges made without such license are void.

SEC. 140. *License.*—On the payment of a fee of one dollar, the Commissioner must issue license to any person or firm, or corporation, or association of persons, authorizing the sale or exchange of fertilizers during a season, expiring on the thirtieth day of September of each year.

SEC. 141. *Tags to be supplied; licensee.*—The Commissioner must furnish the licensee on application, tags to be attached to fertilizers sold or exchanged, of the kind and description he is required by subdivision 17 of section 137 to prepare, on the payment to him of fifty cents for a number sufficient to tag a ton of fertilizers. *Before selling or exchanging, or offering to sell or exchange fertilizers, the licensee must attach one of the tags to each bag, barrel or package thereof, and a sale or exchange of fertilizers, not so tagged, is* void.

SEC. 142. *Fertilizers to be submitted to Commissioner.*—Before offering a fertilizer for sale or exchange, the person proposing to sell or exchange must submit to the Commissioner a written or printed statement setting forth—

1. The name and brand under which such fertilizer is to be sold or exchanged, the number of pounds contained in the bag, barrel or package, in which it is to be put upon the market, the name or names of the manufacturers, and the place of manufacturing.

2. A statement setting forth the amount of the named ingredients which they are willing to guarantee such fertilizer to contain. First, nitrogen ; second, water soluble phosphoric acid ; third, citrate soluble phosphoric acid ; fourth, acid soluble phosphoric acid ; fifth, potash ; and such statement shall be held to constitute a guarantee to the purchaser that every package of such fertilizer contains not less than the amount of each ingredient set forth in the statement, and when such statement sets forth the maximum and the minimum of any ingredient, the commercial value shall be estimated upon the minimum alone, but this shall not preclude the party from setting forth any other ingredients which the fertilizer may contain, which, as well as the preceding, shall be embraced in the guarantee.

Sec. 143. *Fertilizers or chemicals for manufacturing to be branded.*—All fertilizers, or chemicals for manufacturing or composting the same, offered for sale, exchange or distribution, must have branded upon or attached to each bag, barrel or package, *in such manner as the commissioner* may by regulation establish, the true analysis of such fertilizer or chemical, as claimed by the manufacturer, showing the percentage of valuable elements or ingredients such fertilizer or chemical contains, *and its commercial value*, calculated upon the standard of value of the principal ingredients as set forth in section 142, *as priced by the commissioner of agriculture* at the beginning of each season, and in every case the brand must specially set forth the percentage contained in the fertilizer or chemical of the several ingredients specified in section 142 in the terms of that section.

Sec. 144. *Fertilizer; what included in terms.*—The term "fertilizer," or "commercial fertilizer," as used in this article, does not include common lime, land plaster, cotton seed, cotton seed meal, ashes, or common salt not in combination.

Sec. 145. *Chemist of Department*--The Professor of Chemistry of the Agricultural and Mechanical College is the official chemist of the Department. On the application of the Commissioner he must analyze and certify the analysis of all fertilizers, samples of which are furnished him, and at the request of the Commissioner, if he can without conflict with his duties as professor, must attend conventions of agricultural chemists, make reports of such matters as he may deem of interest to the Department, and render such other services in the line of his profession as the Commissioner may require.

Sec. 146. *Compensation of Chemist.*—The Chemist is entitled to such compensation as the Commissioner may deem reasonable; not exceeding five hundred dollars annually; and also to his necessary traveling expenses, while on duty assigned to him by the Commissioner; payable from the funds of the Department, on the certificate of the Commissioner.

Sec. 147. *Copy of official analysis; evidence.*—The copy of the official analysis of any fertilizer or chemical, under the seal of the Department of Agriculture, shall be admissible as evidence in any of the courts of this State, on the trial of any issue involving the merits of such fertilizer or chemical.

CRIMINAL LAWS.

Sec. 4153. *Dealing in fertilizers without submitting statement to Commissioner*—Any person who manufactures or exchanges, sells or offers for sale or exchange, any fertilizer without first submitting the statement required by law to the Commissioner of Agriculture, must, on conviction, be fined not more than five hundred dollars for each offense.

Sec. 4154. *Selling fertilizers without attaching proper tags.*—Any person who sells, exchanges or offers for sale or exchange, any bag, package or barrel of fertilizer which has not been tagged as provided by law, must, on conviction, be fined not less than fifty dollars for each offense.

Sec. 4155. *Using more than once, and counterfeiting tags, etc.*—Any person who counterfeits the tag prepared by the Commissioner of Agriculture, or who knowingly uses a counterfeit of such tag, or who uses a second time a genuine tag, or who uses the tag of a former season, must, on conviction, be fined one hundred dollars.

Sec. 4156. *Making false certificate of analysis of fertilizers.*—Any chemist who wilfully makes a false certificate of the analysis, or of the ingredients of any fertilizer intended or offered for sale or exchange, must, on conviction, be imprisoned in the penitentiary for not less than two, nor more than five years.

Sec. 4157. *Dealing in commercial fertilizers without license.*—Any person, who sells or exchanges fertilizers without having obtained a license from the Commissioner of Agriculture, as provided by law, must, on conviction, be fined not less than one hundred dollars for each offense.

Sec. 4158. *Fraud in manufacture, sale or exchange of fertilizer.*—Any person who commits a fraud in the manufacture, sale or exchange of any fertilizer, or of any of the ingredients of a fertilizer, must, on conviction, be fined not less than one hundred dollars for each offense.

LICENSES.

The following is a list of all licenses issued this season up to July 1st, with date when issued, number of license, post-offices, and the counties of the local dealers:

Date of Issue.	To Whom Issued.	Post-Office.	County.	No. of License
1891				
Oct. 5	Adair, A. D. & McCarty	Atlanta, Ga		5
Oct. 8	Atlanta Guano Co	Atlanta, Ga		8
Oct. 8	Americus Guano Co	Americus, Ga		9
Oct. 14	Ashepoo Phosphate Co.	Charleston, S. C		32
Dec. 3	Angier, Clarence	Atlanta, Ga		87
Dec. 10	Alabama Fertilizer Co	Montgomery, Ala	Montgomery.	94
Dec. 17	Arnold, F. M	Six Mile, Ala.	Bibb	98
Dec. 19	Allen, Sellers & Co	Montgomery, Ala.	Montgomery.	101
Dec. 21	Albany Fer. & F. Imp. Co.	Albany, Ga.		107
1892				
Jan. 6	Acree, O. A. C	Newton, Ala.	Dale	131
Jan. 7	Agee, W. P	Perdue Hill, Ala.	Monroe.	135
Jan. 16	Allen, Joel L	Opelika, Ala	Lee	168
Jan. 26	Allen, R. W. & Co	LaFayette,Ala	Chambers.	205
Feb. 5	Askew, J. M	Wetumpka, Ala	Elmore	267
Feb. 6	Andrews, W. T	Gold Hill, Ala	Lee	276
Feb. 9	Adams, Harrison & Willis.	Alexander City, Ala.	Tallapoosa	291
Feb. 13	Akin, G. C. & Sons	Notasulga, Ala	Macon.	324
Feb. 19	Appling, Samuel	Day's Gap, Ala.	Walker.	375
Feb. 19	Atkins, Owens & Co	Heflin, Ala	Cleburne	377
Feb. 25	Ashurst & DeLoach	Tallassee, Ala	Elmore	402
Mar. 14	Allred, Joseph	Hanceville, Ala	Blount	477
1891				
Oct. 5	Berkely Phosphate Co	Charleston. S. C		4
Oct. 8	Betts, W. H	Burnt Corn, Ala	Monroe.	11
Oct. 14	Bean, W. F	Troy, Ala	Pike	35
Oct. 17	Barbour, T. M	Tuscaloosa, Ala.	Tuscaloosa	40
Oct. 19	Baldwin Fertilizer Co	Savannah, Ga		42
Oct. 22	Bowker Fertilizer Co	Savannah, Ga		45
Oct. 26	Beavers & Marsh	Collinsville, Ala.	DeKalb	50
Nov. 7	Bradley Fertilizer Co	Boston, Mass.		60
Nov. 16	Brannen, C. S. & Son	Troy, Ala	Pike	69
Nov. 19	Beall, Jay W	Luverne, Ala.	Crenshaw.	73
Dec. 17	Boykin, Comer & Co.	Baltimore, Md.		99
Dec. 23	Brantley, T. K. & Sons.	Troy, Ala	Pike	110
Dec. 23	Brantley, T. K. & Sons	Troy, Ala	Pike	111
1892				
Jan. 15	Brantley & Edmonson	Troy, Ala	Pike	164
Jan. 16	Beard, J. M	Rutledge, Ala	Crenshaw.	170
Jan. 19	Bowden, Samuel	Gordon, Ala	Henry	175
Jan. 28	Bowen, J. L	Five Points, Ala	Chambers.	215
Jan. 29	Bellinger Brothers	Gadsden, Ala	Etowah.	220
Jan. 29	Brock, G. W	Sand Rock, Ala	Cherokee.	223

LICENSES—CONTINUED.

Date of Issue.		To Whom Issued.	Post-Office.	County.	No. of License
1892					
Jan.	30	Bosworth, Smith & Co	LaFayette, Ala	Chambers	229
Feb.	1	Bell, Lane & Co	Lincoln, Ala	Talladega	234
Feb.	1	Brown, J. A. & Co	Kellyton, Ala	Coosa	235
Feb.	2	Bradley & Edwards	LaPine, Ala	Crenshaw	240
Feb.	2	Burgess, J. A	Edwardsville, Ala	Cleburne	244
Feb.	8	Burgess & Kirby	Scottsboro, Ala	Jackson	286
Feb.	8	Bradley, J. W. & Co	Bradleyton, Ala	Crenshaw	288
Feb.	10	Brake, J. L	Warrior, Ala	Jefferson	303
Feb.	10	Burt, R. A	Brandon, Ala	DeKalb	304
Feb.	11	Broun, W. S	Birmingham, Ala	Jefferson	306
Feb.	11	Baldwin, W. E	Flint, Ala	Morgan	315
Feb.	12	Brake, B. M	Warrior, Ala	Jefferson	317
Feb.	12	Brice & Donehoo	Murphree's Valley	Blount	320
Feb.	15	Brice, C. H. & H. E	New Market, Ala	Madison	336
Feb.	15	Beach, H. M	Columbia, Ala	Henry	338
Feb.	17	Bell & Barker	Bell's Mills, Ala	Cleburne	357
Feb.	18	Brown, J. J	Ivy, Ala	Fayette	361
Feb.	20	Beeland, J. & Sons	Greenville, Ala	Butler	383
Feb.	23	Byers & Robinson	Ashville, Ala	St. Clair	390
Feb.	26	Brown, Robt. B. Oil Co	St. Louis, Mo		411
Feb.	27	Burns & Wilson	Lincoln, Ala	Talladega	416
Mar.	10	Burnett Brothers	Cedar Bluff, Ala	Cherokee	462
Mar.	10	Baddiford, W. H	Hardwicksburg, Ala.	Henry	464
Mar.	11	Branyan & Wilson	Kennedy, Ala	Lamar	466
Mar.	18	Bliss, R. L	Florence, Ala	Lauderdale	489
Mar.	23	Bledsoe, J. W	Three Notch, Ala	Bullock	499
Mar.	26	Banks & Owen	Hurtsboro, Ala	Russell	508
Apr.	2	Billingsly, F. M	Fayetteville, Ala	Talladega	513
Apr.	5	Bass, J. W	Leeds, Ala	Jefferson	514
Apr.	27	Ballard, Joshua	Omaha, Ala	Randolph	524
1891					
Oct.	9	Comer, Hull & Co	Savannah, Ga		15
Oct.	10	Connor, M	Troy, Ala	Pike	22
Oct.	12	Carroll & Murphree	Troy, Ala	Pike	26
Oct.	14	Carlisle, M. W. & Brother	Roanoke, Ala	Randolph	31
Oct.	16	Commercial Guano Co	Savannah, Ga		36
Oct.	22	Cowetta Fertilizer Co	Newnan, Ga		47
Oct.	22	Crocker Fert. & Chem. Co	Buffalo, N. Y	New York	48
Nov.	7	Columbus Oil Mills	Columbus, Miss		59
Nov.	21	Columbus Fertilizer Co.	Columbus, Ga		78
Nov.	25	Crawford, J. W	Abbeville, Ala	Henry	81
Nov.	28	Cincinnatti Dessicating Co	Cincinnati, O		82
Dec.	4	Cody, M. & J. M	Dothen, Ala	Henry	88
Dec.	10	Chicora Fertilizer Co.	Charleston, S. C		93
Dec.	24	Cody, M. & J. M	Midland, City, Ala	Dale	113
Dec.	28	Crawford, J. R	Dothen, Ala	Henry	118
1892					
Jan.	6	Clarke, W. T. & Co	Spring Garden	Cherokee	130
Jan.	11	Cooke, R. E. & Co	Cottonwood, Ala	Henry	145
Jan.	16	Cleveland, M. L	Randolph, Ala	Bibb	169
Jan.	21	Crew, Drummon & Co.	Goodwater, Ala	Crenshaw	189
Jan.	21	Crawley & Rouse	Wetumpka, Ala	Elmore	191

LICENSES—Continued.

Date of Issue.	To Whom Issued.	Post-Office.	County.	No. of License
1892				
Jan. 26	Cosper, Glover & Co	Sterrett, Ala	Shelby	208
Jan. 28	Cox, Geo. W	Notasulga, Ala	Macon	214
Feb. 1	Caswell, D. H	Tuscaloosa, Ala	Tuscaloosa	236
Feb. 9	Campbell, C. G	Shorterville, Ala	Henry	296
Feb. 9	Crompton, S. U	Maplesville, Ala	Chilton	298
Feb. 12	Chadwick, J. J	Snead, Ala	Blount	323
Feb. 13	Clements, W. N	Ft. Deposit, Ala	Lowndes	235
Feb. 13	Cumbee, J. & Son	Strouds, Ala	Chambers	328
Feb. 13	Cordovan, F. M	Clio, Ala	Barbour	333
Feb. 19	Cherry & Smith	Opelika, Ala	Lee	370
Feb. 19	Chewacla Lime Works	Chewacla, Ala	Lee	372
Feb. 24	Cohson, B. L	Gordon, Ala	Henry	396
Feb. 27	Cooke, J. E	Marietta, Ala	Walker	418
Mar. 1	Cullman Co., A. W. H. Co	Cullman, Ala	Cullman	425
Mar. 1	Crim Brothers	Newton, Ala	Dale	426
Mar. 2	Cooke Brothers	Cooke Springs, Ala	St. Clair	431
Mar. 2	Cooke Brothers	Vandiver, Ala	Shelby	432
Mar. 8	Cooke, Phillips & Walker	Kennedy, Ala	Lamar	456
Mar. 14	Chestnut, J. E	Gaylesville, Ala	Cherokee	479
Mar. 19	Cooke Brothers	Eden, Ala	St. Clair	491
Mar. 23	Cotton, Geo	Columbia, Ala	Henry	497
Mar. 24	Cooper, O. W	Oxford, Ala	Calhoun	503
May 6	Carney, Wm. M	Williams Sta., Ala	Escambia	525
1891				
Oct. 10	Davis, W. F. & Sons	Marion, Ala	Perry	19
Dec. 2	Dowling, John W	Ozark, Ala	Dale	86
1892				
Jan. 14	Dawson, W. P. & Son	Ware, Ala	Elmore	157
Jan. 15	Dermis, P. C	Coopers, Ala	Chilton	166
Jan. 21	Daniel, J. G. & Co	Greenville, Ala	Butler	192
Jan. 22	Davis, John H	Athens, Ala	Limestone	194
Jan. 29	Davis, E. R	Rock Run Sta., Ala	Cherokee	225
Jan. 30	Davis, Marshall & Co	Mobile, Ala	Mobile	233
Feb. 2	Dodson, W. R	North Port, Ala	Tuscaloosa	245
Feb. 2	Douglass Brothers	Russellville, Ala	Franklin	246
Feb. 4	Davenport, N. S	Valleyhead, Ala	DeKalb	255
Feb. 6	Dunklin, D. G. & Sons	Greenville, Ala	Butler	275
Feb. 10	Dumas, J. T	Arlington, Ala	Wilcox	305
Feb. 15	Dean, W. T. & Brother	Fayetteville, Ala	Talladega	345
Feb. 27	Davis & Naylor	Sand Mountain, Ala	DeKalb	420
Mar 3	Dake, Alex. G	Clanton, Ala	Chilton	436
Mar. 7	Douglass & Duncan	Alexander City, Ala	Tallapoosa	451
Mar. 15	Dean, W. R	Warrior, Ala	Jefferson	483
1891				
Oct. 12	East Ala. Fertilizer Co	Clayton, Ala	Barbour	23
Oct. 12	Etiwan Phosphate Co	Charleston, S. C		27
Oct. 28	Eufaula Oil & Fertilizer Co	Eufaula, Ala	Barbour	52
Dec. 28	Ellis, Charles	Savannah, Ga		117
1892				
Jan. 2	Edisto Phosphate Co	Charleston, S. C		127
Jan. 14	Edmonson, R. L. & Bro	Eufaula, Ala	Barbour	155
Jan. 21	Evans, H. H. & Co	Greensboro, Ala	Hale	186
Feb. 2	Emmons, T. J	Monroeville, Ala	Monroe	248

LICENSES—CONTINUED.

Date of Issue.	To Whom Issued.	Post-Office.	County.	No. of License
1892				
Feb. 11	Earle, P. H. & Co	Birmingham, Ala.	Jefferson	308
Feb. 17	Emmett, L. S	Albertville, Ala	Marshall	350
Feb. 18	Ethridge, W. R	Peach Bloom, Ala	Conecuh	367
Mar. 5	Estes, T. J	Day's Gap, Ala	Walker	446
Apr. 5	Englebert, F. R	Athens, Ala	Limestone	515
Apr. 16	Emmons, J. D	Williams Sta., Ala	Escambia	521
July 5	Espy, J. R	Gordon, Ala	Henry	530
1891				
Oct. 5	Folmar & Sons	Troy, Ala	Pike	2
Dec. 22	Farley, John C	Opelika, Ala.	Lee	108
1892				
Jan. 14	Finlay, W. A	Pollard, Ala	Escambia	161
Jan. 18	Faust, Jap. M	Warrior, Ala	Jefferson	172
Jan. 19	Forrester, B. A	Cowarts, Ala	Henry	177
Jan. 29	Frohoff, Frank	Hanceville, Ala	Blount	221
Feb. 4	French, B. D	Sylacauga, Ala.	Talladega	253
Feb. 8	Felder, J. B	Loachapoka, Ala.	Lee	279
Feb. 25	Fassett, F. M	Kirby's Creek, Ala.	Jackson	403
Feb. 25	Formby & Stewart	Spring Garden, Ala.	Cherokee	409
Mar. 5	Fullenwider, H	Vincent, Ala.	Shelby	449
Mar. 12	Finch, J. C	Finchburg, Ala.	Monroe	473
1891				
Oct. 22	Goulding Fertilizer Co., L'td	Pensacola, Fla		46
Nov. 9	Georgia Chemical Works.	Augusta, Ga		61
Dec. 31	Gilley, W. A	Wicksburg, Ala	Dale	122
1892				
Jan. 20	Griel Bros. & Co	Montgomery, Ala	Montgomery.	178
Jan. 23	Gray, William	Dadeville, Ala	Tallapoosa	195
Jan. 25	Greene, James R	Waverly, Ala.	Lee	199
Feb. 2	Gilbert, R. F	Portersville, Ala	DeKalb	247
Feb. 8	Gerson, A. & Sons	Montgomery, Ala	Montgomery.	277
Feb. 9	Gray, Draper & Co	Oxford, Ala	Calhoun	297
Feb. 10	Gulledge, F. A	Verbena, Ala	Chilton	302
Feb. 12	Gilbert, John R	Pinckneyville, Ala	Clay	319
Feb. 18	Garner, William	Ozark, Ala	Dale	364
Feb. 20	Griffith, Asa	Hanceville, Ala	Blount	381
Feb. 26	Gitbreath, Emmett	Guntersville, Ala	Marshall	413
Feb. 29	Gaines, R. A	Fredonia, Ala	Chambers	422
Mar. 4	Griffith, J. J. & Bro	Hanceville, Ala	Blount	442
Mar. 15	Gilder, G. C	Mount Meigs, Ala	Montgomery.	481
Mar. 15	Gilder, G. C	Shady Grove, Ala	Pike	482
Mar. 16	Griffin, W. H	Oxford, Ala	Calhoun	486
1891				
Oct. 10	Henderson, J. C	Troy, Ala	Pike	20
Oct. 10	Henderson, Fox	Troy, Ala	Pike	21
Oct. 12	Henderson & Murphree	Ozark, Ala	Dale	25
Oct. 14	Henderson & Rainer	Troy, Ala	Pike	34
Oct. 24	Hooper, C. W. & Co	Selma, Ala	Dallas	49
Nov. 14	Hodo, A. T	Carrollton, Ala.	Pickens	67
Dec. 19	Hughes, J. E	Floralla, Ala.	Bullock	102
Dec. 23	Hunt, L. A. & Co	Clio, Ala	Barbour	112
Dec. 31	Henderson, E. M	Troy, Ala	Pike	122

LICENSES—Continued.

Date of Issue.	To Whom Issued.	Post-Office.	County.	No of License
1892				
Jan. 2	Hurst, W. D	Opelika, Ala	Lee	124
Jan. 2	Hoffman, Paul.	Waverly Ala	Lee	126
Jan. 6	Houton & Co	Columbia, Ala	Henry	133
Jan. 7	Herring B. W	Headland, Ala	Henry.	138
Jan. 11	Henderson Bros. & Co	Troy, Ala	Pike	140
Jan. 11	Henderson, W. D. & Chas	Troy, Ala	Pike	141
Jan. 11	Henderson, J. M. & Fox	Troy, Ala	Pike	142
Jan. 11	Howle Brothers	Edwardsville, Ala.	Cleburne	150
Jan. 11	Harwell, W. O	Opelika, Ala.	Lee	151
Jan. 11	Holley, F. M	Lawrenceville, Ala.	Henry	153
Jan. 18	Hill, Jones & Co	Roanoke, Ala	Randolph	171
Jan. 20	Hobbie, Teague & Co	Montgomery, Ala	Montgomery.	180
Jan. 21	Holifield, J. A. & Co	Auburn, Ala	Lee	190
Jan. 21	Head, T. L. & Co	China Grove, Ala	Pike	193
Jan. 29	Harrison, Jno. D.	Grafton, Ala	Henry	218
Jan. 29	Hudson, H. E	Monroeville, Ala	Monroe	222
Feb. 1	Hutchinson, J. N	Salem, Ala	Lee	239
Feb. 3	Hughes, R. F	Piedmont, Ala	Calhoun	250
Feb. 4	Henderson & Rainer	Troy, Ala	Pike	260
Feb. 5	Herring, J. W. & Bro	Midland City, Ala	Dale	263
Feb. 6	Hertzler & Anderson.	Madison, Ala	Madison	270
Feb. 8	Hirsch Brothers	Seale, Ala	Russell.	290
Feb. 9	Haddock, F. P	Hatchechubbee, Ala	Russell.	295
Feb. 9	Haynes, D. P	Oxford, Ala	Calhoun	301
Feb. 11	Hamil Brothers	Troy, Ala	Pike	310
Feb. 24	Hagwood, T. E	Branchville, Ala	St. Clair.	399
Feb. 25	Hoffman, Walter	Waverly, Ala	Lee	406
Feb. 25	Hood, David	Clarence, Ala	Blount	407
Feb. 27	Hood, W. T	Murphree's Val. Ala	Blount	417
Mar. 3	Henderson, T. J	Mountain Creek, Ala	Chilton	437
Mar. 4	Haynie, W. H	Loachapoka, Ala	Lee	443
Mar. 9	Hartselle Bros. & Co	Hartselle, Ala	Morgan	457
Mar. 9	Henderson Brothers	Fullerton, Ala	Cherokee	458
Mar. 12	Hurt & Co	Limrock, Ala	Jackson	471
Mar. 14	Henry, A. G., Jr	Guntersville, Ala	Marshall	474
Mar. 15	Hooper, C. S	Blount Springs, Ala.	Blount	480
Mar. 17	Harrell, W. F	Blount Springs, Ala.	Blount	488
Mar. 23	Hale, J. R. & Bro	Hale, Ala	Marion	495
Mar. 24	Hamilton Bros	LaPlace, Ala	Macon	504
Apr. 7	Hale & Hale	Leesburg, Ala	Cherokee	514
1891				
Oct. 14	Imperial Fertilizer Co	Charleston, S. C		33
1892				
Feb. 17	Ivey, J. W	Petrey, Ala	Crenshaw	353
1891				
Oct. 30	Johnson, T. M	Augusta, Ga		57
Nov. 10	Jones, V. D	Troy, Ala	Pike	65
Dec. 1	James, P. P	Centreville, Ala	Bibb	84
Dec. 17	Jernigan & Lipscomb	Opelika, Ala	Lee	97
Dec. 21	Jones & Co	Newton, Ala	Dale	105
1892				
Jan. 11	Johnson, J. J	Geneva, Ala	Geneva	143
Feb. 11	Jones, Searcy & Whitman	Charlton, Ala	Dale	309

LICENSES—Continued.

Date of Issue.	To Whom Issued.	Post-Office.	County.	No. of License
1892				
Feb. 15	Jackson, A. C	Vernon, Ala	Lamar	344
Feb. 23	Jordan, Manning & Co	Guntersville, Ala	Marshall	394
Mar. 1	Jennings, Ben	Seale, Ala	Russell	423
Jan. 20	Killan, W. E	Brandon, Ala	DeKalb	179
Jan. 25	Kirkland, Levi	Cowarts, Ala	Henry	200
Jan. 30	Koopman & Gerdes	Cullman, Ala.	Cullman	232
Feb. 5	Kelley, G. W	Midland City, Ala	Dale	264
Feb. 6	Keel, S	Merigold, Ala	Madison	274
Feb. 17	Kyser, J. K	Burnt Corn, Ala	Monroe	352
Feb. 25	King, Claude	Leighton, Ala	Colbert	404
Mar. 7	Killian, G, W	Portersville, Ala	DeKalb	450
Mar. 7	Kitchens Brothers	Heflin	Cleburne	452
Mar. 25	Kroell, George	Montevallo, Ala	Shelby	506
1891				
Oct. 10	Lazenby, Reynolds & Co	Forest Home, Ala	Butler	17
Oct. 30	Loeb, Simon	Montgomery, Ala	Montgomery	56
Nov. 23	Listers Agric. & Chem. Works	Newark, N. J		79
Dec. 5	Lorentz & Rittler	Baltimore, Md		89
Dec. 11	Lull & Lancaster	Wetumpka, Ala	Elmore	96
1892				
Jan. 7	Lemay, S. I	Hartselle, Ala	Morgan	137
Jan. 15	Langston & Woodson	Atlanta, Ga		165
Jan. 18	Lewis. D. L. & J. A	Alpine, Ala	Talladega	174
Jan. 21	Long & Co	Granger, Ala	Henry	187
Jan. 26	Lamar, L. & E	Selma, Ala	Dallas	204
Jan. 27	Leary, J. F	Montgomery, Ala	Montgomery	209
Jan. 29	Leslie, Geo	Gordon, Ala	Henry	217
Feb. 2	Lewis, D. L. & J. A	Sycamore, Ala	Talladega	242
Feb. 2	Lauderdale & Crew	Goodwater, Ala	Coosa	249
Feb. 8	Lemle, L	Montgomery, Ala	Montgomery	280
Feb. 8	Lowry, R. F	Perdue Hill, Ala	Monroe	285
Feb. 11	Lowry, W. W	Williams Sta., Ala	Escambia	312
Feb. 17	Lemle, I	Montgomery, Ala	Montgomery	356
Feb. 18	Lauderdale, J. S	Alexander City, Ala	Tallapoosa	358
Feb. 19	Luverne Fertilizer Co	Luverne, Ala	Crenshaw	379
Feb. 20	Little, C. E	Auburn, Ala	Lee	380
Feb. 22	Lee, Alonzo J	Burnt Corn, Ala	Monroe	385
Feb. 27	Leman, A	Greenville, Ala	Butler	415
Mar. 3	Lee, Robt. A. & Co	Greenville, Ala	Butler	439
Mar. 10	Latham, S. A & Co	Montevallo, Ala	Shelby	463
Mar. 21	Long, N. W. E	Hurtsboro, Ala	Russell	492
Mar. 26	Lawrence, R	Cedar Bluff, Ala	Cherokee	507
1891				
Oct. 5	Marietta Guano Co	Atlanta, Ga		3
Oct. 9	Montgomery Fertilizer Co	Montgomery, Ala.	Montgomery	13
Oct. 9	Mobile Phosphate Co	Mobile, Ala	Mobile	14
Oct. 9	Meridian Fertilizer Factory	Meridian, Miss		16
Oct. 10	Mahur, W. H	Randolph, Ala	Bibb	18
Oct. 13	Murphree, Joel D	Troy, Ala	Pike	29
Oct. 30	Montague, C. L. & Co	Savannah, Ga		54
Dec. 2	Mayfield, Pittman & Co	Roanoke, Ala	Randolph	85

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1891				
Dec. 10	Malone, Collins & Co	Geneva, Ala	Geneva	92
Dec. 10	Marks & Gayle	Montgomery, Ala	Montgomery.	95
Dec. 17	Miles, T. B	Union Springs, Ala	Bullock	100
Dec. 24	Mills & Pauncey	Clay Hatchee, Ala	Dale	114
1892				
Jan. 11	Manley, Handley & Co	Roanoke, Ala	Randolph	146
Jan. 14	Martin, W. J	Abbeville, Ala	Henry	156
Jan. 14	Melton & Co	Pine Apple, Ala	Wilcox	162
Jan. 20	Mills, J. B	Shortersville, Ala	Henry	182
Jan. 25	Montgomery, H. B. T	Opelika, Ala	Lee	197
Jan. 28	Middlebrooks & Bro	Elamville, Ala	Barbour	212
Jan. 29	Mickle & East	Roanoke, Ala	Randolph	216
Jan. 30	Mash, D. J	Greenville, Ala	Butler	230
Feb. 4	Martin, T J	Harpersville, Ala	Shelby	259
Feb. 5	Maas & Schwartz	Selma, Ala	Dallas	266
Feb. 11	Moreman, J. M	Waverly, Ala.	Lee	311
Feb. 12	May, J. T	Montgomery, Ala	Montgomery.	316
Feb. 19	Morris, J. C	Day's Gap, Ala	Walker	376
Feb. 25	Myers, J. S	Fort Payne, Ala	DeKalb	410
Feb. 26	Morris, D. W & Bro	Chepultepec, Ala	Blount	412
Feb. 27	Mackey, B. F	Mackey, Ala.	Cherokee	419
Feb. 29	Manasses, J	Clayton, Ala	Barbour	421
Mar. 2	Marshall, J. Z	Irondale, Ala.	Jefferson	429
Mar. 10	Milner, J. K	Columbiana, Ala.	Shelby	460
Mar. 30	Morgan & Merryman	Heflin, Ala	Cleburne	510
May 28	Martin & Crocker	Gladstone, Ala.	Madison	527
May 30	Mastin, C. J	Huntsville, Ala	Madison	528
June 9	Moore, H. D	Alpine, Ala	Talladega	529
1891				
Oct. 16	McMillan & Harrison	Mobile, Ala	Mobile	39
Dec. 19	McGriff & Oakley	Columbia, Ala	Henry	103
1892				
Jan. 5	McKenzie, F, S	Tallassee, Ala	Elmore	128
Jan. 11	McWilliams, J. B. & Co	Talladega, Ala.	Talladega	147
Jan. 11	McGriff, T. P	Columbia, Ala	Henry	149
Jan. 14	McEntire & Co	Hanceville, Ala	Blount	158
Jan. 26	McEldery, G. T	Talladega, Ala	Talladega	206
Feb. 3	McGriffers, David	Knoxville, Ala.	Greene	251
Feb. 5	McDonald, F. C. & Co	Luverne, Ala	Crenshaw	265
Feb. 9	McElhaney, F. G	Auburn, Ala	Lee	299
Feb. 12	McCleskey, & Co	Boaz, Ala	Marshall	321
Feb. 13	McKenzie & Rogers	Goodwater, Ala	Coosa	332
Feb. 15	McNutt, W. W	Brandon, Ala.	DeKalb	335
Feb. 15	McGeehe, Driver & Co	LaFayette, Ala	Chambers	340
Feb. 16	McLendon & Tune	Jernigan, Ala	Russell	347
Mar. 2	McMillan & Simpson	Invernes, Ala.	Bullock	433
Mar. 12	McCorquisdale, E	Coffeeville, Ala.	Clarke	469
Mar. 14	McCord, W. T	Albertville, Ala.	Marshall	476
Mar. 15	McBroom, A. M	Porterville, Ala	DeKalb	484
1891				
Oct. 13	National Fertilizer Co.	Nashville, Tenn		30
Oct. 26	North Western Fertilizer Co.	Chicago, Ill		51

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1891				
Nov. 21	Neece, M. B	Huntsville, Ala.	Madison	77
Dec. 9	Nettles, T. A	Longstreet, Ala	Monroe	91
1892				
Jan. 20	Neighbors, J. A. & Co	Goodwater, Ala	Coosa	183
Jan. 30	Nicholls, J. A	Childersburg, Ala	Talladega	227
Feb. 18	Noles & Tenant	Roanoke, Ala.	Randolph	363
Feb. 22	Nordan, L. W	Hardwicksburgh	Henry	386
Feb. 24	Nixon, W. D	Merrellton, Ala	Calhoun	401
Mar. 4	Norwood & Hattimer	Fort Deposit, Ala.	Lowndes	444
Mar. 21	Nichols & Vernon	Roanoke, Ala.	Randolph	493
May. 6	Newton, C. A. & Son	Bellville, Ala	Conecuh	526
1891				
Oct. 21	O'Neal & Acree	Dothen, Ala	Henry	44
Nov. 16	Oberg Sons Company	Baltimore, Md		72
Dec. 22	Ozbin, W. N	Hackelburg, Ala	Monroe	109
1892				
Jan. 23	Ogletree & Jackson	Estaboga, Ala	Talladega	196
Feb. 1	Oliver Brothers	Dadeville, Ala	Tallapoosa	237
Feb. 15	Orman & Bayless	New Market, Ala	Madison	339
Mar. 5	O'Neal & Law	Seawright, Ala	Covington	447
1891				
Oct. 17	Pearce, J. & Co	Guin, Ala	Marion	41
Oct. 30	Pollard, W. J	Augusta, Ga		55
Nov. 9	Patapsco Guano Co	Baltimore, Md		62
Nov. 23	Pelzer, Rogers & Co	Charleston, S. C		80
Dec. 26	Prescott, C. M. & J. S	Roanoke, Ala.	Randolph	115
Dec. 28	Parish, P. L	Henderson, Ala	Pike	116
1892				
Jan. 2	Pickens, J. M	Cullman, Ala	Cullman	125
Jan. 7	Pope, M. F. & Co	Fayetteville, Ala.	Talladega	136
Jan. 11	Pope, J. F	Wilsonville, Ala	Shelby	148
Jan. 11	Ponder, B. F	Opelika, Ala	Lee	152
Jan. 18	Porter, Martin & Co	Jacksonville, Ala.	Calhoun	173
Jan. 19	Platt, W. H	Kennedy, Ala	Lamar	176
Jan. 20	Phillips & Dean	Charlton, Ala	Dale	181
Feb. 5	Pullen & Taylor	Eutaw, Ala	Greene	262
Feb. 5	Pope, G. W	Midland City, Ala.	Dale	268
Feb. 9	Polk, M. S	Alexander City, Ala	Tallapoosa	294
Feb. 17	Preer, T. C	Opelika, Ala	Lee	351
Feb. 18	Parker, H. C	Georgiana, Ala.	Butler	360
Feb. 26	Pitts & Norris	Vincent, Ala.	Shelby	414
Mar. 3	Payne, W. H	Dadeville, Ala	Tallapoosa	438
Mar. 14	Phillips, D. T	Elkmont, Ala.	Limestone	475
Mar. 16	Prim & Kimbell	Jackson, Ala	Clarke	485
Mar. 24	Phillips, J. J. & G. W	Syllacauga, Ala	Talladega	502
Mar. 31	Pennery, James A	Hokes Bluff, Ala	Etowah	511
Apr. 18	Pugh, Stone & Co	Dadeville, Ala	Tallapoosa	522
1891				
Oct. 12	Raisin Fertilizer Co	Baltimore, Md		28
Oct. 19	Royal Fertilizer Co	Charleston, S. C		43
Nov. 10	Reese, John S. & Co	Baltimore, Md		71
Dec. 5	Read Fertilizer Co	Charleston, S. C		90
Dec. 21	Rayner Brothers	Newton, Ala.	Dale	106

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1892				
Jan. 20	Rainer, F. P & Co	Brundidge, Ala	Pike	184
Jan. 26	Russell, M. T. & Co	Grand Bay, Ala	Mobile	207
Jan. 29	Reynolds, F. L	Geneva, Ala	Geneva	219
Jan. 30	Rogers, J. E	Rogers, Ala	DeKalb	226
Feb. 5	Rainer Brothers	Troy, Ala	Pike	261
Feb. 6	Raspberry, B. T	Strasburg, Ala	Chilton	269
Feb. 6	Roberts & Webb	Pleasant Gap, Ala	Cherokee	273
Feb. 8	Robinson, B. F	Jemison. Ala	Chilton	283
Feb 8	Roberson & Jones	Cropwell, Ala	St. Clair	289
Feb. 9	Ray & Robertson	Wilsonville, Ala	Shelby	300
Feb. 13	Rayner, L. W	Kirks Grove, Ala	Cherokee	326
Feb. 13	Robertson, Frederick & Co	Opelika, Ala	Lee	327
Feb. 15	Russell, E. J	Athens, Ala	Limestone	334
Feb. 15	Rome Oil Mill & Fertilizer Co	Rome, Ga		342
Feb. 20	Rains, G. M	Albertsville, Ala	Marshall	382
Feb. 25	Roberts, Frank S	Mobile, Ala	Mobile	392
Mar. 3	Robinson, W. C	Coffeeville, Ala	Clarke	435
Mar. 3	Russell, R. A. & Co	Gaylesville, Ala	Cherokee	440
Mar. 3	Russell, O L. & Co	Lawrence, Ala	Cherokee	441
Mar. 8	Roberts, G. W	Collinsville, Ala	DeKalb	454
Mar. 12	Robertson, F. M	Fayette C. H., Ala.	Fayette	472
Mar. 24	Revnolds, H. C. & B. W	Montevallo, Ala	Shelby	500
Apr. 9	Robinson, M. H	Jackson, Ala	Clarke	517
Apr. 11	Riddle, S W. & Co	Gadsden, Ala.	Etowah	519
Apr. 21	Riser, A. O	Alpine, Ala	Talladega	523
1891				
Oct. 6	South Ala. Oil & Fertilizer Co	Ozark and Dothen	Dale & Henry	7
Oct. 12	Scott, Geo. W. Mfg Co	Atlanta, Ga		24
Oct. 16	Stono Phosphate Co	Charleston, S. C		37
Oct. 30	Savannah Guano Co	Savannah, Ga		53
Oct. 31	Southern Phosphate Co	Atlanta, Ga		58
Nov. 9	Stedham, J. V	Stedham, Ala	Escambia	63
Nov. 9	Smith, Jasper	Guntersville, Ala	Marshall	64
Nov. 10	Shirley, S. W	Glee, Ala	Pike	66
Nov. 20	Steiner, Jas. & Son	Greenville, Ala	Butler	74
Nov. 20	Steiner Bros. & Co	Greenville, Ala	Butler	75
Dec. 1	Skipper, Jno. C	Dothen, Ala	Henry	83
1892				
Jan. 2	Schloss & Kahn	Montgomery, Ala	Montgomery	123
Jan. 5	Smith, T. & Meadows	Opelika, Ala	Lee	129
Jan. 14	Smith, F. C. & Co	Greenville, Ala	Butler	154
Jan. 15	Sampey, W L	Clanton, Ala	Chilton	167
Jan. 21	Schuessler Brothers	LaFayette, Ala	Chambers	188
Jan. 25	Savage, L. W	Evergreen, Ala.	Conecuh	198
Jan. 25	Street, J. C	Bluff Springs, Ala	Clay	201
Jan. 25	Smith Brothers	Syllacauga, Ala.	Talladega	202
Jan. 27	Stephens, B F.& Co	Louisville, Ala	Barbour	211
Jan. 30	Steinheardt, A	Greenville, Ala	Butler	228
Feb. 1	Seaman, E. S	DeArmanville, Ala	Calhoun	238
Feb. 2	Stevens & Spivy	Patsburg, Ala	Crenshaw	241
Feb. 3	Simon, Henry	Montgomery, Ala	Montgomery	254
Feb. 4	Shelton, G. D	Liberty, Ala	Blount	257

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Feb. 8	Stevens, John M	Zoe, Ala	Henry	281
Feb. 8	Snead, James E	Snead, Ala	Blount	282
Feb. 8	Samhenry & Co	Gadsden, Ala	Etowah	287
Feb. 9	Slaughter, Staffin & Co.	Perdue Hill, Ala.	Monroe	293
Feb. 11	Sanders & Purcell	Columbia, Ala.	Henry	307
Feb. 11	Sims, J. F	Brompton, Ala.	St. Clair	313
Feb. 12	Snead, J. H	Boaz, Ala	Marshall	322
Feb. 13	Stodghill, J. T.	Fredonia, Ala	Chambers	329
Feb. 13	Sibert, W. J	Gadsden, Ala	Etowah	330
Feb. 17	Scholze & Brother	Chattanooga, Tenn.		349
Feb. 17	Simmons, C. M	Monroeville, Ala.	Monroe	354
Feb. 18	Simpson, C. M	Branchville, Ala.	St. Clair	362
Feb. 19	Stiefelmeyer, C. A	Cullman, Ala	Cullman	369
Feb. 19	Stumpe, J. M	St. Florian, Ala.	Lauderdale	371
Feb. 19	Sims, John M	Georgiana, Ala.	Butler	373
Feb. 22	Stinnett, S. L	Athens, Ala	Limestone	384
Feb 22	Smith & Black	Luverne, Ala	Crenshaw	387
Feb. 23	Smith, W. T	Wilsonville, Ala	Shelby	389
Feb. 25	Stewart, B. M. & J. D.	Spring Garden, Ala.	Cherokee	408
Mar. 3	Schiffman, S. S	Huntsville, Ala	Madison	434
Mar. 5	Stewart, H. C	Sylacauga, Ala	Talladega	445
Mar. 5	Smith Brothers & Co.	Heflin, Ala	Cleburne	448
Mar. 8	Shepherd, R. M	Kennedy, Ala	Lamar	455
Mar. 10	Sloane Brothers	Lebanon, Ala	DeKalb	459
Mar. 10	Steagall, P. C	Eufaula, Ala	Barbour	461
Mar. 14	St. John & Quigley	Mobile, Ala	Mobile	478
Mar. 19	Smith, E. S	Argo, Ala	Jefferson	490
Mar. 23	Sturdivant Brothers	Dadeville, Ala	Tallapoosa	498
Mar. 24	Smith, J. P. & Brother	Warrenton, Ala	Marshall	501
Mar. 28	Sistrunk & Jordan	Tallassee, Ala	Elmore	509
1891				
Oct. 5	Troy Fertilizer Co	Troy, Ala	Pike	1
Oct. 6	Tinsley Fertilizer Co	Selma, Ala	Dallas	6
1892				
Jan. 6	Tuttle, A. G	Shorters Stat'n, Ala.	Macon	132
Jan. 11	Tillis, R	Geneva, Ala	Geneva	144
Jan. 27	Torbert, C. C	Society Hill, Ala.	Macon	210
Jan. 30	Tucker, Brock & Co	LaFayette, Ala	Chambers	231
Feb. 2	Thomas Brothers	Fairfield, Ala	Covington	243
Feb. 3	Tally, Dyer N	Trussville, Ala	Jefferson	252
Feb. 23	Thompson, J. T	Huntsville, Ala	Madison	395
Feb. 24	Thornton, G. A	Fayette C. H., Ala	Fayette	398
Mar. 11	Treadwell, Abbott & Co	Atlanta, Ga		465
Mar. 12	Tucker, W. D	Opelika, Ala	Lee	468
Apr. 14	Towers, G. W	Maple Grove, Ala.	Cherokee,	520
1891				
Oct. 8	Vandiver, W. F. & Co	Montgomery, Ala	Montgomery	12
1892				
Feb 18	Vandegrift, J. H	Branchville, Ala	St. Clair	365
Feb. 19	Vincent, U. C	Georgiana, Ala	Butler	374
Feb. 23	Vaughan & Robinson	Heflin, Ala	Cleburne	393
Mar. 2	Vandegrift, A. B	Birmingham, Ala	Jefferson	430

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Oct. 16	Walton & Whann Co	Charleston, S. C		38
Nov. 14	Williams & Clark Fert. Co	New York, N. Y		68
Nov. 16	Wood, W. S	Cottonwood, Ala	Henry	70
Dec. 19	Whiddon & Dawsey	Dothen, Ala	Henry	104
Dec. 29	Winkler, A. G	Greenville, Ala	Butler	119
Dec. 29	Weedon & Dent	Eufaula, Ala	Barbour	120
1892				
Jan. 6	Wiel Brothers	Opelika, Ala	Lee	134
Jan. 11	Wando Phosphate Co	Charleston, S. C		139
Jan. 14	Wright, Henderson & Rainer	Brantley, Ala	Crenshaw	159
Jan. 14	Wood, J. P. & Co	Talladega, Ala	Talladega	160
Jan. 14	Wallers, & Russell	Alexander City, Ala	Tallapoosa	163
Jan. 21	Williams, R. S	Wetumpka, Ala	Elmore	185
Jan. 28	Warnock & Sons	Oxford, Ala	Calhoun	213
Jan. 29	Willis, J. J. S	Mt. Andrew, Ala	Barbour	224
Feb. 4	Wood, R	Childersburg, Ala	Talladega	256
Feb. 4	Williamson, Thomas F	Opelika, Ala	Lee	258
Feb. 6	Whitman, S. P. & Sons	Guntersville, Ala	Marshall	271
Feb. 6	Whitman & Co	Boaz, Ala	Marshall	272
Feb. 8	Webb, J. H	Loachapoka, Ala	Lee	278
Feb. 8	Winter & Loeb	Montgomery, Ala	Montgomery	284
Feb. 9	Williams, A. J	Linwood, Ala	Pike	292
Feb. 11	Weed & Williams	Ariosta, Ala	Dale	314
Feb. 12	Wolf, J. P	Piedmont, Ala	Calhoun	318
Feb. 15	Webb, John C	Demopolis, Ala	Marengo	337
Feb. 15	Whaley & Buckley	Attalla, Ala	Etowah	341
Feb. 15	Wells, K	Verbena, Ala	Chilton	343
Feb. 16	Watkins, F. & Co	Opelika, Ala	Lee	346
Feb. 17	Wilson Brothers	Clanton, Ala	Chilton	348
Feb. 18	Walden, D	Trinity, Ala	Morgan	359
Feb. 19	Webb Brothers	Kellyton, Ala	Coosa	368
Feb. 19	Walker, J. M	Plevna, Ala	Madison	378
Feb. 23	Williams & Turner	Cherokee, Ala	Colbert	388
Feb. 23	Williams, B. R. & Sons	Cullman, Ala	Cullman	391
Feb. 24	Wade, A. C. & Co	Calera, Ala	Shelby	397
Feb. 24	Weldon, J. H. & Sons	Wilsonville, Ala	Shelby	400
Feb. 25	Wright, A. R	Farill, Ala	Cherokee	405
Mar. 1	Wiggins, W. J., Sr	Monroeville, Ala	Monroe	424
Mar. 2	Wimberly, H. T	Greenville, Ala	Butler	427
Mar. 7	Watkins, John P	Burnt Corn, Ala	Monroe	453
Mar. 11	Williams Brothers	LaPlace, Ala	Macon	467
Mar. 12	Williams, C. D	Luttrell, Ala	DeKalb	470
Apr. 17	Williams, R. G. & Co	Opelika, Ala	Lee	487
Mar. 22	White & Awbrey	Roanoke, Ala	Randolph	494
Mar. 23	Ward & May	Cuba Station, Ala	Sumter	496
Mar. 24	Windham, A. L	Moulton, Ala	Lawrence	505
Apr. 2	Westmoreland, L. R	Florence, Ala	Lauderdale	512
Apr. 11	White & Griffith	Hokes Bluff, Ala	Etowah	518
Feb. 13	Young, Reubin	Snead, Ala	Blount	331
Feb. 18	York, A. J	Cullman, Ala	Cullman	366

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1891 Nov. 20	Zell Guano Co	Baltimore, Md.. ...	....	76
1892 Feb. 17	Zadek, S	Montgomery, Ala...	Montgomery.	355
Mar. 2	Zorn, D. H	Zornville, Ala	Henry. ...	428

Bulletin No. 39. November, 1892.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

WHEAT.

A. J. BONDURANT, Agriculturist.
JAS. CLAYTON, Assistant Agriculturist.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

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Experiments in Wheat.

In 1890 the Agricultural Experiment Station began some experiments in wheat culture. Application for varieties of wheat, was made to the Agricultural Department at Washington, D. C., but only two varieties, imported from France, were sent, viz: Richelle de Naples, Large White, and de Reiti, or Large Red. The Purple Straw, a standard amber variety, was obtained near Auburn, and twelve other varieties were presented by James Carter & Co., High Holborn, London.

It was not intended to show the farmers *how* to raise wheat, but to find some variety so adapted to our soil and climate, that they might be induced to plant something besides cotton, and at least raise enough wheat for home consumption.

In October, 1891, eight bushels of purple straw, and six bushels each of large red and large white were distributed to forty-five farmers in different parts of the State; twenty-six of whom reported, sixteen of them were failures, owing largely to late planting, and ten met with moderate success.

In addition to the above experiments, this Station also carried on a comparison of the same varieties, as follows:

EXPERIMENT No. 1.

The land had been planted in oats the previous year, followed by peas. About Nov. 1st, 300 lbs. cotton seed meal and 200 lbs, acid phosphate, per acre, were sown broadcast and turned under with a Dixie plow. On Nov. 4th, plots of $\frac{1}{4}$ acre each were accurately measured, (the "Farmer's Acre" of 70 yards square used) and to obtain the same number of grains of wheat for each plot, three ounces of each variety were weighed and counted separately, and the average taken. The grain of the Large White, being an intermediate between that of the Large Red, and the Purple Straw, was used as a basis, and ¼ bushel, or 15lbs. (the quantity to be used per plot) was found to contain 156,000 grains. The Large Red required 15.7lbs. to make 156,000 grains, while the Purple Straw, being much smaller, required only 10.1 lbs.

The following tabulated statement shows the comparative yield from the same number of grains per plot.

SAME NUMBER OF GRAINS PER PLOT.

Plot No.	Size of plot.	No. of Lbs to plot.	Names of varieties.	No. of grains to plot.	No. of Lbs. per acre.	Yield per plot in lbs.	Yield per acre in bushels.
1...	¼ Acre.	10.1	Purple Straw.	156,000	40.4	236.3	15¾
2...	"	15.7	Large Red.	156,000	62.8	235.1	15⅔
3...	"	15.	Large white	156,000	60.	209.7	13.29–30

Experiment No. 2.

The land had been planted the previous year in wheat, followed by peas, and was prepared and fertilized as in Experiment No. 1.

In this Experiment fifteen pounds of each of the three foregoing varieties were sown in ¼ acre plots, with results as shown in the tabulated statement below.

SAME NUMBER POUNDS PER PLOT.

Plot No.	Size of plot.	Names of varieties.	No. lbs. sowed per plot.	No. lbs. sowed per acre.	Fertilizers per Plot.	Fertilizers per Acre.	Yield in Lbs. per plot.	Yield in bushels per acre.
1	¼ Acre.	Purple Straw.	15	60	75 lbs. C. S. M., 50 lbs. A. phos.	300 lbs. C. S. M 200 lbs. A. phos	176.4	11¾
2	"	Large Red.	15	60	"	"	90.2	6.2–15
3	"	Large White.	15	60	"	"	116.5	7¾

The object of these two experiments being to compare the yield of the same number of pounds planted, with that of the same number of grains planted, it is clearly shown that if the same number of *grains* be planted, the results are nominally the same, but that if the same number of *pounds* be planted, the smaller grain, giving more stalks per acre, produces a larger yield. That wheat *can* be grown profitably the statement below will show, and we urge our farmers to take a few acres of good land, prepare them well and plant a standard wheat. Even if the yield is a little below our estimate, the gleanings for the hogs, and the pea crop following on the same land, are items not to be lost sight of.

ESTIMATED COST OF ONE ACRE OF WHEAT.

Breaking land and sowing		$ 1.00
1 bushel seed wheat		1.00
500 pounds fertilizers		5.00
Harvesting and threshing		1.50
		$ 8.50
By 15 bushels wheat	$ 15.00	
Net proceeds	$ 6.50	

The above is based on the price the station paid for seed wheat.

Experiment No. 3 consists of a comparison of fifteen varieties, planted in drill on the same land as experiment No. 2 with same preparation. Some of the imported varieties, as compared with the Purple Straw, give satisfactory results, and it is hoped that when they are thoroughly acclimated they may yield still more. The following statement shows comparative yield per acre.

VARIETIES OF WHEAT PLANTED NOVEMBER 4TH, 1891.

Plot No.	NAME OF VARIETIES.	Date of Cutting	Yield per plot in pounds.	Yield per acre in bushels.	Bearded or Smooth.
1	Anglo Canadian	June 6	7.1	16.17–30	Bearded.
2	Bird Proof.	" 11	3.7	8.19–30	Smooth.
3	Earliest of All	" 6	6.4	14.14–15	"
4	Flour Ball.	" 11	2.2	5. 4–15	"
5	Holborn's Wonder.	" 11	4.2	9. 4–5	"
6	Hundred Day.	" 11	2.7	6. 3–10	"
7	Miller's Delight	" 11	1.8	4. 1–15	"
8	Purple Straw.	May 23	7.7	17.29–30	"
9	Pride of Market	June 11	2.3	5.11–30	"
10	Prince of Wales	" 11	3.5	8. 1–16	"
11	Queen	" 11	3 3	7. 7–10	"
12	Red (Large)	" 1	3.7	8 19–30	Bearded.
13	Stand Up	" 11	3.1	7. 7–30	Smooth.
14	White (Large)	May 27	2.3	5.11–30	"
15	White Chaff.	June 6	5.7	13. 3–10	"

REPORTS OF EXPERIMENTERS.

Mr. R. H. Cross of Letohatchie, Lowndes County, Ala., writes: "Your station furnished me with $\frac{1}{4}$ bushel of Large Red wheat, I planted it upon $\frac{1}{4}$ acre land, top dressed it twice with Ala. fertilizer, and cultivated twice with harrow. No smut or blight of any kind, and gathered $5\frac{3}{4}$ bushels, or 23 bushels per acre."

M. A. Bishop of Madison Co., writes: "Your station furnished me with $\frac{1}{4}$ bushel of wheat, planted Nov. 10th on $\frac{1}{4}$ acre. Season unfavorable. I fertilized with 250 lbs. green cotton seed per plot, (or 1000 lbs. per acre,) and gathered 171 lbs. wheat, or 11 bushels and nearly a half per acre."

F. W. Bradley of Walker Springs, Clarke, Co., says: "Your station furnished me with $\frac{1}{4}$ bushel of wheat, I planted it on $\frac{1}{4}$ acre of piney woods land, fertilized it with forty-five bushels of green cotton seed per acre, and made five bushels (5) of wheat, fine large grain, or 20 bushels per acre."

Mr. Dan Gillis in charge of South East Ala. Agricultural Experiment Station at Abbeville, Henry Co., writes: "We planted a plot $\frac{1}{8}$ acre of each of the two varieties sent us on Nov. 19th.

White wheat, cut May 19th, yield 59lbs, or 7 bushels and 52 lbs per acre.

Red wheat, cut May 25th, yield 41 lbs., or 5 bushels and 28 lbs. per acre.

These experiments were injured by a long dry spell in March and April, no rust or blight of any kind."

J. W. Mize of Remlap, Blount Co., writes: "I received $\frac{1}{4}$ bushel of wheat from your station which I received on Oct. 20th, obtained a good stand, but a heavy rain in February injured a part of the plot. I gathered $2\frac{1}{2}$ bushels, or 10 bushels per acre.

Mr. J. C. Ott of Florence, Lauderdale Co., says: "I received $\frac{1}{4}$ bushel of Large White wheat from your station, which I sowed late, owing to a protracted drought. I planted $\frac{1}{4}$ acre and made 2 bushels, or 8 bushels per acre."

Mr. Z. T. Stroud of Aberfoil, Bullock Co., says: "I received $\frac{1}{4}$ bushel Large White wheat from your station, which I planted on $\frac{1}{4}$ acre, and saved 3 bushels of fine wheat, or 12 bushels per acre."

S. H. Burgess, Shady Grove, Pike Co., writes: "I received $\frac{1}{2}$ bushel wheat from your station, which I planted on the 8th of Feb. It did well and I think will prove a success here."

Bulletin No. 40. **January, 1893.**

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

COTTON EXPERIMENTS.

A. J. BONDURANT, Agriculturist.
JAMES CLAYTON, Assistant.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

All communications should be addressed to
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EXPERIMENTS WITH COTTON,—1892.

COMPARISON OF VARIETIES.

This experiment consists of a comparison between thirty (30) varieties of cotton.

In the preparation of the soil 250 lbs. cotton seed meal and 250 lbs. acid phosphate per acre, were used broad cast, and thoroughly plowed in. The rows were measured exactly 3½ ft. apart, and 200 lbs. of the above mixture applied in the drill, per acre, at a total cost of $6.67. The cotton was carefully picked and stored, each variety to itself, until time of ginning, when all were weighed under like conditions and ginned separately. A sample of each variety was numbered and sent to Mr. H. C. Parker, of Montgomery, Ala., for classification and valuation.

No. 30, Catacaos, or Peruvian Cotton, failed to mature.

The short staple cotton was sold in Opelika, on Dec. 9, 1892, for 9 7-16, and the long staple, for 10¾. The fact that the long staple varieties do not yield as much seed cotton per acre as the short staple, is more than counter-balanced by the higher price which it commands. The following tabulated statement gives results of this experiment.

		Yield per Acre		Per cent of Lint	Length of Staple	Price
		Seed Cotton	Lint Cotton			
1	Allen Long Staple....	751 5	193 5	25 7	1 3-16c.1¼	10½
2	Bailey	697 5	207.0	29.6	1⅛	10¼c 10½
3	Cherry's Cluster	715 5	211 5	29 5	⅞	9 9-16
4	Coltharp's Prickle ...	769 5	238 5	30 9	1⅛c.1 3-16	10⅜
5	Coltharp's Eureka.....	733.5	220 5	30 0	1¼	12
6	Cook W. A.	643 5	180 0	27.9	1⅜c.7-16	13½
7	Crossland	657 0	252 0	38.3	⅞	9 11-16
8	Dalkeith's Eureka	706 5	216 0	30 5	1 3-16	10¼
9	Dixon	652 5	198 0	30 3	13-16	9 9-16
10	Gold Dust.	630 0	189.0	30.0	13-16	9 9-16
11	Hawkin's Improved...	625 5	211 5	33 8	⅞	9 11-16
12	Hunnicut	706 5	220 5	31 2	⅞	9 11-16
13	Herlong	607 5	184 5	30 3	13-16c.⅞	9 11-16
14	Jones Long Staple. ..	702.0	202 5	28.8	1⅛	10
15	Jones No. 1..........	639 0	202 5	31.7	13-16	9 9-16
16	Keith	792 0	238 5	31 7	1	9¾
17	King, T. J...........	801 0	256 5	32 0	⅞	9 9-16
18	Okra	724 5	234.5	32 3	1⅛c.13-16	10
19	Peeler	850 5	256 5	30 1	1⅛	10
20	Peerless	882.0	274 5	31 1	1	9⅞
21	Peterkin..:	994 5	337 5	33 9	1	9¾
22	Petit Gulf	976 5	315 0	32 2	⅞c.15-16	9 9-16
23	Southern Hope........	954 0	292.5	30 6	1 3-16c.1¼	10
24	Storm Proof.....	985 5	324 0	32.8	1 1-16c.1⅛	10
25	Truitt	958 5	301 5	31.4	1	9¾
26	Welborn	933 5	225.0	30 6	1	9¾
27	Wonderful	956 0	211 5	27 9	1⅜c.17-16	11½
28	Zellner	814 5	243 0	29 8	⅞	9 9-16
29	Matthews Long Staple	913 5	265 5	29 0	1⅛c.13-16	10
30	Catacaos or Peruvian	Fine st	alk. Sea	son too	short to	mature

The following Tabulated Statement is Classification and Valuation as furnished by Mr. H. C. Parker, Montgomery, Alabama, basis Middling, Montgomery, 7-1-93.

No.	LENGTH.	COLOR.	GINNING.	GRADE.	VALUE.		
15	13-16	Good	Good	Middling	9 9-16	Fair Staple.	9 9-16
13	13-16c ⅞	“	Fair	S. Middling.	9 11-16		9 9-16
7	⅞	“	Good	“	9 11-16		9 9-16
11	⅞	“	“	“	9 11-16		9 9-16
3	⅞	“	“	Middling	9 9-16		9 9-16
28	⅞	“	“	“	9 9-16		9 9-16
12	⅞	Fair	“	St. Middling	9 11-16		
17	⅞	S. Color	Fairly	Middling	9 9-16		
13	⅞c 15-16	Good	Fair	“	9 9-16		
22	⅞c 15-16	“	Good	“	9 9-16		
16	1 in	Good	Fair	Middling	9 ¾	Good Staple, 3-16c ¼ on for Staple.	
21	1 in	“	Good	“	9 ¾		
20	1 in	“	“	S. Middling.	9 ⅞		
26	1 in	“	“	“	9 ¾		
25	1 in	Fair	Fair	“	9 ¾		
24	1 1-16c ⅛	Fair	Fair	S. Middling.	10	Extra Middling, ½c ¾ on.	
2	1 ⅛	Good	Good	G. Middling	10¼c ½		
19	1 ⅛	“	Fair	Middling	10		
14	1 ⅛	Fair	Good	“	10		
4	1 ⅛c 3-16	Good	“	S. Middling.	10 ⅜		
18	1 ⅛c 3-16	“	“	S. L. Mid.	10		
29	1 ⅛c 3-16	“	Fair	Middling	10		
8	1 3-16	Good	Good	Middling	10 ¼	c	
1	1 3-16c ¼	“	“	S. Middling.	10 ½	1c ½ on.	
23	1 3-16c ¼	“	“	G. Middling	10		
5	1 ¼	“	“	S. G. Mid.	12	Long Staple, 2c, 3c on.	
6	1⅜c 7-16	“	“	“	13 ½		
27	1⅜c 7-16	“	Poorly gin’d		11 ½		
9	13-16	Same as	No. 15			Short Staple.	

EXPERIMENTS WITH PHOSPHATES.

Question:—Will the vegetable matter in freshly cleared land, supply all the nitrogen needed by the cotton plant?

The experiment in reply to this question was begun in 1890, and published in Bulletin 22; Continued in 1891, and published in Bulletin 33; and carried on the present year, (1892) without changing the rows, or the addition of any fertilizers.

It is proved by comparing plots 1 and 2, and 3 with 5, that the *applied* nitrogen has been exhausted. By comparing plots 1 and 5, it will be seen that *plot* 5, where 1,000 lbs. of acid phosphate were used per acre, gives only 48 lbs. seed cotton per acre increase over plot 1 where 500 lbs. acid phosphate were used per acre.

It is evident from this comparison that the vegetable matter in new ground does not supply sufficient nitrogen to utilize so large an application of phosphoric acid.

The decreased yield in plot 4, (no manure) is explained by the shortage of the general crop throughout this section.

The following tabulated statement shows the results for three years:

PHOSPHATE ALONE, AND PHOSPHATE AND NITROGEN APPLIED ON NEW GROUND IN 1890.

Plot No.	Names of Fertilizers and Quantity Used Per Acre, Applied in 1890.	Total yield lbs. Seed Cotton, 1890.	Increase in lbs. Seed Cotton over no manure, 1890.	Total yield in lbs. Seed Cotton. 1891.	Increase in lbs. Seed Cotton over no manure, 189	Total yield in lbs. Seed Cotton, 1892.	Increase in lbs. Seed Cotton over no manure, 1892
1	500 lbs. of Acid Phosphate	819	360	851	513	407	185
2	500 lbs. Acid Phosphate, 500 lbs. CottonSeed Meal....	1017	558	816	478	428	206
3	1,000 lbs. Acid Phosphate...............	883	424	790	452	453	231
4	No Manure.......................	459	——	383	——	222	——
5	1,000 lbs. Acid Phosphate. 1,000 lbs. C. S. Meal	1213	754	936	598	455	233

EXPERIMENT WITH FERTILIZERS.

In these experiments, *461 lbs. seed cotton*, being the average yield of the unmanured plots 4, 8 and 12, will be taken as a basis for comparison.

In plots 1, 2 and 3, where the chemicals are used separately, it is seen that nitrogen in plot 1, gives an increase of 265.4 lbs.;—that phosphoric acid in plot 2, gives 51 lbs.; and that potash in plot 3, gives an increase of only 5 lbs.; while in combination, as in plots 5, 6 and 7—plot 5 gives the best yield, though only making 54 lbs. per acre more than plot 1; and while plot 6 gives 118 lbs. less than plot 5, it (plot 6) makes 22 lbs. more than plot 7, and 150 lbs. more than plot 2; clearly showing that nitrogen is the element needed here.

The best results, however, are obtained in plot 9, where the complete Fertilizer is used. Plot 10, (floats,) gives 29 lbs. less than average of unmanured plots 4, 8, and 12; but when combined with nitrogen, as in plots 11 and 14, we have 131 lbs. increase in plot 11, and only 37 lbs. in plot 14.

Plot 15, (4,240 lbs. stable manure) gives 6 lbs. less than plot 9, where complete Fertilizer is used. Plot 16, (C. S. meal and acid phosphate) yields less than either plots 9 or 15, yet the increase over average of no manure is 467 lbs. Thus, when the cost of the cotton seed meal and acid phosphate, is compared with that of stable manure, and the greater ease with which they are handled, and the utter impossibility of getting stable manure in sufficient quantity, considered, it is evident that C. S. meal and acid phosphate have great economic advantages over stable manure.

COTTON EXPERIMENTS WITH FERTILIZERS—EXPERIMENT STATION, AUBURN, ALABAMA.

Plot No.	LBS. FERTILIZER PER PLOT.	LBS. FERTILIZER PER ACRE.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda	96 lbs. Nitrate Soda	45.4	726.4
2	15 lbs. Acid Phosphate	240 lbs. Acid Phosphate	32 0	512 0
3	4 lbs. Murate Potash	64 lbs. Murate Potash	31 0	466.0
4	No Manure	No Manure	32 8	524 8
5	6 lbs. Nitrate Soda, 4 lbs. Murate Potash	96 lbs. Nitrate Soda, 64 lbs. Murate Potash,	48.8	780.8
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate	41 4	662 4
7	4 lbs. Murate Potash, 15 lbs. Acid Phosphate	64 lbs. Murate Potash, 240 lbs. Acid Phosphate	40 0	640 0
8	No Manure	No Manure.	32.2	515.0
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Murate Potash	96 lbs. Nitrate Soda, 64 lbs. Murate Potaah, 240 lbs. Acid Phosphate	60 8	972 8
10	15 lbs. Floats.	240 lbs. Floats	27 0	432.0
11	6 lbs. Nitrate Soda, 15 lbs. Floats	96 lbs. Nitrate Soda, 240 lbs. Floats.	37 0	592 0
12	No Manure	No Manure	21 6	345 6
13	23 lbs. Green Cotton Seed.	848 lbs. Green Cotton Seed.	31 0	466.0
14	15 lbs. Floats, 53 lbs. Green Cotton Seed.	240 lbs. Floats, 848 lbs. Green Cotton Seed.	30 6	498.6
15	265 lbs. Stable Manure	4.240 lbs. Stable Manure	60 4	966 4
16	15 lbs. Acid Phosphate, 15 lbs. Cotton Seed Meal	240. lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal.	58 0	928.0

This experiment consists of a comparison between compost, when the materials are put in the rows, and mixed with the plow, and bedded on in February—and compost freshly made in the usual way, and applied at time of planting.

It is to be regretted that no comparison as to the cost of the two applications can be given, as the record has been misplaced.

This work was ordered by Dr. Wm. L. Broun, President of the Board of Directors, results of which are shown below:

COTTON EXPERIMENTS WITH FERTILIZERS.

EXPERIMENT No. 1.	Lbs. Cott'n 1st Pick'g Sept. 7	Lbs. Cot. 2nd Pick. Sept. 17	Lbs. 3rd Picking Sept. 26	Lbs. 4th Picking Oct 6.	Lbs. 5th Picking Oct. 18.	Lbs. 6th Picking Nov. 14.	Total yield Per Acre.
700 lbs. Acid Phosphate, 650 lbs. Stable Manure, 650 lbs. Green Cotton Seed.	80 3	247.3	333 6	148.2	70.	261.	905.5
Applied in drill, and mixed with plow, Feb. 24th. Cotton planted May 10th, 1892.							
EXPERIMENT No. 2.							
700 lbs. Acid Phosphate, 650 lbs. Stable Manure, 650 lbs. Boiled Cotton Seed.	60.5	222.7	331 5	145 6	84.	33.4	877.7
Applied in drill, and mixed with plow, May 9th. Cotton planted May 10th, 1892.							

The following experiments were made for Dr. N. T. Lupton, Chemist, to compare raw or ground phosphate rock with acid phosphate, the results of which are given in the tabulated statement below:

COTTON EXPERIMENTS WITH FERTILIZERS, BY DR. N. T. LUPTON, CHEMIST.

Plot No.	POUNDS OF FERTILIZER PER PLOT.	POUNDS OF FERTILIZER PER ACRE.	Lbs. cotton 1st picking Sept. 9.	Lbs. cotton 2nd picking Sept. 16	Lbs. cotton 3rd picking Sept. 29.	Lbs. cotton 4th picking Oct. 7.	Lbs. cotton 5th picking Oct. 20.	Lbs. cotton 6th picking Nov. 3.	Lbs. cotton 7th picking Nov 16.	Lbs. cotton 8th picking Nov. 25	Total yield per plot.	Total yield per acre.
1	25 lbs. raw phosphate, 25 lbs. cotton seed meal.	200 lbs. raw phosphate, 200 lbs. cotton seed meal..	9.	26.3	33.5	25.2	18.7	9.	4.1	1.4	119.1	952.8
2	50 lbs. raw phosphate, 50 lbs. cotton seed meal	400 lbs. raw phosphate, 400 lbs. cotton seed meal..	11.2	31.	43.	26.4	13.9	8.2	3.7	0.8	138.2	1105.6
3	25 lbs. acid phosphate, 25 lbs. cotton seed meal.	300 lbs. acid phosphate, 200 lbs. cotton seed meal..	1.3	23.	43.3	20.7	11.5	4.2	1.3	0.3	105.6	844.8
4	50 lbs. acid phosphate, 50 lbs. cotton seed meal.	400 lbs. acid phosphate, 400 lbs. cotton seed meal..	12.3	37.1	55.	15.1	12.	5.	1.5	0.6	138.6	1108.8
5	No manure....	No manure	4.3	16.8	31.9	21.5	19.2	10.5	2.8	0.9	107.9	863.2
6	25 lbs. raw phosphate, 50 lbs. green cotton seed	200 lbs. raw phosphate, 400 lbs. green cotton seed.	11.5	25.3	42.	13.6	15	5.5	1.5	0.5	114.9	919.2
7	50 lbs. raw phosphate, 100 lbs. green cotton seed	400 lbs. raw phosphate, 800 lbs. green cotton seed.	11.4	43.5	41.5	27.5	16.1	6.3	1.1	0.4	147.8	1182.4
8	25 lbs. acid phosphate, 50 lbs. green cotton seed	200 lbs. acid phosphate, 400 lbs. green cotton seed.	20.1	39.1	47.8	22.	12.8	4.2	1.	0.3	147.3	1178.4
9	50 lbs. acid phosphate, 100 lbs. green cotton seed	400 lbs. acid phosphate, 800 lbs green cotton seed	27.4	45.1	50.4	25.8	16.5	6	1.5	0.7	173.4	1387.2
10	No manure...	No manure	13.4	30.8	38.1	16.7	11.7	4.1	1.1	0.5	136.4	931.2
11	50 lbs. raw phosphate...	400 lbs. raw phosphate....	11.6	30.2	38.2	16.4	10.6	3.	1.	0.6	111.6	892.8
12	50 lbs. acid phosphate..	400 lbs. acid phosphate. .	16.	37.6	47.2	13.	5.6	1.6	0.6	0.3	121.9	975.2
13	50 lbs. cotton seed meal.	400 lbs. cotton seed meal..	17.5	42.	42.2	28.3	16.3	6.7	2.8	3.1	158.9	1271.2
14	100 lbs. green cotton seed	800 lbs green cotton seed.	17.2	39.2	45.1	28.6	18.2	7.2	3.	3.3	161.8	1294.4
15	No manure..............	No manure..............	12.2	32.4	45.5	29.6	19.8	9.1	4.5	4.6	157.7	1261.2

COTTON EXPERIMENTS WITH FERTILIZERS, BY DR. N. T. LUPTON, CHEMIST.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking, Sept. 7.	Lbs. cotton 2nd picking, Sept. 20.	Lbs. cotton 3rd picking Sept. 30.	Lbs. cotton 4th picking, Oct. 20.	Lbs. cotton 5th picking, Nov. 16.	Total yield per plot.	Total yield per acre.
1	57 1-7 lbs. raw phosphate.........	400 lbs. raw phosphate............	5	14.1	10.1	8.5	3.8	41.5	290.5
2	114 2-7 lbs. raw phosphate.........	800 lbs. raw phosphate............	3.2	8.2	8.1	8.7	3.2	31.4	219.8
3	57 1-7 lbs. acid phosphate	400 lbs. acid phosphate............	2.3	10.3	6.8	6.6	2.1	28.1	196.7
4	114 2-7 lbs. acid phosphate	800 lbs. acid phosphate.	1.4	6	5.1	6.5	1.6	20.6	144.2
5	No manure........................	No manure	1.	4.4	3.2	3.5	3.1	15.2	106.4
6	57¼ lbs. raw phosphate, 114 2-7 lbs. raw phosphate..........	400 lbs. raw phosphate, 400 lbs. cotton seed meal...........	6.5	13.5	7.6	6.2	1.8	35.6	249.2
7	114 2-7 lbs. raw phosphate, 114 2-7 lbs. cotton seed meal......	800 lbs. raw phosphate, 800 lbs. cotton seed meal.....	9.6	19.2	8.3	6.9	2.1	46.1	322.7
8	57 1-7 lbs. raw phosphate, 57 1-7 lbs. cotton seed meal.......	400 lbs. acid phosphate, 400 lbs. cotton seed meal..........	7.9	14.2	8.	4.9	1.	36.0	252.0
9	114 2-7 lbs. acid phosphate, 114 2-7 lbs. cotton seed meal......	800 lbs acid phosphate, 800 lbs. cotton seed meal...........	15	18	8.1	3.7	1.	45.8	320.6
10	No manure	No manure	6.2	7.2	11.4	7.5	1.1	33.4	233.8

The following Experiments were made by Prof. Geo. F. Atkinson, Biologist, for the Station, but as he resigned his position before the results were obtained, no comments are made, and only the tabulated statement of the work given, as follows:

COTTON EXPERIMENTS WITH FERTILIZERS, BY PROF. GEO. F. ATKINSON.

Plot No.		lbs. cotton 1st picking Sept. 6th	lbs. cotton 2nd picking Sept 15th	lbs. cotton 3rd picking Sept. 30th	lbs. Cotton 4th picking Oct. 4th	lbs cotton 5th picking Nov 16th	Total yield per Plot.	Total yield per Acre.
	1088 lbs. of Kainit and 500 lbs. Acid Phosphate applied broadcast and turned in with Dixie plow, Feb. 16th, 1882.							
1.	Peas: plow under first crop, let second crop rot on ground. No cotton for two years. Plant cotton third year	Plow	ed un	der,	Augus	t 27th.		
2.	Plant cotton first year, plant peas last plowing, and peas and cotton plowed under in the fall	40.6	73 0	96 0	29.5	13 3	252.4	556.5
3.	Plant cotton first year, plant peas last plowing, and let rot on the ground	31 6	73 1	12.9	47 7	22	187 3	480.6
4.	Plant cotton first year, plant peas last plowing, and remove from the ground in the fall	20 2	55.	94.	37.5	21.2	227 9	502.5

COTTON EXPERIMENTS WITH FERTILIZERS.—BY PROF. GEORGE F. ATKINSON.

Plot No.	Lbs. Fertilizer per Acre.	Lbs. Cotton 1st picking, Sept. 8th.	Lbs. Cotton 2nd picking, Sept. 26th.	Lbs. Cotton 3rd picking, Oct. 6th.	Lbs. Cotton 4th picking, Oct 17th.	Lbs. Cotton 5th picking, Nov 3rd.	Lbs. Cotton 6th picking, Nov. 18th.	Lbs. Cotton 7th picking, Nov 29th.	Total yield per Plot.	Total yield per Acre.
1	Check	1.7	14.6	11 9	14.	6 4	3.9	1.	53 5	1872 5
2	400 lbs. Salt	3.	12.8	12 5	13.8	8	6 1	1 2	57 4	2009 0
3	200 lbs. Salt	3 8	12 5	13.	12 8	7 5	5.3	2 1	57 0	1995 0
4	Check	1.2	9 8	12	14.4	8	6 1	2 6	54.1	1893 5
5	200 lbs. Murate Potash	1 6	11.	12 1	13 3	7 1	5 9	1 6	52 6	1841 0
6	300 " " "	2.	11 2	11 9	13.7	7.1	6.4	2 1	54 4	904 0
7	100 " " "	2 5	11 3	12	22 6	8	5 4	1.7	63 5	2222 5
8	Check	2.	12 4	11 1	13 3	8 1	5	1 5	53 4	1869.0
9	400 lbs. Kainit	1 9	8 3	9 1	10.6	4.1	5 6	1 4	41.0	1435.0
10	600 " "	1.6	10 6	10.1	11.3	7.1	5.4	2.1	48 2	1687 0
11	In Feb. {300 lbs. of Kainit, 1st plowing, 300 lbs. {300 lbs. of Acid Phosphate, 1st plowing	1.2	12.4	10.5	6 5	5	2 2	1.	38 8	1358.0
12	200 lbs. kainit	3	13.	10 5	7 7	6 4	3 9	1 7	46 2	1617 0
13	Check	2.7	13.2	11.5	13.9	7 8	5.1	2	56.2	1967.0
14	800 lbs. of Thos. Slag, applied April 4th	3 3	12 5	13.	11.	5 6	4 7	0.9	51 0	1785.0
15	1.200 lbs. Thos. Slag, applied April 4th	3 2	16.	13.	13 5	4 4	2 3	1 3	53 7	1879 5
16	Check	3 4	12 6	13 3	12 7	7.5	6	2	58.3	2040 5
17	1,600 lbs. Thos. Slag	3 2	12 7	10 6	10 8	4 3	2 9	1 0	45 5	1592.5
18	2,000 lbs. Thos. Slag	1 7	14.	9 6	11.	4 3	3 9	7	45 2	1582 0
19	Check	1 8	11 8	10 4	8 6	4 4	2	.9	40 3	1410 5

COTTON EXPERIMENTS WITH FERTILIZERS, BY PROF. GEO. F. ATKINSON.

Plot No.	FERTILIZERS USED DURING CULTURE.	POUNDS FERTILIZER PER ACRE.	lbs. cotton 1st pickidg Sept. 8th.	lbs. cotton 2nd picking Sept. 26th.	lbs cotton 3rd picking Oct. 6th.	lbs cotton 4th picking Oct. 18th.	lbs. cotton 5th picking Nov. 3rd.	lbs. cotton 6th picking Nov. 18th.	lbs. cotton 7th picking Nov. 29th.	Total yield per plot.	Total yield per acre.
1	....	Check	6.3	7.4	4.0	0.3	0.5	1.1	0.2	19.8	1485.0
2	200 lbs. kainit, 1st plowing, 200 lbs. acid phos "	400 lbs. kainit, Feb. 18	5.6	8.1	3.9	0.9	1.0	1.0	0.2	20.7	1552.5
3	200 lbs. kainit, 1st plowing.	400 lbs. kainit, Feb. 18	4.8	7.7	3.4	3.3	2.0	1.0	0.2	22.4	1680.0
4	200 lbs. kainit, 1st plowing	600 lbs. kainit, Feb. 18	6.6	7.5	3.0	2.8	1.2	1.0	0.2	22.3	1672.5
5	200 lbs. kainit, 1st plowing. 200 lbs acid phos	600 lbs. kainit, Feb. 18	8.0	8.3	3.6	4.7	1.5	0.5	0.2	26.8	2010.0
6	Welborn's Pet.	Check	8.2	7.1	2.5	2.5	2.0	0.9	0.1	23.3	1747.5
7	Was the variety of cotton, used in the 1st 9 plots	300 lbs. muriate potash	8.3	10.0	3.5	2.8	2.1	1.8	0.3	28.8	2160.0
8	Herlong, in the last four...	100 lbs. muriate potash	6.1	10.1	3.4	3.0	2.1	1.9	0.4	27.0	2025.0
9	... .	400 lbs. muriate potash	0.9	7.7	8.3	6.3	3.4	4.2	0.8	31.6	2370.0
10	....	Check	1.8	8.7	5.2	4.7	2.7	2.3	0.7	26.1	1957.5
11	....	400 lbs. kainit	2.8	9.0	5.0	5.0	2.5	1.9	0.8	27.0	2025.0
12	....	600 lbs. kainit	2.0	8.6	5.5	5.3	2.2	2.0	0.4	26.0	1950.0
13	....	Check	2.5	10.9	5.3	5.8	2.5	1.5	0.4	28.9	2167.5

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

BULLETIN NO. 41, - - DECEMBER, 1892.

SOME DISEASES OF COTTON,*

GEO. F. ATKINSON.

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☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

All communications should be addressed to

EXPERIMENT STATION, AUBURN, ALA.

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SOME DISEASES OF COTTON.

BY GEORGE F. ATKINSON.

I. GENERAL NATURE OF COTTON DISEASES.

Two years study of the diseases of cotton have brought to light several well characterized maladies of this plant in the United States. Some of these are physiological in their nature, being due to disturbances of nutrition and assimilation, brought about by various causes, which will be discussed under the several topics.

Other diseases of the plant are due to the action of fungus organisms which live as parasites in various parts of the plant, penetrating the tissues, consuming the nutriment and living matter and setting up fermentations which act disastrously on the plant tissues.

To a trained observer the plants affected present certain symptoms and characteristics which would enable him to diagnose the disease.

Several diseases have been known to many planters and naturally names have been given to them in the absence of exact knowledge as to their nature. These names vary in different localities. Sometimes different names are applied to the same disease and frequently a single name is used for several very different troubles.

"Rust" is a term which is more widely used than any other and is frequently defined as "red rust," or "black rust." The term has become so general in its application as to be utterly valueless other than conveying the notion of *disease*. Quite likely that notion is all the planter intends to convey when he uses the term "cotton rust." To accept the term "cotton rust" as synonymous with cotton disease will tend to eliminate much of the confusion which must necessarily result should the term be accepted for any single disease. The great mystery which has clustered around this term as a name for a single disease is thus cleared away, and we are enabled to attach a true value to the reports and discussions of "rust" which appear from time to time in various publications.

The diseases of the cotton plant in general are increasing in severity and extent each year, especially those which are due to parasitic organisms and to impoverished and badly cultivated soils. Under conditions which exist largely throughout the cotton belt, this increase of disease is the natural outcome of years of continued cultivation of the crop without a wise rotation with other remunerative farm crops and a careful diagnosis of the needs of the soil.

The organisms which cause the more disastrous of the parasitic diseases rest in the soil during the winter season. With each successive crop they increase in numbers because their favorite pabulum is close at hand. The increase of the disease is comparable to what would occur among human beings were no sanitary measures taken to eradicate disease when once it gains foothold in a community. Varying conditions of temperature and humidity might cause temporary fluctuations in the rate of increase, but each year the trouble would become more deeply seated.

One of the most important features of cotton culture is the adaptability of fertilizers to different soil conditions and the requirements of the plant. For cotton growers, the fertilizer trade, so far as it relates to the various brands of ready mixed fertilizers is one of the greatest follies of the present day. The continued use of these fertilizer nostrums is as fatal to the cotton grower as it would be for an invalid with some dangerous disease who resorts to some of the medicinal nostrums, or cure alls, instead of at once consulting a competent physician. He grows steadily worse, but with reviving hope tries one after another of these ill-adapted mixtures, some of which actually do him injury.

Ready mixed fertilizers with attractive names, or those whose merits are pictured by the blandishments of the salesman or the seductive sentences of the advertising column find a too ready acceptance and use by the unsuspecting planter. Chance will sometimes bring about a happy coincidence, but more often the composition is unsuited to the particular soil, may lack the most needed constituent, or possess in excess several constituents, resulting in a loss to the user. One after another brand is used, while the crop grows smaller and the soil depreciates.

The trade in unmixed fertilizers, as kainite, acid phosphate, cotton seed meal, etc., is the more profitable for the planter to patronize if home production of manures will not meet his wants. They can be mixed by him at home more profitably during the winter season. The effect of the known ingredients can be observed in given soils and each year better adaptations can be made for the necessarily varying character of soils on a single plantation.

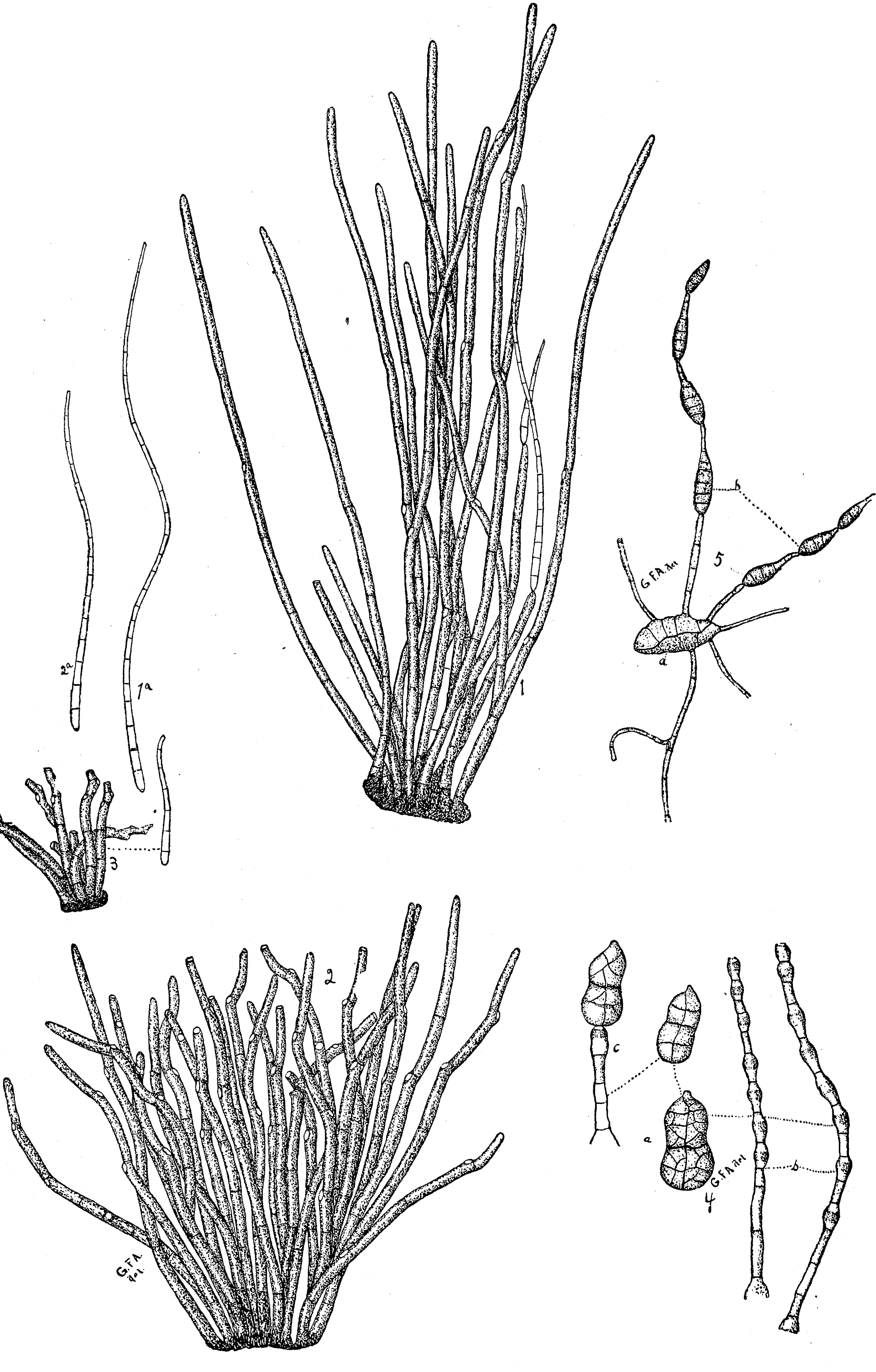
Much is yet to be learned by many planters concerning methods of cultivation and the proper distance which should be given the plants on different soils and with different degrees of fertilization. Very many probably err in hasty preparation of the soil before planting, in too much cultivation of the soil after planting, and in leaving too many plants on the ground.

There is a notion in some localities that "cotton will not begin to make fruit until the tap root strikes hard ground." The preparation of many fields for planting would lead one to believe that the motive was to have the hard ground so near the surface as possible in order that the tap root might readily and quickly "strike hard ground."

Thorough and deep preparation of the soil not too long before planting, followed by very shallow surface cultivation, just enough to cut off the weeds and leave a shallow surface layer of loose soil, is probably the best treatment which can be given so far as cultivation is concerned. The treatment of the soil bears a very important relation to the health of the plant. Too many in their haste to plant the crop do so on a shabbily prepared ground, probably thinking they will loosen the soil more deeply during cultivation. Experience shows, as is well known by those who have observed the effects of deep versus shallow cultivation, that the former is very injurious to the plant, since so many roots are severed by the plow.

Having discovered the nature of several of the most important diseases of the cotton plant, the next step to be taken is to put the knowledge in such form that cotton growers may be able to diagnose the diseases which appear. So long as the indefinite term "rust" is used for several diseases, we can make no progress in combatting them, and it would be useless to recommend a line of treatment for any particular disease, when the planter is liable to confuse several diseases and to apply the remedy for a different trouble from the one for which it is intended. The present bulletin is intended to present some of this matter in such a way that a few at least may more intelligently determine the trouble.

Oil paintings illustrating the various color effects produced upon the foliage by the different diseases have been made and should be published, that the planter might have such striking and visible characteristics of the disease at hand to compare with plants from any diseased area. The subject is of more than local or even State interest. It is a subject which concerns the entire cotton belt region of the United States and bears on the improvement of the condition of the most important agricultural product there grown. These paintings are too expensive to publish without Gov-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ernment aid, and the National Department of Agriculture could not do a better work for the cotton producing states than to put a copy of these illustrations, accompanied by popular descriptions of the disease, in the hands of several intelligent planters in each community.

II. YELLOW LEAF BLIGHT OR MOSAIC DISEASE.

The conclusions arrived at concerning the nature of this disease, as well as its treatment, published in bulletin No. 36, have been strengthened by farther study and experimentation during the summer of 1892. The reader is referred to that bulletin for the data concerning the disease as well as for the detailed description of the experiments for 1891.

It will be in place here, however, to give a brief description of the characteristic appearance of the disease, after noting the confirmatory experiments conducted during 1892.

Experiments for 1892.—A set of experiments to test the comparative merits of kainite, salt, and muriate of potash was arranged on the Experiment Station farm, the ingredients being worked in the soil during the month of February. As the disease did not appear at all on this plat, no comparisons could be made.

Another experiment was started on very poor sandy land which was designed to extend over a series of five years to test the value of "cow peas" (*Dolichos sinensis*) as nitrogen collectors for cotton under different conditions. The soil was heavily fertilized broadcast before plowing, with kainite and acid phosphate. No nitrogenous fertilizer was applied. A plat of nearly two acres was devoted to this experiment. Directly adjoining this plat on the south, the soil being the same, cotton was planted, having been quite heavily dressed with nitrate of soda in addition to some other fertilizer, but no kainite was used. North of one end of the first mentioned plat was one devoted to varieties of cotton treated with a complete fertilizer.

In July there began a perceptible yellowing of the plants in plat No. 1, while plats No's 2 and 3 bore a rich green foliage. Close observation showed that the yellow color in the plants of plat 1 was quite evenly diffused over the leaf. There was no indication of the checkered or mosaic arrangement of the yellow and green so characteristic of the disease. From this time on the yellowing of plat 1 became more and more marked until sometime in September the plants matured. Only a very few in this plat were at all badly diseased at this time, probably in places where the kainite was not well distributed.

Early in August plat No. 2 was very badly diseased, the leaves first presenting the checkered arrangement of the yellow and green color, then easily falling prey to such fungi as *Macrosporium nigricantium* and *Cercospora gossypina*, curling up, drying and falling away. The contrast between plats 1 and 2 was remarkable. In plat No. 3 a large area was also badly diseased.

A field of cotton of three or four acres, grown during the same season on a neighboring plantation, is worthy of mention. During May and June the plants grew vigorously and bore a healthy looking rich green foliage, and promised to surpass any cotton in that vicinity. But in July and August the disease appeared over the entire field and the destruction of the foliage was complete. The plant did not yield more than 50 per cent. of what it would if the foliage had not been destroyed by the disease. Judging from the experience of the past two years I inferred that no kainite or potash, or at least very little, was applied, though I knew the field was quite heavily fertilized at the time of planting. Upon inquiry I learned that the fertilizer was a compost of stable manure, cotton seed and acid phosphate. Had 200 lbs. to 300 lbs. per acre kainite been applied at time of planting the yield might have been nearly doubled.

Mr. A. H. Clark, of Hope Hull, Ala., continued experiments this year on the same plat of ground where they were conducted last year and reported in bulletin No. 36. The plat was laid off with the rows in the same place as last year, but different amounts of kainite etc., were used. The table presents the yield of seed cotton per acre in the different plats. The results of the experiment last year are introduced in a parallel column for easy comparison. As the disease appeared in the plat the effect of kainite on the yield is very marked.

TABLE I.

No. Plat.	1891. Basis fertilizer is 667 lbs. phosphate and 333 lbs. cotton seed meal per acre applied when bedded, other fertilizers as below stated applied June 9th, 1891, all on each side of drill.	PRODUCT SEED COTTON.	PRODUCT SEED COTTON.	1892. Basis fertilizer 500 lbs. phosphate and 500 lbs. cotton seed meal per acre applied when bedded, all other fertilizers applied same date except when otherwise stated, all on each side of drill except where otherwise stated.
1	200 pounds kainite	1,088	1,720	400 pounds kainite.
2	400 “ “	1,291	1,741	200 “ “
3	Check	1,104	1,876	600 “ “
4	“	1,048	1,143	Check.
5	200 pounds nitrate soda	959	1,655	600 pounds kainite June 20th.
6	400 “ “ “	1,040	1,151	600 “ salt June 20th.
7	Check	711	1,403	200 “ kainite in drill.
8	“	784	1,075	200 “ salt in drill.
9	200 pounds salt	1,015	1,050	400 “ salt.
10	400 “ “	1,186	1,341	200 “ “
11	Check	931	1,320	600 “ “
12	“	997	1,115	Check.
13			1,570	200 pounds nitrate of soda.
14			1,260	400 “ “ “

Mr. Clark writes of the experiment as follows: “Plat 13 of 1892 with 200 pounds of nitrate of soda shows a benefit from it greater than does No. 14 from 400 pounds, which latter does not seem to be much benefitted, considering that it did not increase the crop to any extent last year, and that this year the larger application acted the same way. I am satisfied the product from No. 13 is an error. It is plain that kainite is a specific for the disease.”

September 16 I visited Mr. Clark for the purpose of observing the result of the experiment as presented in the appearance of the foliage of the plant. The result was very marked and plainly indicated the value of kainite in checking the disease. The foliage of the salt and nitrate of soda plats was very little if any better than the checks, showing the characteristic workings of the disease far in excess of the kainite plats. Plat No. 13 presented no better appearance in this respect than any of the checks, and this fact corroborates Mr. Clark's belief that the yield as reported from that plat for 1892 is an error.

A preliminary account of this disease was published in 1891* and the results of a more extended study appeared in 1892.† The reader is referred to the latter for a full account of that study, but it will be in place here to briefly state the nature of the disease, especially since some figures have been prepared which make the description more intelligible.

Description of the Disease.—The disease‡ is a physiological one, the condition of the plant being one of imperfect nutrition or assimilation. To appreciate the peculiar appearance accompanying the first stages of the disease, when it can quite readily be recognized in comparison with other affections of the leaf, one must note the general form of the leaf, as well as the venation, the courses through which nutriment is distributed, and the final areas through which it is diffused in reaching the ultimate units or cells of the leaf. The leaf is palmate, the main ribs,or veins, radiating from a common point at the junction of the petiole to several points on the leaf's circumference, so that the leaf is either undivided, as in the case of the first few leaves developed after

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*Botanical Gazette, Vol. XVI, March.

Bulletin No. 27, Alabama Agricultural Experiment Station, May.

†Bulletin No. 36, Alabama Agricultural Experiment Station, March.

‡ Portions of pages 5 and 6 of Bulletin No. 36 are quoted here.

the cotyledons and the young leaves in the axils of the branches; or three to four or five lobed or pointed, one of the main veins extending into the corresponding lobe of the leaf.

From these few main veins smaller ones branch in a monopodial fashion nearly at right angles, reaching out into the triangular area lying between. From these again still smaller branches extend, which themselves are branched, and so on until all parts of the leaf are at last intersected by the final smallest veinlets. This net work of veins is the medium through which the minute channels course that conduct water and nutritive solutions absorbed by the roots and transported through the circulatory passages of the stem to all parts of the leaf.

It will be seen that the ultimate ramifications of this network of veins divides the leaf tissue into quite small angular areas, and that the circulatory channels in the veinlets lie along the borders of these areas, Now it is clear that, as the nutritive substances pass by diffusion from the channels in the veinlets to the areas between them, the cells of these areas lying closest to the veinlets will be the first to obtain nourishment, and that the cells toward the centre of these small angular areas will be the last. When there is an abundance of the nutritive solution containing all of the necessary elements, all the cells of the areas will be well supplied, and, other things being equal, will remain healthy and green.

But if the supply is deficient either in quantity or quality the first cells to feel this deficiency will be those in the centre of these angular areas, while all the cells lying along the track of the distributing channels may be well supplied for a time. The effect of this deficiency, either in nutrition or assimilation, is shown in the partial disorganization of the chlorophyl, or green substance, which causes it to become yellow in color. At first this change in color is quite indistinct, but gradually becomes more marked until it is plainly seen. When this takes place it gives to the leaf a checkered or mosaic appearance, the cells along the channels in the veinlets which bound the yellowish areas remaining quite green for some time.

Figure 1 represents such a leaf in the early stage of the disease, the lighter colored spots representing the yellow areas.

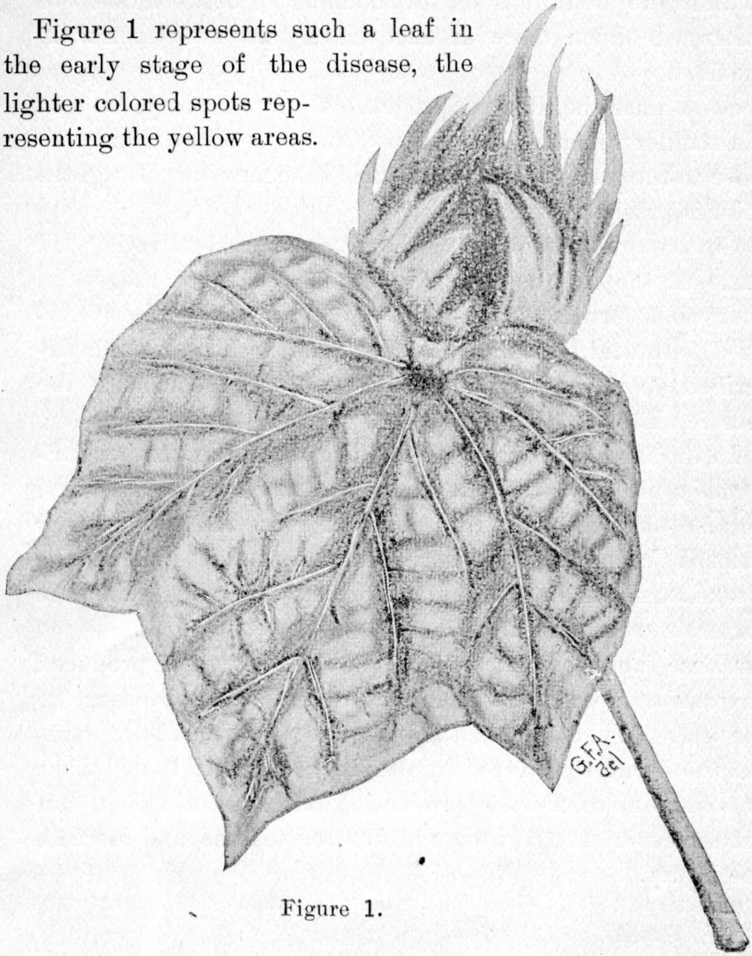

Figure 1.

During the summer of 1892 I succeeded in developing this disease artificially. Several rows of cotton in the plant laboratory were set apart for the experiment. When the plants were about one foot high the soil was flooded with water every day. In the course of two weeks the characteristic mosaic arrangement of the yellow and green color appeared in the leaves, and in a week more was very marked so that the definition of the boundaries between the two colors was much more distinct than I have ever seen it in the field.

Sometimes the disease progresses more rapidly, so that the smaller veins are also yellow, and it is only along quite close to the larger veins and their branches that the green color is present.

Cotton quite frequently has a yellow cast affecting all parts of the leaf as well as the tender parts of the stem, even when fertilized with kainite, and especially when fertilized with acid phosphate, as shown in the experiments described above, but it should not be confounded with the mosaic disease.

In the farther progress of the disease, if the weather continues quite dry, the leaf after awhile will gradually dry, become shrivelled and fall off. If rain and hot weather succeed each other, semi-parasitic fungi attack the weakened spots in the leaf, absorbing the living substance for their own growth.

These fungi are microscopic plants, but when produced in great numbers, give a dark brown or black appearance to the leaf. When the plant is badly diseased it will die without the injuries produced by these organisms if the weather is not suitable for their production and dissemination, but the attacks of fungi always hasten the disease and increase the injury.

In the latter stages of the disease the leaves assume different appearances according to the kind of fungus which grows in the diseased parts of the plant. Figure 2 represents one form when the leaf is attacked by *Macrosporium nigricantium.* This fungus causes circular spots, brown in appearance, and frequently marked by concentric rings of different colors. Fig. 4, Plate I, represents spores and fruiting threads of this fungus. The growing part of the fungus consists of minute thread-like bodies which grow inside the leaf and cause the spots. In a short time these fruiting threads shown at *b* in fig. 4 of the Plate, grow outside of the leaf and bear the spores on their ends. Frequently the leaf is covered with a fungus growth, the spores of which are shown at fig. 5 of the same Plate.

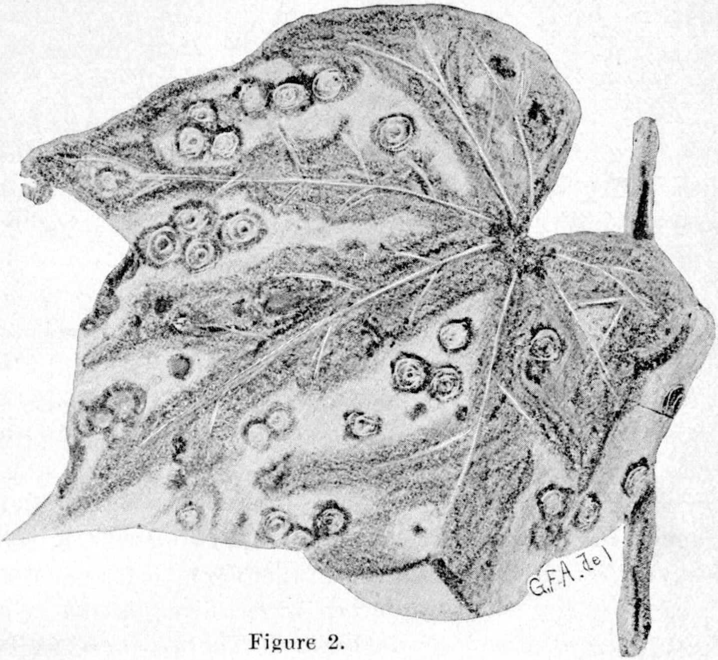

Figure 2.

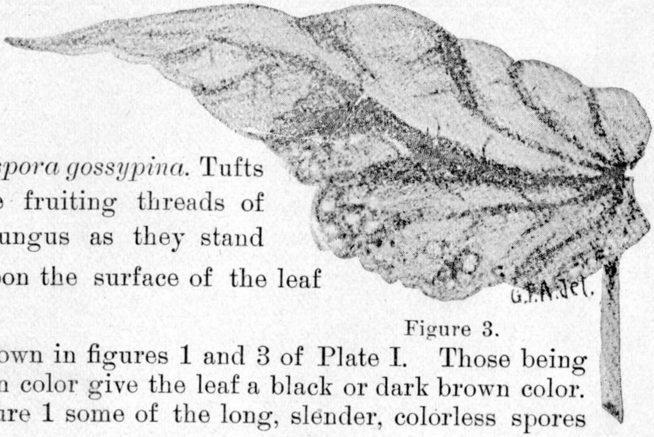

Figure 3.

Figure 3 of the text represents another form the leaf may assume when the principal fungus growing on it is *Cercospora gossypina*. Tufts of the fruiting threads of this fungus as they stand out upon the surface of the leaf are shown in figures 1 and 3 of Plate I. Those being dark in color give the leaf a black or dark brown color. In figure 1 some of the long, slender, colorless spores are shown attached to the ends of the fruiting threads, and some free ones are shown at 1*a* and 2*a*. When these spores are developed in great profusion, being colorless, they give a whitish appearance to those places—some of these are shown in the white spots at the lower edge of the leaf in figure 3 of the text. This form of the fungus is the one which develops several successive crops of spores through the season. There is another form which is developed toward the close of the season, and is probably the form in which the fungus passes the winter. This is repesented in figure 4.

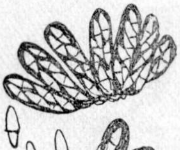

Fig. 4

A black ovate conceptacle is developed from the threads inside the leaf, which extends partly through the leaf surface. Inside this are several sacs, each of which contains eight spores. These are sometimes produced in great numbers upon leaves like the one in figure 3. The name of this fungus is *Sphærella gossypina*.*

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*See Bulletin Torrey Botanical Club, Vol. XVIII, No. 10, 1891.

For description of the other fungi alluded to here see Bulletin No. 27, Ala. Agr. Exp. Station, and Botanical Gazette, Vol. XVI, No. 3, March, 1891.

III. FRENCHING.

This disease was first called to my attention June 16, 1891, but has for sometime been known to a number of planters. Why the name "frenching" was ever applied to this disease I have been thus far unable to determine, unless it be that, following the signification of the verb from the same root which means something *foreign*, and therefore later, *strange*, *unnatural*, etc., it is intended to denote a strange or unnatural appearance of the cotton plant.

I first collected specimens of the diseased plants at Matthew's Station and Hope Hull, Ala., on June 16th and 17th, and material has been sent me frem Allenton, Ala. July 9th I discovered it at Pike Roads, Ala. July 19th I collected specimens at Selma, Ala., in sandy land. September 4th I found it also in the sandy bottoms of the Alabama river, within two miles of Montgomery.

In August, 1892, I received it from Arkansas, the specimens being sent by Mr. C. L. Newman of Pine Bluff.

During the month of September, 1892, I was called to Athens, Ala., by Commissioner Lane to inspect some diseased cotton, and found the same disease there.

I am led to believe that its distribution is much wider, but these are the only places of which I have positive knowledge from personal examination of its presence.

Beginning with the lower leaves the first sign of the disease is a light yellowing of the leaf at the edge, or more commonly between the forks of the main ribs of the leaf. This yellow color is sometimes very pale and almost white. It is followed by a drying of the same parts of the leaf, and later, as these parts of the leaf die, they turn brown and become ragged and the leaf eventually falls to the ground. These different colors follow successively, and when the disease is well advanced all the colors are seen on the same leaf, the yellow color, of course, being nearer the still green portion of the leaf along either side of the main ribs. Figure 5 represents a leaf showing all the colors, the darker

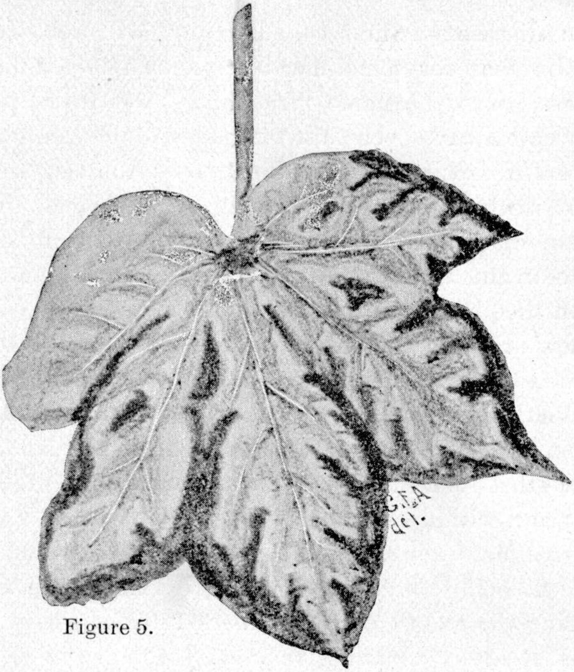

Figure 5.

color being the dead portions, the lighter color, the yellow, and the green color is along the veins.

Gradually the disease advances into the other leaves, until nearly all of the leaves are affected, when the lower ones begin to fall. At last the uppermost leaves are affected and fall away.

My first observations were made on plants about twelve inches in height, a short period before the first blooms appeared.

In May, 1892, at Mathews' Station, I observed the disease in very young plants, only a few days after they were up, and before the plumule was developed. The peculiar yellow color was easily noted in the cotyledons of the plant.

A few of these plants I took from the ground, conveyed them to Auburn and transplanted them. The transplanting checked their growth for a few days, then growth set in and all external signs of the disease disappeared, but in the latter part of June, when the plants were almost one foot high, they were severely attacked, and by the middle of July all of the leaves presented the peculiar striped appearance so characteristic of normal advanced stages of the disease. Some of the young plants collected in May were examined microscopically and found to be identical with the disease observed in the larger plants the previous year.

When the plant is old these progressive changes of color frequently are distributed over many more courses on the leaf, following not only between the main four or five veins of the leaf, but also the spaces between the primary branching of these veins. On plants possessing a mild type of the disease, some of the leaves may exhibit the yellow color in indefinite courses, now a few large yellow spots some distance from the edge, or a pale yellow occupying nearly one side of the leaf. But it is always sufficiently characterized either by the usual relation of the different colors, or by the peculiar shade of yellow, or both, for one who has once carefully observed the disease to easily detect it, except in some cases to be described later.

I am aware that other appearances of the cotton plant are termed "frenching," but I am lead to believe that the disease here characterized, and manifested by the specimens I have seen, is the one more generally known as frenching.

The leaves of a cotton plant are sometimes variegated with different colors, yellow, white, red and green. This is sometimes called "variegated cotton," or the "spotted cotton plant," "leprosy," etc. Some call this "frenching," and consider it the same as the disease I have described above. It is totally different, however. The leaves do not die from the trouble, but may remain alive and perform their functions.

The final and sure test of the disease is found upon breaking or cutting the stem of the plant. If it is "frenching" the tissues of the fibro-vascular system will appear light brown in color, the depth of the color depending upon the virulence, or stage, of the attack. Planters say the "heart" is black. A microscopic section of the stem reveals the presence of fungus threads which are interwoven in labyrinthian meshes, in some cases completely filling some of the vascular channels of the plant. The discoloration of the tissues is more apparent in those ducts infested with the fungus. With good illumination the color appears, when viewed in a microscopic section, to be a brilliant yellow, unless quite old, when it is much darker. The threads of the parasite when young are colorless, but as they age they assume a bright yellow color. They measure 2–4 micromillimeters in diameter. Very minute spores are developed from the ends of some of the threads and are found either

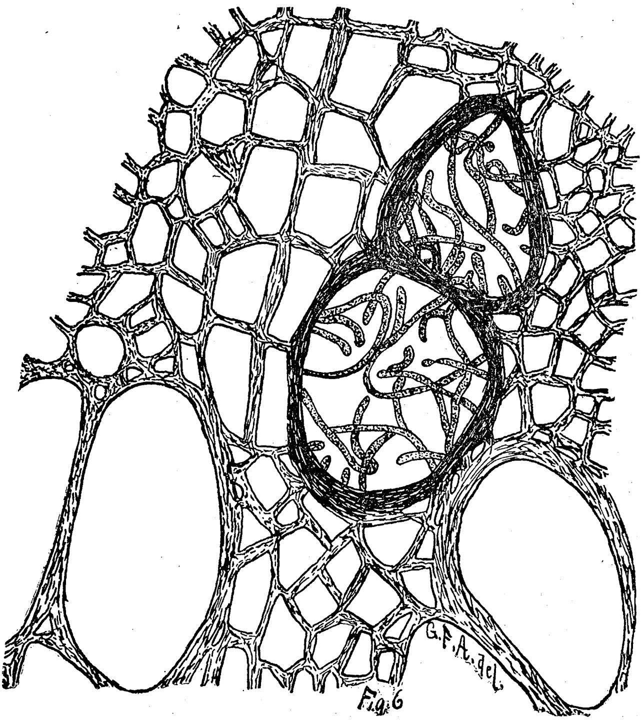

Fig. 6

attached to their places of growth or free within the ducts, and are 1–2 x 2–4 micromillimeters. In figure 6 is shown a portion of a thin section across a diseased stem, very highly magnified, the fungus threads are interwoven in two of the ducts.

Using proper precautions to prevent contamination of the culture media, pure cultures were obtained of the parasite from within the stem. In all such cases the fungus obtained proved to be a species of *Fusarium*.

The parasite enters the plant near the surface of the ground or in the upper parts of the roots. The threads then as they increase grow upwards and reaching the branches and petioles of the leaves grow out into their circulatory channels. This explains why the lower leaves are the first to be affected during the first period of the disease.

During the early stages the parasite is not in the leaves, the color changes and dying of the leaf being the result of a failure in nutrition due to the withdrawal of nourishment from the vascular channels of the stem by the parasite. The larger openings in figure 6 represent some of these cut across. It will be noticed that the failure of nutrition in the leaves is somewhat similar to that which occurs in the mosaic disease, but in frenching the interference with nutrition is so much greater than in the mosaic disease that the yellow color does not first appear in the smaller areas bounded by the smaller anastomosing veinlets, but extends rapidly up from the edge of the leaf between the larger veins.

The plants sometimes put out new growth and seem to recover to a certain degree from the disease. In many cases the upper part of the plant dies, the new growth coming from the latent buds and dwarfed branches near the ground. Many of the plants die outright.

Under favorable circumstances a new growth from the lower branches may entirely hide the dead top of the plant unless careful observation is made. In other cases the new growth may come from all parts of the plant. After a period of convalescence the plant may suffer a relapse. The second attack often differs materially from the first in external appearance, probably from the fact that the mycelium of the fungus is so well distributed throughout all parts of the plant that its effect in attacking the new growth and increasing in the old, is more rapid, thus not permitting the gradual sequence of color observed when the fungus has but one opening through which it can enter the growing parts of the plant.

A few leaves sometimes show the characteristic sequence of color, but the leaf soon wilts, thus checking the color changes. Plants may pass through several periods of convalescence and relapse during a season. The fruit even on plants that do not seem to be very badly effected may frequently decay when nearly ready to open.

The disease when not complicated with other diseases of the roots, does not advance with such rapidity into the roots, and this probably explains why so many plants sometimes recover, the roots in favorable weather sometimes supplying constantly the necessary moisture and nutrition, furnish material for the growth of the latent branches near the base. In sandy land the progress of the disease seems to be much more rapid, especially when the plant has attained considerable size and the fungus already is well distributed throughout the system. It then often happens that very few of the leaves show the gradual changes described above, but suddenly wilt on a hot or dry day; a few on one day, more on the following, or sometimes perhaps all on the same day. The plant then soon dies. This phenomenon of the disease in aged plants in sandy land is in external appearance very much like "root rot" of cotton in Texas, but caused by a different fungus. Occasionally the plants on the sandy land are also affected with nematodes and have large "knotty swellings" on the roots. These galls are caused by a nematode worm. Whenever cotton is frenching in soil affected by these worms, almost every plant effected by the worm is also affected with the organism of frenching. This is probably because the roots, being diseased by the worms, offer easy access to the parasitic fungus. However, many of the plants that are frenching are not affected by the nematodes even in sandy land. The two diseases are distinct, but when both attack a plant, the condition of the plant is much more serious. "Knotty swellings" are also found by some planters on roots of cotton in the prairie lands. These are probably caused by the same nematode. I have not observed them myself on cotton roots in the prairie lands, but have found them in such lands on the roots of tomatoes and lettuce. *

It is thought by most planters familiar with the disease, that it is confined to soils of a certain character. Some will say that it occurs only in gray soils of the prairie belt; others that it occurs only in the loose black, or gunpowder lands. This is due to the comparatively narrow area over which their observation extends. Thus, at Hope Hull, it is mainly in the gray lime lands, with a less per centage in the clay and very little in the bottom land adjoining the gray soil. At Mathew's Station, on the other hand, it seems to be confined mainly to the bottom land, some of the lands being known as "gunpowder land," a deep, black loam, which in dry weather becomes very finely powdered and loose. Considering also its occurrence in sandy soil, it will be seen that it is likely to infest any soil into which it may be carried and gain a foothold.

At Athens, Ala., I found okra affected by the same disease. No other plant is now known to be affected with the same disease that I am aware of. Corn seems to be entirely free from it, and perhaps more frequent rotation with corn would not only starve out the fungus, but benefit the plan-

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*Agricultural Journal, Montgomery, Ala., August, 1891.

ter in another way also—that of providing grain for stock, instead of purchasing it at high prices, as many do.

CULTURES OF THE FUNGUS.—In starting the artificial cultures of the fungus, care was used to free them from contamination from any germs on the plant. With a knife heated to redness, the stem was cut and the bark carefully and quickly shaved off. Then with a flamed cool knife, portions of the diseased ducts were transferred to nutrient agar agar in test tubes. Cell cultures were made in which the sections were so thin that I could observe with the microscope that the growth obtained in the cultures originated from the young fungus threads in the tissues, or from the minute spores. Other cell and tube cultures were made by dropping the thin sections in liquified nutrient agar agar in the test tubes, and then pouring it upon thin glass to solidify. Frequently in such cases the spores were shown to be quite numerous from the number of centres of growth in the medium other than those where the sections were located.

The formation of spores takes place within fifteen or twenty hours from the time of starting culture from the stem or in sowings of the spores. The hyphae in artificial cultures remained hyaline in all the cultures made except in one culture in bouillon. In drawing specimens for examination from this culture, portions of the submerged mycelium were raised above the surface of the liquid. In a few days these possessed the same color as the older threads in the tissues. In bouillon and nutrient agar agar frequently enlarged cells appear in the hyphae, which resembles gemmae. Sometimes they occur at the end of a hypha, and in both cases often bear several flasked-shaped basidia.

The spores obtained in cultures vary from 2-4.5x4—40 micromillimetres. They are continuous, or one to four or five septate, according to their length. The very minute ones are narrowly oval. As they increase in length many are inequilateral and curved. They are colorless, faintly granular, and frequently possess one to several vacuoles, according to their size. The short ones have usually one rounded end, the opposite end being usually rather sharply pointed. Variations in this character occur. The longer spores have a tendency to be pointed at both ends when mature, though frequently one end is appreciably the stouter.

The fertile hyphae vary greatly. The earlier ones are short, flasked-shaped and supported on the main hypha by a narrow pedicel. As they age, they frequently increase in length, and branch producing dendritic forms. The formation of spores in cultures reminds one strongly of some species of *Glœosporium* and *Colletotrichum*, where they are clustered about the ends of the basidia. Frequently in this *Fusarium* the basidium elongates as the spores are being borne and leaves them distributed along its course.

Cultures in nutrient agar agar or bouillon produced shorter spores than on sterilized cotton bolls or Irish potatoes.

A saprophytic *Fusarium* is very common on decaying cotton bolls in autumn, and I have found it in various places during the past July, growing upon bolls which were probably first attacked by a bacterium. I have also found it on decaying bolls from plants badly affected by this vascular disease. Of this saprophytic species I made parallel cultures with the parasitic form, to determine if they were specifically distinct.

The cultures were made on sterilized cotton bolls and Irish potato. The two seem to be specifically distinct. In the saprophytic species the spores are more strongly curved and the ends very long and slender. This distinction was maintained throughout several cultures.

Some of the growths in artificial cultures are represented in figure 7, *a* from culture in agar, *b* from culture on cotton bolls, *c* from culture on potato.

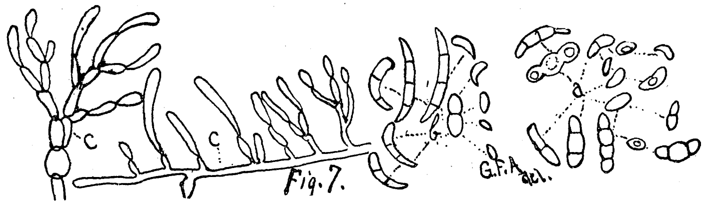

Fig. 7.

The fungus seems to be new and I propose for it the name *Fusarium vasinfectum.*

Inoculations.—Experiments were made in August, 1892, to determine if the disease could be obtained by inoculation with the fungus which I obtained in pure culture. The *Fusarium* was considered not to be a sufficiently aggressive parasite to be able to make its way into the ducts of the circulatory system unaided. Having found that the "damping off" fungus could disease the stems of the young cotton, and that many plants even when the ulcer reached the circulatory system, recovered from the effects of this external injury, it was suggested that possibly this fungus could open the way for the entrance of the *Fusarium.*

Accordingly several short rows of cotton were planted in the plant laboratory and just as the plants were issuing from the ground they were inoculated with the "damping off" fungus. When by examination it was shown that several plants were diseased so that an opening was made in as far as the vascular tissue, a portion of the earth was removed and pure cultures of the *Fusarium* were placed directly against the diseased portions of the plants. Some of the plants died from the effects of the "damping off" fungus, but loosening of the earth and partial drying of the soil saved others. In a few days the soil was kept well watered again. Aug. 24 one plant about 12 inches high died exhibiting signs of the disease in one leaf. Microscopic examination showed the Fusarium ducts near the ground, while for some greater distance up the stem the fibro-vascular tissue was brown in color. The discoloration and disease of the ducts is started by the injury from the "damping off" fungus. The diseased condition of the ducts affords an opportunity for the *Fusarium* to gain a foothold. As the plant recovers from the lesions produced by the "damping off" fungus it imprisons the *Fusarium* in a living condition. The *Fusarium* may for some time lurk in the circulatory passages making but slow growth. Its presence and growth upon the already partially diseased tissues extend the malady farther up the passages with the growth of the plant. Finally in many cases the *Fusarium* has such a strong foothold and is so wide spread through the system that the plant is overcome and dies outright, or sheds all its leaves. Favorable conditions may bring on a period of convalescence followed by a relapse as the *Fusarium* again gains the upper hand.

Some of the plants first diseased with the "damping off" fungus were inoculated by placing stems of a frenching plant against the diseased parts. In one case the result was beautiful, three of the leaves slowly passing through the yellow color changes and then wilting. The ducts of the stem also presented all the characteristics of the disease. The result was much more satisfactory than that obtained from the inoculation with the pure culture of the *Fusarium*. This suggested that possibly bacteria which are frequently obtained from the diseased tissues might be associated with the *Fusarium* in the etiology of the disease. While I do not wish to be understood as making any positive assertion in favor of the *Fusarium* being the cause instead of bacte ria, I do think the evidence thus far in hand gives greater support to the former view. The *Fusarium* is invariably found, both in cotton and in okra afflicted with the disease. Bacteria are not always found in the diseased tissues, forin quite a number of transplantings of diseased tissue to nutrient agar agar no bacteria were developed while the *Fusarium* always appeared. Again not always does the same species of bacteria appear, but now one species and then another.

IV. "SORE-SHIN," "DAMPING OFF," "SEEDLING ROT."

Young cotton plants are frequently injured or killed by what is known among planters as "sore-shin." This is identical in external appearance with what is generally known in Europe and in this country as "damping off," or "seedling rot." The diseased portion of the plant is just beneath the surface of the ground and is characterized by a shrunken area of a dull reddish brown color. The size of the shrunken area and the depth of the injury are in proportion to the serious condition of the ulcer. If the injury remains confined to the superficial tissues the plant may, and frequently does, recover. Such plants may show the disease for several weeks. Figure 8 represents two plants "damping off."

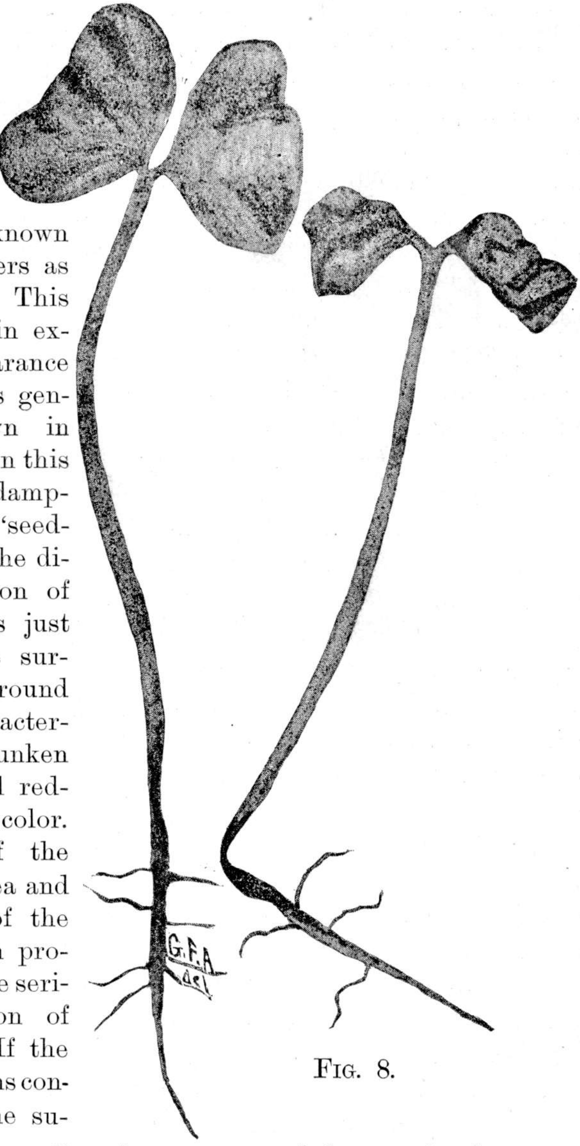

FIG. 8.

Damping off is so frequently attributed to the work of *Pythium DeBaryanum*, I supposed in this case that fungus was present, but numerous examinations failed to reveal it. Beside the frequent occurrence of threads of *Rhizopus nigricans*, and species of *Fusarium*, non-fruiting threads of some fungus were so generally observed I suspected their causal connection with the disease.

The threads are 9–11 micromillimeters in diameter and the cells 100–200 micromillimeters in length. At first they are colorless and possess numerous vacuoles of varying sizes in the nearly homogenous protoplasm. As they age they become brown in color. The branches extend obliquely from the parent thread, are somewhat narrower at their point of origin and possess a septum usually 15–20 micromillimeters from the parent thread, giving a clavate form to this part of the branch which is continuous with the parent cell. Frequently the hyphæ are associated in strands being woven and twisted together.

Pure cultures.—By placing effected seedlings on filter paper in a moist chamber there are developed in 24 to 48 hours numerous threads in a horizontal or procumbent position, which extend out for 1 c m to 3 c m over the paper, often not contaminated with other fungi. By transplanting a few of these threads, using a flamed platinum needle, into nutrient agar rendered acid by lactic acid (one drop concentrated lactic acid to about 10 c c of nutrient agar) a pure culture of the fungus was obtained.

A series of experiments was conducted to determine if the fungus found in the tissues of "sore-shin" cotton, could really produce that disease and "damp off" the young plants.

Experiment No. 1—Soil from the hill in the garden where young plants had just died from the disease was placed in two pots on June 27. Pot *a* was placed in the soil bed of the plant laboratory and watered. Pot *b* was steamed in the steam sterilizer for three hours and left in the sterilizer over night. June 28 it was placed in the soil bed beside pot *a*. Cotton seed after being scalded was planted in both pots. The plants began coming up July 1 and 2 and were well up July 3rd. In pot *a* the plants were damping off while in plot *b*, the soil of which had been steamed, the plants were perfectly healthy. I was now absent until July 16. On returning, my assistant reported that all the plants in pot *a* died in a few days. In pot *b* they were still perfectly healthy. This was very good evidence that the soil contained some parasite which caused the disease and the steaming killed that parasite.

Experiment No. 2.—This experiment was made in order to test the effect of kainite in the soil since it had been found in a few trials where the fungus was not very abundant in the soil that acid phosphate hastened the disease. Earth from soil in the garden which had been heavily fertilized with acid phosphate and in which plants died from "damping off" was placed in two pots. These were sunk in the soil bed in the plant laboratory June 27. Scalded cotton seed was planted in both. Pot *a* was watered with pure water while pot *b* was watered with a strong solution of kainite. The plants were well up July 3rd. Damping off began in both pots and in a few days all were dead. This indicates that while under ordinary circumstances acid soil conduces to the development of the disease, heavy application of kainite will not prevent it where the fungus is abundant in the soil.

Experiment No. 3.—Earth from the garden not known to be infected with the fungus, but quite likely containing it, was placed in a pot and steamed in the steam sterilizer for three hours. It was sunk in the soil in the plant laboratory July 16, and planted with scalded cotton seed. The plants were well up July 20. Three different groups of plants in the pot were inoculated with the fungus threads taken from a pure culture, grown on nutrient agar. The threads were placed against the lower part of the stem after removing the earth. The earth was then returned and the soil watered. Several groups of plants remained untreated in the pot to serve as checks.

July 22 one plant from group 1, and two plants from group 2, had fallen and were wilting. These were removed to a moist chamber on filter paper prepared in the same manner as described above. July 23 there was a profuse growth of the fungus threads extending out upon the filter paper. It was identified as the same as the one used in the inoculation. On the same day one plant in group 3 had fallen and was wilting. Others in groups 1 and 2 were diseased while the checks remained healthy.

This proves that the fungus used in the inoculation is the cause of the disease produced at that season in the garden and fields which I examined.

July 28—Experiment No. 3—was photographed. Only one plant among the remaining number of the plants inoculated was erect, and examination showed that to be diseased. This was in group No. 1. In group No. 2 there were still three plants, one had fallen July 27 and was wilted; two fell during the night of July 27, and on the morning of July 28 were wilting. In group No. 3 were also three plants. Two had fallen July 25 and 26, and were nearly dry, while one had fallen during the night of July 27, and was wilting on the morning of July 28.

The group of plants not inoculated remained perfectly healthy.

Experiment No. 4.—July 22 water cultures were started in the following way. Two 4 oz. bottles were filled with distilled water to which a small quantity of acid phosphate, kainite and nitrate of soda was added. The cork was perforated to admit the radicle of the cotton plant seedling. The seed was previously scalded and germinated on filter paper in a moist chamber. The seedlings were placed in position and the experiment photographed. No. 1 was inoculated by placing a tuft of fungus threads against the stem where they would keep moist, while No. 2 served as a check.

July 23 the fungus had taken hold of the plant in No. 1, as shown by the discoloration and shrinkage of the tissues. July 25 the plant in No. 1 was dead while the check plant in No. 2 was perfectly healthy, and had grown as shown in the photograph taken on the same date.

Experiment No. 5.—This experiment was designed to test the fungus of "root rot" of alfalfa sent by Prof. George W. Curtis, Director of the Texas Agricultural Experiment Station, which appears to be identical with root rot of cotton in Texas.

A pot of soil from the garden was steamed in the steam sterilizer for two hours, cotton seed previously scalded was planted July 20th, along with refuse earth and particles of alfalfa roots from the Texas material. The plants were coming up July 23 to 25. July 26 one plant had "damped off." July 27 several plants were badly diseased so that the least pull caused them to break off at the diseased area. The "damping off" fungus was found, and also numerous threads of *Rhizopus nigricans*, which was abundant on the alfalfa roots.

Experiment No. 6.—This experiment was designed to test the effect of the *Rhizopus nigricans*, which developed so abundantly in experiment No. 5. Two pots of soil from the garden were steamed for two hours, the soil being previously wetted. Scalded cotton seed was planted July 27. A culture of the *Rhizopus* was added to the seed planted in pot *a*. Pot *b* was retained as a check. Plants remained healthy in both.

Experiment No. 7.—This experiment was designed to test a preparation chiefly recommended as an insecticide, but claimed also to possess fungicidal properties. The preparation is known as "par oidium," or "black sulphur." The experiment was conducted in pots *a* and *b* of experiment No. 2, where all the plants had died from damping off. The "par oidium" was mixed with three inches of the surface soil, and seed not scalded was planted in both pots July 16. July 20 when seed planted in other places on July 16 was up, I examined the seed in pots *a* and *b* and found it dead. Fresh seed was then obtained and after being scalded was planted in pots *a* and *b*, while check plantings were made in other places to determine the quality of the seed. The check plantings germinated while not a seed in pots *a* and *b* germinated. July 25 some of the seed in pot *a* were opened and placed on filter paper in a moist chamber, when in 24 hours a profuse growth of the characteristic fungus appeared. This showed that the "par oidium" had not prevented the growth of the fungus.

Experiment No. 8.—This was conducted to determine whether or not seed would germinate in the soil used in experiment No. 7 after being steamed. July 25 the soil in pot *b* was removed. That in a pot *a* was divided perpendicularly, one half being placed in pot *b*. First, soil was placed underneath this soil in both pots to raise the surface nearly level with the rim of the pots. Pot *a* was steamed for two hours, and when cooled, scalded seed was planted in both pots. July 28, 29 and 30, the seed in pot *a* had germinated, the plants were coming up and were perfectly healthy. In pot *b* not a seed had germinated. The fungus had multiplied to such an extent in the soil that it killed the seed before germination could take place.

DESCRIPTION OF THE CULTURES.—It was difficult in the culture in moist chambers from the roots of diseased plants to prevent bacteria from accompanying the threads. The acidulated medium prevented the growth of the bacteria while it did not interfere with the growth of the fungus. Five different cultures were started in this manner. Four test tubes containing sterilized corn stalk pith saturated with acidulated nutrient agar agar were inoculated with the threads. One failed to grow, two were contaminated with *Rhizopus nigricans*, and two developed pure cultures of the desired fungus. The fifth inoculation was made into acidulated nutrient agar agar in a liquid condition, which was allowed to partially cool, and then was poured out upon a sterilized glass plate, the partial cooling of the agar permitted it to remain in a heap about 1 c m high and 4 c m in diameter. A pure culture of the desired fungus was obtained in this also.

In the plate culture a profuse growth followed, the hyphæ emerging in all directions from the substratum, extended all over the glass plate to the edge, and there, in the course of a week, hung down in broad, brown mantles or veils of exceedingly delicate texture, reaching to the water in the bottom of the vessel.

In a like manner by this time the threads grown from the diseased plants in the moist chamber had extended over the filter paper for four or five inches, forming in many cases distinct strands, of a dark brown color, from the association and intertwining of several hyphæ, resembling the strands of some Hymenomycetes. These strands also occurred in the plate culture.

In the test tube culture the hyphæ first appeared, springing in a radial direction from the point of inoculation on the corn-stalk pith as a white, fluffy mass which soon spread over the surface of the pith and leaped by strands across the space intervening between the pith and walls of the tube, where in many cases, compact masses of hyphæ developed, composed of short cells very much constricted at the septa and broader than the normal ones. These were white at first but became brown with age, and suggested the development of sclerotia. This culture was started June 21st, and by July 21st, as growth seemed to have ceased, more nutrient agar was poured into the tube, partly immersing the pith. In twenty-four hours a profuse growth had appeared over the surface of the agar.

July 18th additional cultures were started from the plate culture by transplanting portions of the agar containing the threads, as well as the threads alone taken from near the edge of the glass plate, into test tubes of acidulated nutrient agar. Growth appears first as a loose, abrupt convex tuft of radiating white threads. In a few days this tuft increases greatly in the periphery, but little in height. At the same time minute, powdery-looking masses appear which are seated on the mycelium, near the surface of the medium, in the meshes of the tuft or near the extremity of the loose threads. Some of these are young sclerotia, as noted above,—white at first, but gradually changing to a brown color. These occurred in all the cultures.

Cultures on Irish Potatoes.—July 23rd several Irish potatoes were halved, placed in covered glass vessels and steamed two hours each day for two successive days. Being in closed vessels the steam did not reach the potatoes readily, and numbers of bacteria developed. Observing this, July 25th the covers of the glass vessels were partially removed during the process of steaming which continued for two hours, killing the bacteria, since no farther development took place. After cooling, July 25th, p. m., two of the halves of the potatoes were inoculated with the fungus threads from a test tube culture. July 26th, a. m., the fungus had grown rapidly, spreading in a radial direction over the cut surface of the potato for about 2 *c m.** July 27th, a. m., it had reached and passed the edge of the potato, extending over the edge about 1½ *c m*, the growth for the twenty four hours being about 3 *c m.*

On the surface of the potato the threads form a stout pellicle lying quite close to the surface, while at the edge they tend to separate into strands and diverge outward and downward.

July 28th, a. m., the two cultures in vessels of different size presented some differences. In the glass jar, 6 *c m* in diameter, the infusion from the steamed potato was more plentiful in proximity to the potato and of greater depth on the bottom of the vessel than in the shallow and broader vessel. This increased moisture and richness of pabulum conduced to a much more rapid and profuse growth of the fungus. The threads for a short distance down the perpendicular surface of the potato stood out loosely, while lower down, as the moisture and nutriment increases, they cling more closely to the side of the potato, forming a pellicle with a few loose threads or strands. Upon reaching the infusion they again grow into a very compact pellicle, the strands of which extend radially to the side of the vessel.

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* Two and one-half centimeters are nearly equal to one inch.

The pellicle is thrown into radiating and dichotomously forked folds.

Upon the surface of the pellicle in both cultures there are later developed many procumbent free strands and threads. At the ends of the free threads, and over the surface of the pellicle, numerous powdery-looking tufts, alluded to above, are developed. Those close to the surface of the pellicle form the sclerotia. The pellicle is 400 micromillimeters or more in thickness.

On Irish potato in test tubes the fungus develops a loose weft of threads and strands. Many strands extend across to the walls of the tube where numerous sclerotia are developed. The sclerotia also are developed on the strands in the intervening space between the potato and walls of the tube, as well as on the surface of the potato.

In one of the potato cultures, where the potato was first boiled, then halved and steamed, the pellicle as it advanced over the surface of the potato caused a depression parallel with and a little behind the advancing border of the weft. The pellicle later became strongly and irregularly folded.

Cultures on Cotton Stalks.—A cotton stalk, from 1 *c m* to 2 *c m* in diameter was cut into sections about 5 *c m* long, boiled and then placed in a glass jar where they were steam sterilized for two hours each day on two successive days.

July 30 they were inoculated with threads of the fungus. August 2, from the point of inoculation, which was at one end of the small pile of stems near the lower portion, the fungus had spread radially for a distance of 3 *c m* to 5 *c m* in a rather compact but moderately thin pellicle nearly obscuring the bark of the stems. On the side of the glass jar it also extended radially from the same point for a distance of 3 *c m*. Upon the infusion in the lower part of the vessel the pellicle was much thicker, showing much more vigorous growth, and here the brown color appeared. The powdery tufts and sclerotia were also developed.

Culture on Oak Wood.—From an oak limb which had been

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*One micromillimeter, equals 1-25,000 part of an inch.

dead about one year, still possessing the bark, about 3 *c m* in diameter, a section 5 *c m* long was taken, boiled, and split in halves. These were placed in a small glass jar, a little distilled water, and a small quantity of cotton stem infusion, added, and then steam sterilized two hours each day for two successive days. July 28 this was inoculated with threads of the fungus. August 2 the fungus had spread radially from the point of inoculation, a distance of about 3 *c m*, forming a very thin gauze like pellicle through which the wood could be distinctly seen. The growth was somewhat more vigorous on the weak infusion. August 4th the gauze like pellicle had not increased in density, while the growth on the infusion was much more compact and sclerotia were developing on the sides of the glass jar as well as on the surface of the wood.

Culture on Cotton Seed.—July 25th some cotton seed killed by the fungus was opened and placed on filter paper in a moist chamber. July 26th a profuse growth of the fungus had begun. August 2 sclerotia were observed on the filter paper several centimeters distant from the seed varying in size up to the size of a bird shot. Connecting these with the seed are strands of the fungus.

Culture on Horse Dung.—July 28 a small quantity of horse dung was placed in a small glass jar and steam sterilized for two hours each day on four successive days. Steaming was then omitted one day and then the material again steamed for two hours. August 3 the horse dung was inoculated with the fungus. August 4, very little perceptible growth had taken place, the threads from the point of inoculation radiating for a short distance, about 1 *c m.* August 5 this growth had extended making in all about 2 *c m.* There was no infusion whatever in the vessel, and the slow growth was found to be due to a lack of moisture, for on the addition of sterilized water, the growth was accelerated and numerous sclerotia were afterward formed.

V. ANTHRACNOSE.

Colletotrichum Gossypii SOUTHWORTH.

During the summer of 1890 this then new disease of cotton was studied independently by both Miss Southworth* and the author.† While it seems to be quite widely distributed serious injury seems to be confined to localities. While I have observed it in quite a number of places in Alabama, only at Brundidge have I noted any very serious injury to the fruit. At that place in September, 1891, fully ten to fifty per centum of the crop was destroyed on some plantations. In the vicinity of Auburn while it occurs on the bolls its greatest injury seems to be confined to young cotton plants.

Affecting the Bolls.—The disease on the bolls originates in minute spots. These spots when very small are of a dull reddish brown color, and present minute shallow depressions of the surface tissue. As these spots enlarge the tissue blackens until the development of the spores begins. These are developed in pustules, usually confluent, in the center of the nearly circular spot. Their development changes the color of the spot, which becomes a dirty grey, if there are few spores or a bright pink, if the spores are numerous. Where the spores are few in number, many of them stand out upon the surface on threads which have grown up through the tissue. The spores being colorless give a greyish cast to the dark back ground of diseased tissue. When the spores are developed in great quantities they are piled up into a considerable heap and form a large confluent mass occupying the central portion of the spot. A pink pigment, given off by the spores, is produced here in such quantity by the mass of spores that it can be readily seen. It is this pigment which gives the pink color to the spots.

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*Journal Mycology, Vol. VI, No. 3.

†Journal Mycology, Vol. VI, No. 4.

While the disease is progressing and the spots are increasing in size the bands of color in the tissue move out centrifugally. The outer band which is the border of the spot is dull reddish brown in color and its outer limits are frequently ill-defined. Inside of this border is a blackish band of tissue which borders the pink center. As the spots increase in size they coalesce and frequently unite in forming a large diseased irregular area covering sometimes one-half the surface of the boll.

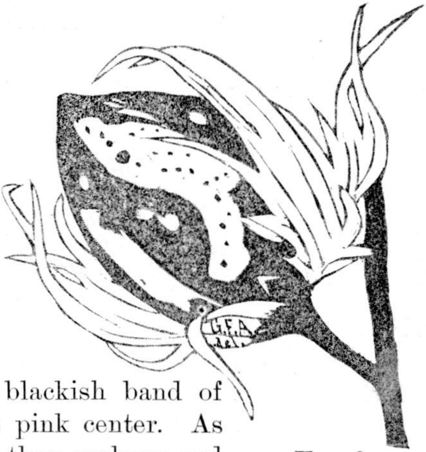

FIG. 9.

Figures *9* and *10* show different stages in the progress of the disease.

Such fruit cannot mature good lint. The fungus brings about a premature ripening of the tissues, so that they deaden and dry into fixed forms. The normal process of maturity being thus interfered with the natural separation of the carpels of the boll is arrested. The boll either remains closed or as is more usually the case the carpels separate at the apex only, the boll appears as in Figure 11, to crack partially open, and in this condition firmly holds the lint within. It is not infrequent then to find the fungus even on the lint.

FIG. 10.

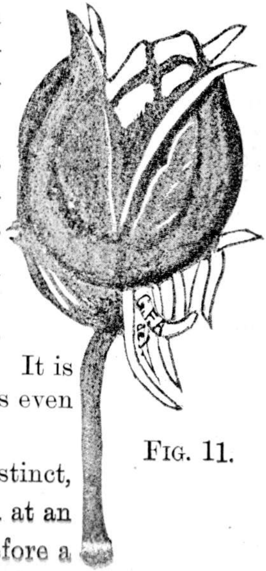

FIG. 11.

Sometimes the spots are not distinct, nearly the entire tissue being involved at an early period so that the boll dies before a profuse development of the spores at any given point takes place. In such cases the boll appears nearly black partly from the dead tissue and partly from the numerous black hyphæ and sclerotia of the fungus.

Affecting the stem.—So far as I have observed the fungus does not produce any characteristic injury of the stem which is noticeable, but it is frequently found in injured parts of the stem, and on the scars left by falling leaves, where the dying tissue of the scar, especially in humid weather, invites its development.

In my early studies of cotton anthracnose* I thought the fungus attacked the upper part of the stems in September occasioning a scalded appearance of the stems and leaves. Since I have become more familiar with the yellow leaf blight or mosaic disease, I am convinced the trouble was caused primarily by that disease and afforded a good opportunity for the fungus of anthracnose to develop.

The fungus sometimes effects seriously the stems of seedling cotton, attacking the stem at the surface of the ground or just below causing the plant to wither and die much as if it damped off. The tissues redden, and shrink frequently in longitudinal lines. The macroscopic appearances of the injury are usually quite different from those occasioned by the "damping off" fungus. The stem is not apt to present the well-defined ulcer, or diseased depression, which is so characteristic of the injury from the "damping off" fungus.

Seedlings are probably frequently diseased in this way from the spores which are lodged in the lint of the seed at time of planting. In some cultures of young plants in sterilized soil I have sometimes been annoyed by the development of the fungus in the stems under circumstances such that they were diseased in no other way than from spores which remained attached to the seed.

Affecting the leaves.—The anthracnose is frequently found upon the leaves but it is more apt to develop in sickly leaves, or injured places, than to attack healthy leaves. Indeed, there does not seem to be any characteristic affection

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* Journal Mycology, Vol. VI, No. 4, p. 174. Washington, D. C., 1891.

of the leaves but from the partial saprophytic habit of the fungus otherwise diseased or injured leaves, as well as the stems, provide a nidus for the propagation and transport of the spores through the growing season, to the bolls.

The seed leaves, or cotyledons, however, suffer frequently from a characteristic injury. While the cotton seed is germinating the spores, caught in the tangle of lint still adhering to the seed coats, germinate also and attack the fleshy cotyledons as they are slipping from the coats. The fungus attacks the edges of the cotyledons and destroys an irregular area bordering the middle portion. The cotyledons being quite fleshy and succulent form a suitable place for the profuse development of spores and the diseased area is marked by the bright pink or roseate tint so characteristic of its profuse development on the fruit.

The degree of success which attends the throwing off of the seed coat by the cotyledons during germination probably bears a very close relation to their susceptibility of disease. After the young root has emerged from the seed coat, or hull, if the temperature conditions are such as to cause the hull to dry and remain so, or provide it with little moisture, it is cast off by the cotyledons with difficulty, and sometimes not at all. Frequently the hull clings to the extremities of the cotyledons, holding them firmly, while their bases are exposed to the light, and consequently take on a healthy green color. The edges of the cotyledons, held firmly bound, acquire a sickly yellow color, and frequently the effort to extricate themselves, results in some abrasion of the tissue. In either case the edges of the cotyledons, so held under extremely unnatural conditions, are an easy prey to the anthracnose spores which fall on them from the tangle of lint still on the seed coat. Such cotyledons are sometimes attacked by a *Fusarium*, the spores of which also produce a pink pigment, and the fungus can then only be differentiated from anthracnose by a microscopic examination.

I have succeeded also in inoculating young plants through their seed leaves.* A portion of a boll containing a profuse

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*Journal of Mycology, vol. vi, no. 4, p. 177, Washington, D. C., 1891.

development of spores was immersed in water, which was then shaken thoroughly to scatter the spores in the water. The cotyledons of the young plant were well wetted with this, and a bell jar placed over the plant for a day. Natural conditions of temperature and humidity were then imitated as nearly as possible. The plants being in a frame artificial heat could be produced, temperature ranging from 20° C at night to 35° C at midday were produced. The humidity of the air in the frame was kept above that outside by closing the frame and wetting the soil. After four days the humidity was reduced while the temperature was maintained.

A week later an examination was made of a cotyledon which was dying, the distal end being half dead and shrivelled while the base was still green. It was well infected, and there were numerous clusters of setæ at the edge, also clusters of spores, and in the interior of the cotyledon spores borne on scattered basidia. Ten days from the time of inoculation another plantlet was diseased, both cotyledons being affected. When the distal half was pretty well dead and shrivelled the examination was made. Very few external signs of the fungus were present, but in a few places at the edge the setæ were just piercing through, and sections showed numerous spores and clusters of gemmæ within. The base of each cotyledon was apparently healthy, and each was still firmly attached to the stem. In no case were the spores developed in such numbers as to show the roseate tint. In this respect the result of the inoculations differed from what we observe in a natural appearance of the disease on the cotyledons probably due to artificial conditions.

Since the plant is thus shown to be vulnerable to the attack of the fungus at the cotyledons and young stem from spores resting on the seed, the suggestion is called forth that possibly we have here a case similar to the well known cases of *Cystopus candidus* and certain of the *Ustilagineæ.* The researches of DeBary showed that members of the *Cruciferæ* were open to the attack of *Cystopus candidus* only through their cotyledons. The fungus having thus found an entrance to its host traveled through the stem to other parts of the plant.

Brefeld and others have shown that wheat, oats and barley are only attacked by their specific Ustilago at the time of germination when the germ tube of the sporid enters the young stem and the parasite grows along with its host, doing no apparent injury until just prior to harvest time. In this case soaking the grains in blue stone water, or immersing them for a short period in hot water, destroys the spores of the smut while the grain is not injured.

If the analogy of cotton anthracnose with *Cystopus,* and the smuts is such as these facts would suggest, then, since the inoculating spores are now shown by my investigations to be in considerable numbers on some cotton seed, why can the analogy not be farther carried out and we be able to prevent anthracnose, in a large measure at least, by scalding the seed prior to planting?

We have no positive evidence that the anthracnose fungus does travel along through the plant from the young stem or cotyledons to the bolls and leaves. But circumstantial evidence indicates that such is not its course. In the first place the fungus reproduces spores again, very soon comparatively, after germination takes place, so that crops of spores are produced in rapid succession where conditions for growth are present. In the second place, the fungus is not in any appreciable degree an obligate parasite, but is markedly saprophytic at times.

There is a reasonable possibility that the crop of spores produced on the diseased young stem or cotyledons will soon find an opportunity for growth and production of another crop of spores at some injured point in a leaf, or upon the partly dying tissue at old leaf scars, where I have found the fungus in fruit. Furthermore, when the fungus obtains a good hold in the tissue of the stem it does serious injury, which is not the case with the smuts in the stem of the cereals. It is therefore exceedingly improbable that the analogy at first suggested really does exist. Nevertheless, it is quite probable that one common source of infection of young plants, and the production of numerous spores at an early season, might be remedied by scalding the seed. When cotton is planted on ground not cultivated in cotton the previous year, if the seed were scalded there is reason to believe that the disease might be prevented in that field. It is not yet known whether or not spores live over the winter in any appreciable numbers in soil where cotton is grown. It is possible that the same treatment of the seed might be efficacious in soils where cotton is continuously planted. The method is worth a careful trial.

Characters of the Fungus.—The spores are oblong, usually rather sharply pointed at the base, often rounded at both ends, with a broad, shallow constriction in the middle, nearly cylindrical or distinctly curved, usually vacuolate with one or more vacuoles.

They vary greatly in size from 4.5 to 9 micromillimeters in diameter by 15 to 20 micromillimeters in length. Where they are produced on green or decaying bolls, or other softened parts of the plant, they are frequently associated in distinct acervuli or heaps, which are 100 to 150 micromillimeters in diameter. One of these pustules is shown at figure 12 *a*. They are composed of numerous spores developed from the ends of fertile threads which arise from a stroma of mycelial threads within the tissues of the plant, and lie in groups closely parallel. The

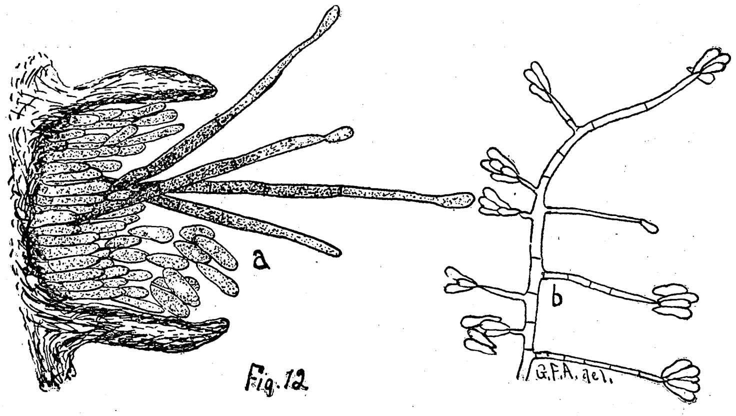

Fig. 12

fertile threads are of two kinds, short colorless basidia, which are first developed and the more numerous, and rather long, dark, olive septate setæ. The setæ are straight, curved, flexuous, simple, or rarely branched, and measure 100 to 150 micromillimeters in length. Their ends are nearly hyaline, and the spores borne upon them are often obovate, the base being rather sharply pointed. They seem to arise later in the development of the pustule, when parts of the stroma are becoming dark in color, either from dark parts of the stroma or from rudimentary sclerotia.

Artificial Cultures.—Several artificial cultures were made to trace the development of the fungus. In some cases the nutrient medium used was agar-agar peptone broth and an infusion of cotton leaves, but it was found that it grew about as well without the addition of the infusion. Pure cultures were obtained in several ways. Bolls on which the spores were just being produced, were placed in a moist chamber. When the cluster of spores was well elevated and distinct, not so old as to be contaminated with bacteria, with a flamed needle a few spores could easily be taken not accompanied by other germs.

Some of the cultures were made in cells so that germination and growth could be directly observed under the microscope at short intervals. The spores germinate quite freely under favorable circumstances in four to ten hours. At the time of germination, or prior to it, frequently one or two transverse septæ are observed in the spore, dividing it into

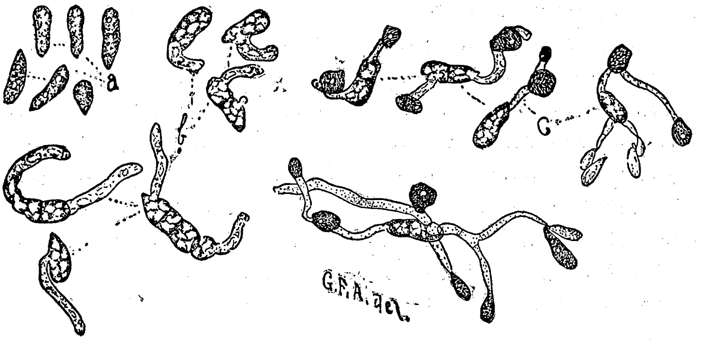

Fig. 13.

two or three cells. Several germ tubes may be produced from a single spore. Figure 13, *a* represents spores when when sown, and *b*, some just after the beginning of germination. The mycelial threads begin to branch immediately, and are somewhat flexuous in their course. From all parts of the mycelium short fertile branches soon arise of 1, 2, or 3 cells' length, which resemble the basidia and produce spores. Sometimes these fertile branches or basidia arise directly from the spore. In the solid medium the spores form a single basidium, when not crowded by the basidia and other spores, are clustered around the end, each succeeding spore pushing the one which has just become free to one side. The sharply pointed basal end of the spore favors this. After several days there is a beautiful crown cluster of spores about the end of the basidium, all lying parallel to each other. Figure 12, *b* shows a few of such clusters in an artificial culture. Spores are sometimes produced in less than twenty-four hours from the time of sowing.

Besides the production of spores certain branches, either near or remote from the center of the growth, produce at their ends peculiar enlarged cells, olive brown in color varying in their outline but always of greater diameter than the hyphæ which produce them. These bodies frequently produce immediately a normal hypha resembling the others of the mycelium. This in turn may soon produce another bud, or may grow to considerable length, produce basidia and spores, or produce spores soon after its origin from the bud as an ordinary basidium. These buds, or gemmæ, as they might be properly called, are shown in Figure 13, *c*. In many cases the gemma immediately begins to bud in an irregular manner, producing cells similar in color but very closely compacted into an irregularly oval or elongated or flattened, imperfect sclerotium. After one or two weeks' growth a large number of these gemmæ and imperfect sclerotia are developed near the center of growth, *i. e.*, the original spore. At the same time the basidia have become very numerous at this point, arising from the mycelium or by the branching of the older ones, and the mass of spores assumes the roseate tint. Cultures were also started in pure water and in a weak nutrient medium. In water the germ tubes almost invariably, when once or twice the length of the spore, produced the gemmæ. If these developed another tube it was only to give rise to another gemma. In no case at that time were spores produced nor any appreciable length of mycelium. In the weak nutrient medium the gemmæ were produced freely. Also, a number of hyphæ produced one to four or five spores. While the vegetive growth exceeded that of the spores sown in pure water, there was but little compared with the growth in a rich nutrient medium, and the spores did not live so long.

These gemmæ produced soon after germination, more freely in weak nutrient media, are spoken of by some as secondary spores.* They are not secondary spores in the usual acceptance of that term. They do not become freed from the mycelium except by accident, or by the dying of the thread to which they are attached, in which case they are more properly gemmæ. Their frequent later development into compound gemmæ by budding would strengthen this view, and indicate that they are rudimentary sclerotia, or perhaps presage the development of pycnidial or ascigerous stages as yet unknown in this genus.

I have also obtained pure cultures of the fungus when contaminated with bacteria by the usual method of separation by dilution in liquid nutrient agar, both by plate cultures and by Esmarch rolls.

In cultures on nutrient agar, I have never observed the setæ to develop in such numbers as they do naturally on the cotton plant, but by pouring a small quantity of liquid agar on scorched cotton in a culture tube and then inoculating this medium with spores the setæ developed profusely.

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*Southworth, Journal of Mycology, vol. vi, Nos. 3 and 4. Halsted, Botanical Gazette, vol. xvii, No. 9.

VI. SHEDDING OF BOLLS.

The "shedding" of bolls or "forms," or their death and drying while still attached to the plant is very frequently a source of great loss to the cotton crop. The trouble has long been known, but perhaps the most widely prevalent and disastrous form has been misunderstood. It is variously attributed to the work of the boll worm, to a puncture made by some Hemipterous insect, etc. That some of the shedding is due to the work of the boll worm can not be denied, but many planters are now coming to believe, as is quite true, that usually comparatively little of this trouble is caused by that worm. The shedding referred to here is a purely physiological trouble not due to the work of insects, nor to the action of a fungus.

During three years observation in Alabama, I have found this physiological form of shedding to be by far more serious than that produced by other causes combined. It occurs most frequently in extremes of either dry or wet weather, or during the change from one extreme to the opposite extreme. It may occur to some extent under normal climatic conditions, especially if the cotton plants are too numerous on the ground, or the variety of cotton is one which develops a very large amount of fruit forms in proportion to the leaf surface.

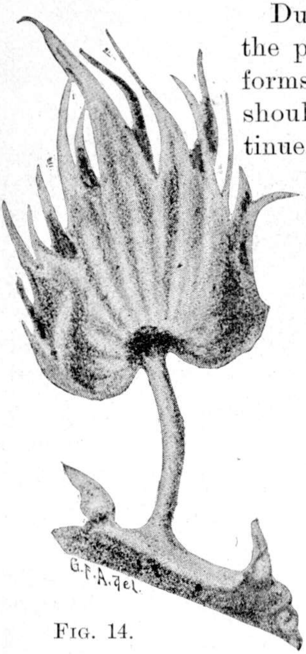

FIG. 14.

During a normal period for growth the plants put out a number of fruit forms, say so many as could be matured should the favorable conditions continue. If a very dry period succeeds this so that it interferes with the supply of nutrient materials or moisture from the soil there will occur a partial withholding of the customary daily supply of tissue forming material just at a very critical period in the life of the younger "forms." This may be sufficient not only to stop the growth of the tissue in the form, but also to deprive it of much of its accustomed moisture. The tissues of the young fruit are thus forced into an unnaturally matured condition. The fruit, including the pedicel and often more or less of the surface tissue of the stem at its point of attachment becomes first of a paler green color than the adjacent parts of the plant, so that a well marked color line delimits the healthy from the unhealthy portion. This is well shown in figure *14*, where a part of the surface tissue of the stem participates in this unnatural maturity. In many cases the tissue is separated at this line so that the fruit falls off completely or hangs by a few fibres to the stem, hence the term shedding.

The more or less complete separation of the tissues at the line of division between the healthy and dying portion depends upon the point of attachment of the fruit to the stem, and also to some extent upon the variety of cotton.

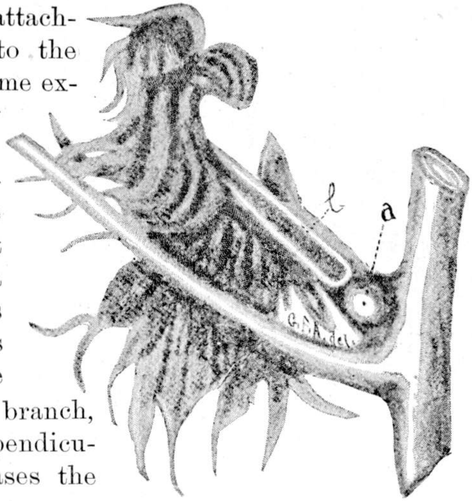

Fig. 15.

In figure *15*, *a* represents a scar, the point of attachment of the pedicel of a fallen boll. In this case the boll was situated near the angle formed by the branch, and also nearly perpendicular to it. In such cases the line of separation is apt to be clean cut, resembling the scar left by a falling leaf. If the point of attachment is at a somewhat greater distance from the angle and the pedicel much more inclined obliquely, the line of separation is apt to include from one half to one inch of the surface tissue of the stem below the pedicel, and very frequently then the lower part of the dead surface tissue does not entirely separate and the boll remains clinging to the plant. In some varieties, especially the so-called "cluster" varieties of cotton the separation of the tissues does not take place so frequently, and the boll usually remains firmly fixed in position, but the dead part readily indicate the tissues involved. Figure *15*, *b* represents such a case.

The matured bolls do not form a separative layer of tissue when the tissue dies, but they remain fixed to the plant. This is a provision of nature not only for the opening of the boll, but also for the preservation of the lint until it can be gathered in good condition. In like manner the falling away, of the dead immature bolls and forms is a useful provision of nature, since the plant is left in a better condition for gathering the fruit which does mature. One great objection held by some to the cluster varieties of cotton is their tendency to hold the dead immature fruit. It is interesting to note here the factors of selection which in time may cause only the fittest of the varieties to survive; the fact that cluster varieties are more subject to this physiological trouble, and the objection held by many to the strong tendency of the immatured boll to cling to the plant when dead. Another objectionable tendency in some of the cluster varieties, is that so marked in "Welborn's pet," where several bolls in a cluster may fuse into an abnormal one, which readily cracks open when immature and subjects the internal parts to the action of bacteria and fungi.

VII. Angular Spot of Cotton.

This disease is named from the dark angular spots which appear in the leaf as shown in figure 16. It is very wide spread but seldom appears to such an extent as to attract attention, though I have observed it in every cotton field I ever visited during the growing season. The disease is first manifested* by a watery appearance in definite areolate spots, which are bounded by the veinlets of the leaf. The spots are sometimes very numerous and frequently conjoined; often the disease follows one or more of the main ribs of the leaf, being bounded on each side by an irregularly zigzag line. As the disease ages the spots become blackish and then light brown, frequently then bordered by a blackish color where the disease has extended somewhat centrifugally. The dead spots in the leaves sometimes break out, leaving many perfo-

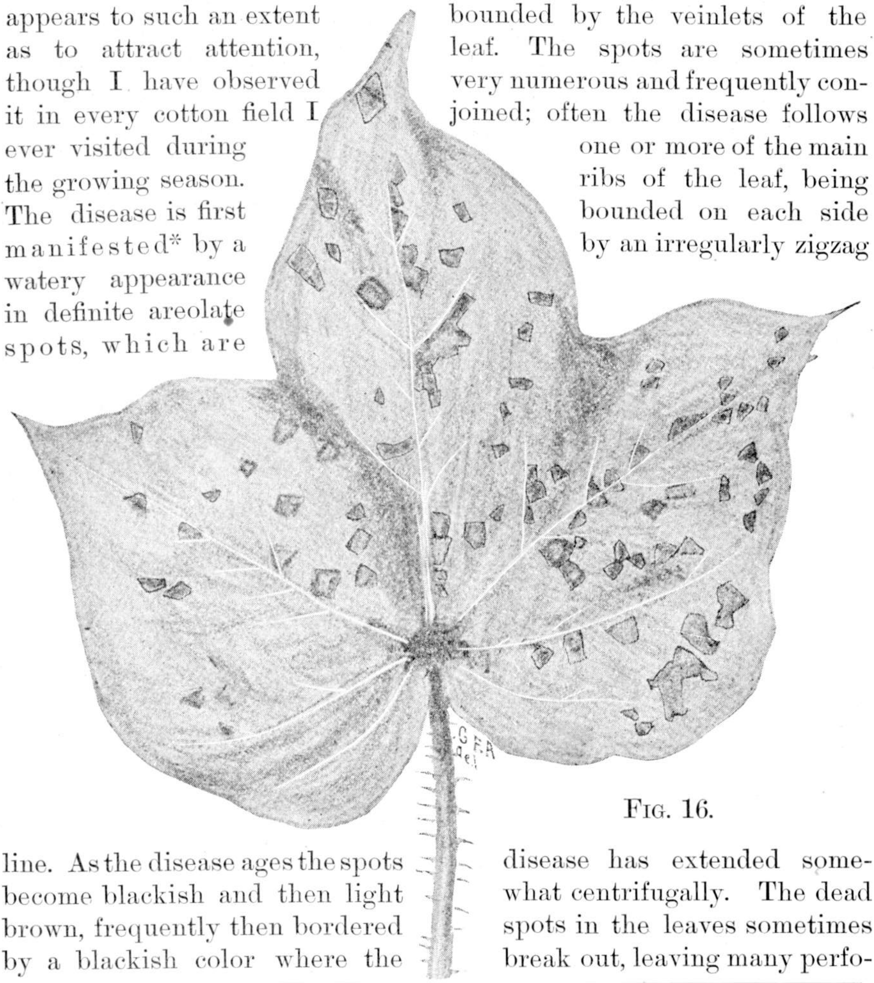

Fig. 16.

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* Bulletin No. 27, Ala. Agr. Exp. Station. Botanical Gazette, vol. xvi, No. 3, March, 1891.

rations in the leaves with ragged edges, somewhat as results in cotton leaf blight. The disease hastens the falling off of the leaves. In the very earliest appearance of the spots, when the watery condition is coming on, these spots swarm with bacteria. This suggested that it might be a bacterial disease. Cultures of the organism present were obtained, and inoculations of healthy leaves have been made at several different times, but I have never been able to produce the disease as a result. The disease usually appears only on the older leaves, those which have passed the prime of their existence. It is quite likely that the bacteria present may easily start the trouble in such leaves, but that they might be unable to enter and disease the younger healthy leaves. This might account for the failure of the inoculations. Sometimes it attacks nearly all the leaves in the plant, but rarely. This suggests that such plants may be constitutionally weak from some unfavorable condition, either frost or the weather, which renders them susceptible of attack.

VIII. Areolate Mildew of Cotton.

(Ramularia areola Atkinson.)

The areolate mildew of cotton is so called because it occurs in definite small areas of the leaf which are limited by the small veins and gives a mildewed, or frosty appearance to the affected places, as shown in figure 17.

It was first discovered in the autumn of 1889, when I collected it in the vicinity of Auburn. Since then I have found it in various parts of the State, and have received it from Mississippi on material sent me by Prof. S. M. Tracy. Sometimes it is quite abundant locally, but does not at present seem to occasion any serious injury. I have found it as early as August, and from that time it may be met with until the close of the season.

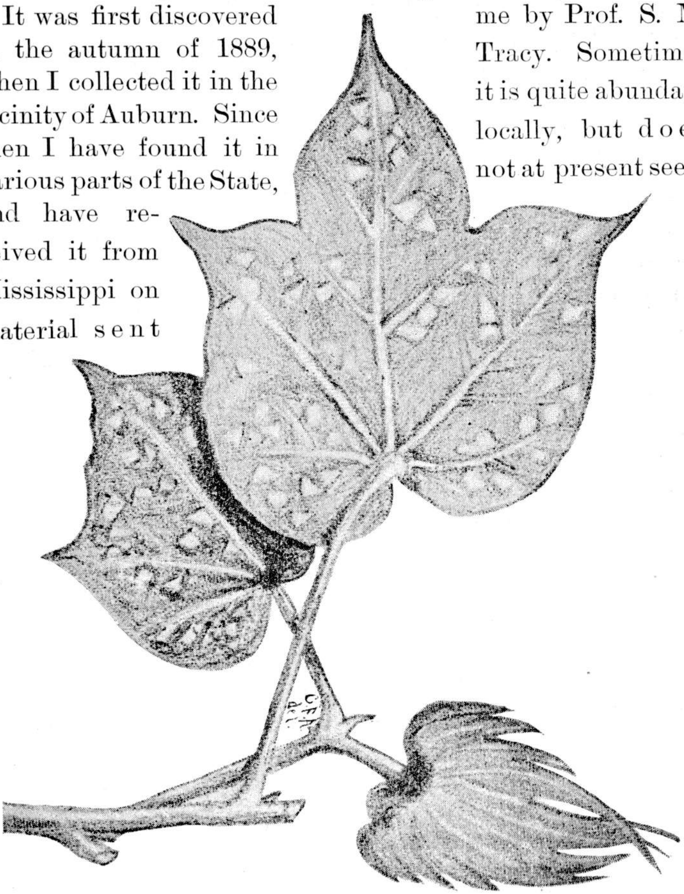

FIG. 17.

The mildew is caused by a fungus, a member of the genus *Ramularia*. The mycelium, or vegetive part of the fungus, grows inside the leaf. It reproduces by the growth of a cluster of short fungus threads through the leaf epidermis

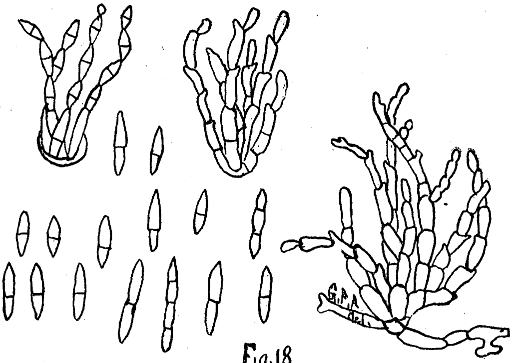

Fig. 18

to the outside. Clusters of these fertile threads are shown in figure 18. In figure 18 are also represented some of the spores, or reproductive bodies, which are borne on the wind to other leaves and spread the mildew. These spores grow at the end of the fertile fungus threads and become separated by a constriction forming, which eventually cuts the spore free. The hypha, or fertile thread, then elongates at one side of the scar left by the abjointed spore and produces another. Sometimes, in the early development of the spores, they are produced in series or chains, as shown in one of the figures.

All parts of the fungus are colorless, or rather, hyaline, so that the mass of hyphæ and spores on the surface of the diseased area give it a frosted appearance.

The fungus was first described in the Botanical Gazette, Vol. xv, No. 7. Following is a technical description of the fungus.

Ramularia areola, spots amphigenous, pale at first, becoming darker in age, 1 m m to 10 m m (mostly 3 m m to 4 m m), angular, irregular in shape, limited by the veins of the leaf, conidia in profusion giving a frosted appearance to the spots. Hyphæ amphigenous, fasciculate, in small clusters distributed over the spots, subnodose, older ones frequently branched below, more rarely above. Where they are toothed, the teeth are frequently unilateral when the hyphæ are curved instead of zigzag, several times septate, stouter below, hyaline, 25–75 micromillimeters x 45–7 micromillimeters. Conidia oblong, usually abruptly pointed at the ends, sometimes concatenate in the early development of the hyphæ, hyaline, 14–30 micromillimeters x 4–5 micromillimeters.

IX. Cotton Leaf Blight.

(*Sphærella gossypina* Atkinson.)

Cotton leaf blight is a disease of the leaves caused by the *Cercospora* stage of a fungus, *Sphærella gossypina.* It usually attacks the older leaves of the plant, or all of the leaves when the plant is not very vigorous, or in rather wet soil, in unfavorable weather, or when the vitality of the plant is weakened from other causes. The same fungus attacks plants effected with the yellow leaf blight, or mosaic disease, but plants first affected by that trouble and afterward attacked by the *Cercospora* do not present the characters of the cotton leaf blight. The beginning of the disease is indicated by small reddish spots on the leaf which increase in size centrifugally, the outline being rather irregular. Later the central portion of the spots becomes light brown, or even a dirty greyish white, the border only presenting the red color. By this time the tissues in the center of the spot are dead and dry and frequently break and fall away. These stages of dissolution are brought about by the threads of the fungus growing within the tissues of the leaf and absorbing the liquid substance of the leaf for their own growth. As the nutriment in these spots is being exhausted the fungus threads give rise to tufts of fertile hyphæ, as shown in figures 1, 2 and 3 of Plate I. The reproductive bodies, or conidia, are shown in the same Plate at 1 *a* and 2 *a*. These conidia are carried to other plants and spread the affection. Figure 19 of the text represents a leaf with this disease.

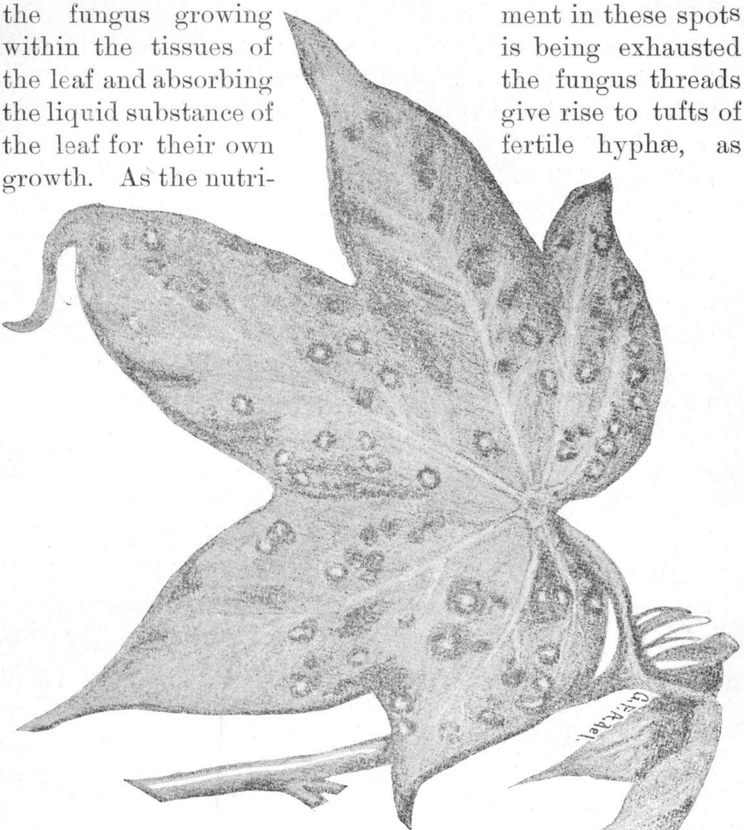

FIG. 19.

By comparing this with figure 3 of the text some notion can be gained how great the difference is when complicated with a physiological disease. The *Cercospora* stage of this fungus was first described by Cooke as *Cercospora gossypina**. A short notice of the disease was published by Scribner in 1887.† He notes that it is probably the *Cercospora* stage of some *Sphœrella*, since it agrees in many respects with other fungi known then to be but the conidial stage of *Sphœrella*. This suggestion the present writer found to be correct, when in 1890 he found the perfect stage of the *Cercospora*, and named it *Sphœrella gossypina*.‡ The *Sphœrella* is illustrated in figure 4.

I found this *Sphœrella* at Auburn several times during the autumn of 1890 on leaves of *Gossypium herbaceum* in the spots earlier occupied by the *Cercospora*. During the following winter, in looking over a quantity of cotton leaves sent me by correspondents, I found the same *Sphœrella* on leaves from Eutaw and Alberta Station. These leaves were remarkable for being almost covered with a profuse growth of the *Cercospora* on both sides. The *Sphœrella* was also very abundant, and since we would, from the analogy of other forms, expect the perfect stage of the *Cercospora* to be a *Sphœrella*, there was practically no doubt of the genetic connection of the two forms. Since then, the perfect stage of a fungus is the one which bears the name, *Cercospora gossypina* Cke. becomes a synonym of *Sphœrella gossypina*.

The perithecia are ovate, and nearly black, as shown in figure 4. They are partly immersed in the tissue of the leaf, the ostiolum and the upper surface projecting through the epidermis. They measure 60–70 x 65–90 micromilli-

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*Grevillea, Vol. XII, P. 31, 1883.

†Dept. Agr. Report for 1887, P. 355.

‡Bulletin Torrey Bot. Club, vol. xviii, No. 10, 1891.

meters. These perithecia contain several subcylindrical asci, varying from clavate to lanceolate, and measure 8–10 x 40–45 micromillimeters. Two of these can be seen partly escaped from the perithecium, and a group is shown just above the perithecium in figure 4. Each ascus contains eight spores. These are ellipitcal, or nearly fusoid, and when mature constricted at the septum, one cell being usually somewhat smaller than the other. They are obliquely uniseriate, or partly biseriate, and measure 3–4 x 15–18 micromillimeters.

The illustrations of the fungus accompany the first article in this bulletin, because the fungus is so frequently an accompaniment of the disease described there, in its later stages.

X. Root Gall of Cotton.

Root gall is a disease of the roots caused by minute parasitic worms. These worms live in the roots where they cause abnormal thickenings, resulting in what is known as galls, which give the roots a knotty appearance. There are several places in the State where it occurs with unusual severity. I have seen it at Saville, Ala., on the farm of G. W. Rhodes; at Selma, and also at Montgomery.

Figure 20 on next page represents one of the plants from the farm of S. F. Houston, at Selma. The injuries produced by the worms upon entering the roots, as well as the injuries following the breaking down of the tissues of the galls, forms a suitable opening for the organism of "frenching," when that is also present in the soil. Cotton is frequently affected by these nematode worms at Auburn and in other places, but I have only seen serious results when "frenching" was complicated with it. It is possible in such cases to find plants badly diseased by the nematode which are not at all affected with "frenching," but the majority are. This goes to show that the nematodes do not produce the "frenching" in those places, but that they may open the way for the entrance of that organism, just as the "damping off" fungus, or any other injury to the root will do, provided the organism of "frenching" is in the soil. These worms are nematodes, and belong to the family *Anguillulidæ*, the eel worms. A common example of eel worms is the vinegar eel, as it is called, because it is so frequently found in the mother of old vinegar. The worms are usually shaped like an eel,

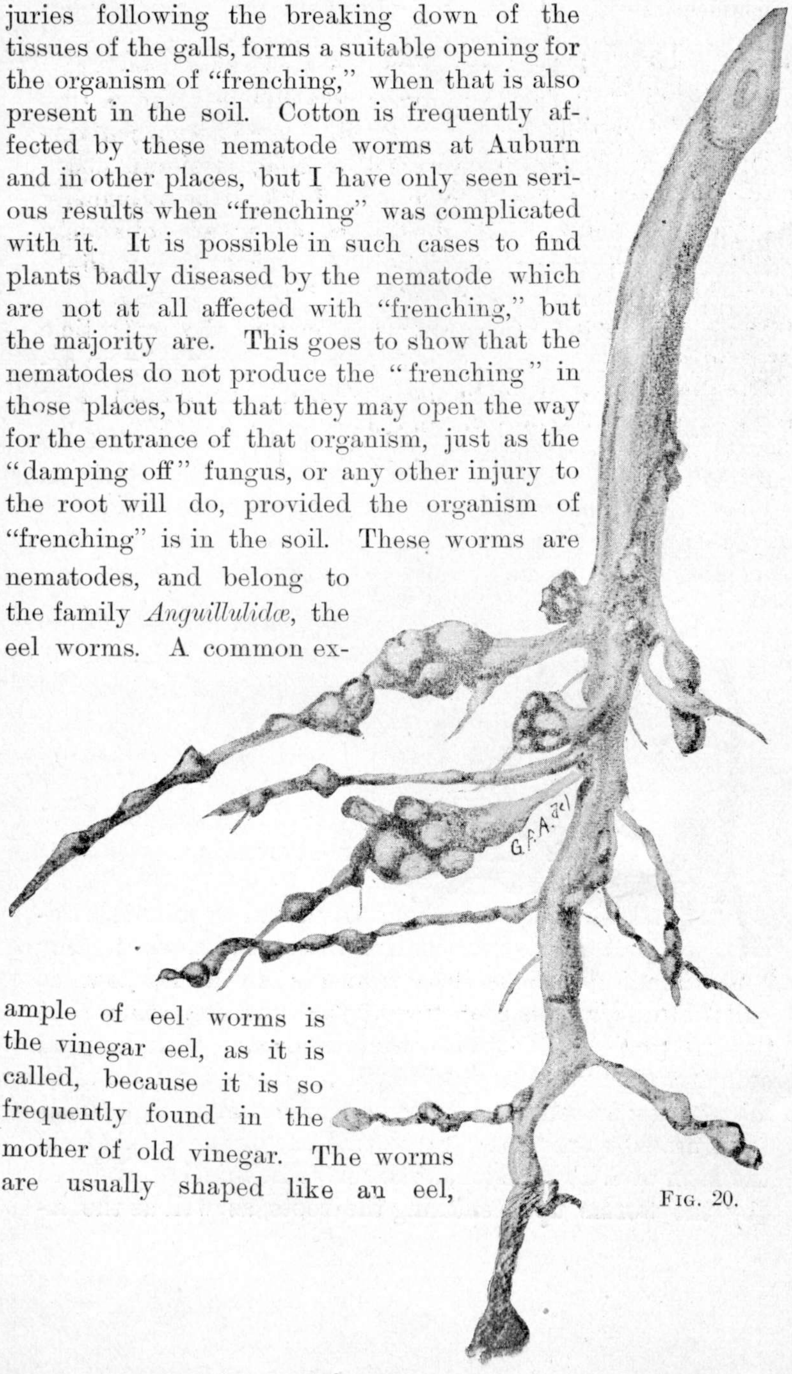
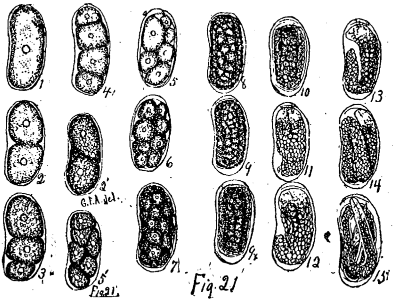


FIG. 20.

whence the name, but of course they are much smaller, being microscopic, or only so that they can just be seen with the eye when full grown.

The eggs of the nematode are bean-shaped and about 100 micromillimeters long. Figure 21 represents the egg in all stages of development, from the single cell to the mature larva, which is coile several times in the egg membrane. From the time that the embryo begins to take on the form of a larva, as shown in 11 and 12 of figure 21, it now and then moves around in the egg membrane by twisting and coiling its body. When mature these writhings and contortions become more violent, and finally cause the rupture of the membrane and the larva is set free.



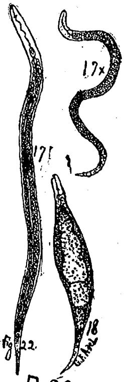


Fig. 22.

It can now be seen to possess the form of an eel, but its structure is quite different. The blunt end is the head. In 17 of figure 22 there can be seen a minute slender spear, which projects a little out of the mouth of the head end. The nematode has the power of thrusting this spear forward and backward. By this means it punctures a hole in the root and enters, and by similar operations makes a passage for itself through the tissues. Once in the tissues it sucks up the juices, and by its presence stimulates the tissues of the root to abnormal growth by attracting liquid nutriment to those parts, In this way galls are formed. The worm soon becomes stationary in the tissues of the gall, moults its skin for the second time, having moulted once just about the time of hatching. Its body now begins to distend, as shown in 18 of figure 22, and continues until it forms a vesicular body resembling a small gourd. Before it is fully grown important differences appear in the males and females. The males, instead of distending farther, begin to pass through another transformation. Their cyst wall, or the distended skin, remains unchanged, but the worm inside begins to elongate and at the same time to become more slender, so that it separates from the cyst wall and eventually lies within, coiled two to four times, as shown in figure 23. Casting this distended skin makes the third moult, and while they are elongating they cast their skin for the fourth time. By this transformation the male has returned to the eel form of the worm, but they are much longer and stouter than the larva, and their tails are blunt instead of pointed, and are about 1 *mm* long. They now break through their cyst wall and seek the female to fertilize her.

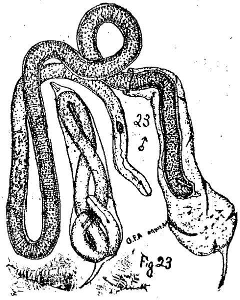
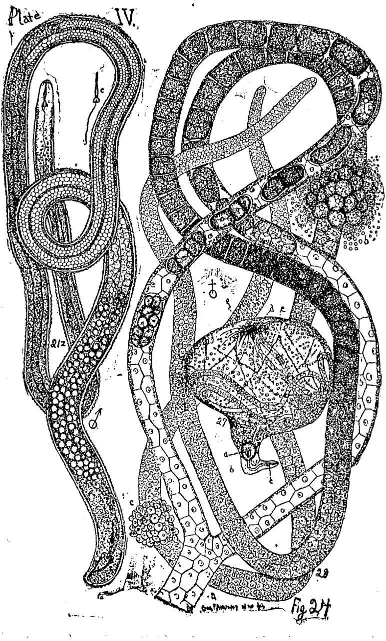


Plate IV.



The female continues to distend so that she closely resembles a stout gourd, the head being the small end, and when mature contains 200 to 300 eggs. Figure 24 (27) represents a female much enlarged, and (28) are the ovaries much more magnified. (21*z*) represents a male. The paired testes can be seen. The larvæ hatch while still in the body of the parent, unless accident ruptures the gall and frees them. Under favorable conditions the worm will develop from the egg to the mature female with more eggs in about one month. Several generations can therefore be developed in a single season.

Figure 25 represents a section through a gall on cotton roots.

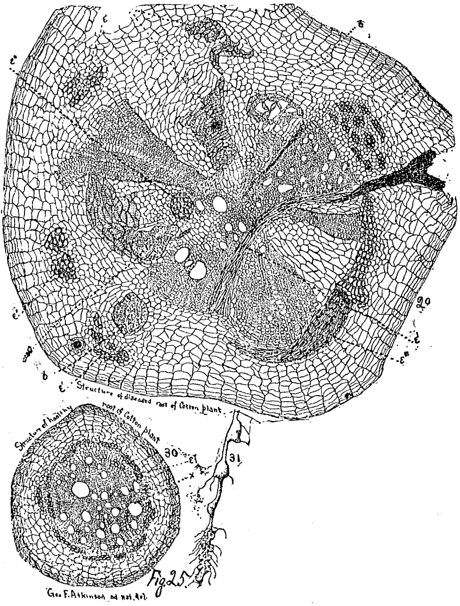


Fig. 25.

A full account of this worm was published in Bulletin No. 9 of this Station. This should be consulted by those who wish to obtain more accurate information concerning the worm and its injuries to various plants. Its scientific name is *Heterodera radicicola*.

Bulletin No. 21 of this Station gives an account of a new root rot disease of cotton. I have since found that the organism of frenching was associated with the nematodes in producing that disease, or rather in making it much more serious.

Bulletin No. 42. January, 1893.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

CO-OPERATIVE SOIL TEST EXPERIMENTS

FOR 1892.

A. J. BONDURANT, Agriculturist.
JAMES CLAYTON, Assistant.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

All communications should be addressed to
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* To be filled.

† In charge of Soil-Test Experiments.

CO-OPERATIVE SOIL-TEST EXPERIMENTS.

FOR 1892.

Results of co-operative experiment for 1981 were published in Bulletin No. 34, January, 1892, from this Station, and will be made use of in comparing results obtained from the same line of experiments conducted in 1892.

The fertilizers were carefully analyzed, mixed, weighed, placed in bags and numbered at the Experiment Station, according to the plot on which each was to be used, and then shipped with freight prepaid to the following experimenters:

NAMES.	POST-OFFICE.	COUNTY.
1. Aday, Rev. L. C	Newburgh	Franklin.
2. Beasley, E. J.	Red Level	Covington.
3. Binford, R. E.	Athens	Limestone.
4. Bishop, M. A	Madison	Madison.
5. Bradley, F. W	Walker Springs	Clarke.
6. Brannon, J. M.	Seale	Russell.
7. Brown, D. L	Randolph	Bibb.
8. Compton, G. W.	Dixon's Mills	Marengo.
9. Cory, A. F.	Mulberry	Autauga.
10. Cross, R. H	Letohatchie	Lowndes.
11. Davis, Maj. E. M.	Prattville	Autauga.
12. Deer, Jno. F	Monroeville	Monroe.
13. Dick, R. M.	Attalla	Etowah.
14. Ellison, J. M.	Creek Stand	Macon.
15. Ewing, R. T	Centre	Cherokee.
16. Gillis, Dan, jr	Abbeville	Henry.
17. Goodwyn, A. T.	Robinson Springs	Elmore.
18. Gordon, Dr. Jno	Healing Springs	Washington.
19. Hobdy, J. M	Louisville	Barbour.
20. Inzer, J. T	Eden	St. Clair.
21. Johnson, Uriah	Trinity Station	Morgan.
22. Killebrew, J. C.	Newton	Dale.
23. Lane, H. D.	Athens	Limestone.
24. Logan, J A.	Clanton	Chilton.
25. Martin, Wm	Greensboro	Hale.
26. Mize, J. W	Remlap	Blount.
27. Newman, W. H.	Uniontown	Perry.
28. Oliver, J. P.	Dadeville	Tallapoosa.
29. Ott, J. C	Florence	Lauderdale.
30. Pitts, J. W.	Cresswell Station	Shelby.
31. Pruett. S. A	Chesser	Pike.
32. Radney, J. H	Roanoke	Randolph.
33. Sellers, W. H.	Geneva	Geneva.
34. Snuggs, T. A.	Holly Pond	Cullman.
35. Stroud, Z T	Aberfoil	Bullock.
36. White, W. L	Hattan	Lawrence.

No reports were received at the date of issuing this Bulletin, from the following co-operative experimenters to whom fertilizers were sent:

NAMES.	POST-OFFICE.	COUNTY.
1. Beasley, E. J.	Red Level............	Covington.
2. Brannon, J. M....	Seale......	Russell.
3. Ewing, R. T......	Centre................	Cherokee.
4. Goodwyn, A. T...	Robinson Springs	Elmore.
5. Hobdy, J. M	Louisville............	Barbour.
6. Inzer, J. T........	Eden	St. Clair.
7. Lane, H. D.......	Athens..............	Limestone.
8. White, W. L	Hattan................	Lawrence.
9. Binford, R. E....	Athens	Limestone.

Cost of Fertilizers Applied per Acre.

In order that the experimenters and other farmers may better understand the inquiry made upon the different plots, the cost of the different materials used is given in the statement which follows. The calculations are made upon the cost laid down at Auburn. The local freights upon the packages reshipped to the depots of the experimenters would produce a false impression, since the average local rate of freight charged upon the amount sent to each experimenter from Auburn to their depots exceeds five dollars per ton. Shipped in quantity, the freight to the various depots of the experimenters would average little more than that from the factories to Auburn. Again, in estimating profits resulting from the use of the different fertilizers, it will be more convenient to have a common standard of comparison.

Quantity and Cost per Acre of Fertilizers used by Co-operative Soil Test Experimenters, 1892.

Plot.	FERTILIZERS.	
1	96 lbs. Nitrate Soda	2.79
2	240 lbs. Acid Phosphate	1.68
3	64 lbs. Muriate Potash	1.62
4	No Manure.	
5	96 lbs. Nitrate Soda 2.79 64 lbs. Muriate Potash 1.62—	4.41
6	96 lbs. Nitrate Soda 2.79 240 lbs. Acid Phosphate 1.68—	4.47
7	64 lbs. Muriate Potash 1.62 240 lbs. Acid Phosphate 1.68—	3.30
8	No Manure.	
9	96 lbs. Nitrate Soda 2.99 240 lbs. Acid Phosphate 1.68 64 lbs. Muriate Potash 1.62—	6.09
10	240 lbs Floats	1.82
11	240 lbs. Floats 1.82 96 lbs. Nitrate Soda 2.99—	4.61
12	No Manure	
13	848 lbs. Green Cotton Seed @ 45c per cwt.	3.81
14	848 lbs. Green Cotton Seed @ 45c per cwt. 3.81 240 lbs. Floats 1,82—	5.63
15	4240 lbs. Stable Manure @ $1 per 1,000 lbs.	4.24
16	240 lbs. Acid Phosphate 1 68 240 lbs. Cotton Seed Meal. 2 36—	4 04

The following table shows the quantity of potash, phosphoric acid, nitrogen, (and its equivalent of ammonia) contained in the different fertilizers used per acre, as determined by Prof. N. T. Lupton, State Chemist:

Plot No.	FERTILIZERS.	Lbs. of Potash.	Lbs. Phosphoric Acid Available.	Lbs. Phosphoric Acid Total.	Lbs. Nitr'gn.	Lbs. Equivalent to Ammonia.
1	96 lbs. Nitrate Soda............	....	..		14.17	17.20
2	240 lbs. Acid Phosphate..........	....	34 94	38 32	....	......
3	64 lbs. Muriate Potash.........	31 91		.....	....	......
4	No Manure	....	....	....	.....	......
5	96 lbs. Nitrate Soda............	....	....	....	14.17	17 29
	64 lbs. Muriate Potash.........	31.91	....	....	....	......
6	96 lbs. Nitrate Soda...........	....	....	....	14 17	17 20
	240 lbs. Acid Phosphate.........	....	34 94	38.32	.....	......
7	64 lbs. Muriate Potash	31 91	.....	.....	......	......
	240 lbs. Acid Phosphate.........	.....	34.94	38.32	.....	......
8	No Manure..................	....	.....	....	.....	.....
9	96 lbs. Nitrate Soda...........	......	......	....	14 17	17 20
	240 lbs. Acid Phosphate.........	...	34.94	38 32	......	......
	64 lbs. Muriate Potash.........	31 91	.....	....	......	......
10	240 lbs. Floats	.....	....	28 50	....	......
11	240 lbs. Floats.................	....	....	28.50	.....	......
	96 lbs. Nitrate Soda............	.....	.....	....	14 17	17.20
12	No Manure...................	....	....	.....	.....	.....
13	848 lbs. Green Cotton Seed....	10.6	....	10.17	21.2	25 74
14	848 lbs. Green Cotton Seed......	10 6	....	10 17	21.2	.....
	240 lbs. Floats	.....	.....	28 50	..	.....
15	240 lbs. Stable Manure........ ..	28.40		13 14	26.71	32 43
16	240 lbs. Acid Phosphate.........	......	34.94	38 32		...
	240 lbs. Cotton Seed Meal	6 55	...	..	15 79	19 17

EXPERIMENT MADE BY REV. L. C. ADAY.

NEWBURGH, FRANKLIN COUNTY.

Soil, Red Cedar Land; Sub-soil, Red Clay.

By examining the following statement of Mr. Aday's work for 1892, and comparing it with the experiments made by him for 1891, it will be seen that the general indications are that his soil is deficient in the three main elements of plant food, as plot No. 9, where a complete fertilizer is used, gives the best results for both years. When floats in combination with nitrate of soda and floats with green cotton seed are compared it is in favor of floats with green cotton seed in 1891, and floats with nitrate of soda in 1892.

Plot No.	POUNDS OF FERTILIZER PER PLOT.	POUNDS OF FERTILIZER PER ACRE.	Lbs. Cotton 1st picking.	Lbs. Cotton 2nd picking.	Lbs. Cotton 3rd picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda...	96 lbs. Nitrate Soda.....	39	22	23	84	1344
2	15 lbs. Acid Phosphate	240 lbs. Acid Phosphate..	27	16	4	47	752
3	4 lbs. Muriate Potash..	64 lbs. Muriate Potash..	26	12	4	42	672
4	No Manure...... ...	No Manure..	23	11	4	38	608
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash..	32	14	6	52	832
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate.	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate..	36	17	5	58	928
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate.	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	29	15	5	49	784
8	No Manure..........	No Manure..	27	13	5	45	720
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash.	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	46	22	10	78	1240
10	15 lbs. Floats.........	240 lbs. Floats.	27	14	6	47	752
11	6 lbs. Nitrate Soda, 15 lbs. Floats..........	96 lbs. Nitrate Soda, 240 lbs. Floats..........	34	16	6	56	896
12	No Manure..	No Manure............	34	9	2	45	720
13	53 lbs. Green Cot. Seed	848 lbs. Green Cotton Seed	41	11	2	54	864
14	15 lbs. Floats, 53 lbs. Green Cot. Seed	240 lbs. Floats, 848 lbs. Green Cotton Seed.	39	11	3	53	848
15	265 lbs. Stable Manure.	4,240 lbs.. Stable Manure	31	24	5	60	960
16	15 lbs. Acid Phosphate, 15 lbs. Cot. Seed Meal.	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal.	33	23	7	63	1008

EXPERIMENT MADE BY MR. M. A. BISHOP,

MADISON, MADISON CUUNTY.

Soil, Dark Loam; Sub-soil, Clay.

In Mr. Bishop's experiments for 1891, plots number 6 and 9 give the same yield, and plot number 16 gives 256 lbs. less than either, but the same as plot number 3, while in his experiments for 1892, plot number 6 gives 128 lbs. less than plot number 9, plot number 16 gives 64 lbs. more than plot number 6, and 128 lbs. less than plot number 9, and 192 lbs. more than plot number 3. The results are so conflicting that no conclusion can be drawn. Floats with the nitrate of soda gave best results in 1891, but in 1892 the combination is in favor of floats with green cotton seed.

Plot No.	POUNDS OF FERTILIZER PER ACRE.	POUNDS OF FERTILIZER PER PLOT.	Lbs. Cotton 1st picking	Lbs. Cotton 2nd picking.	Lbs. Cotton 3rd picking	Total yield per plot.	Total yield per acre.
1	6 lbs. Nitrate Soda....	96 lbs. Nitrate Soda.....	10	8	4	22	352
2	15 lbs. Acid Phosphate	240 lbs. Acid Phosphate..	16	14	8	38	608
3	4 lbs. Muriate Potash	64 lbs. Muriate Potash...	14	12	6	32	512
4	No Manure.	No Manure	...	10	8	18	288
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash...	14	12	8	34	544
6	6 lbs. Nitrate Soda, 5 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate	16	14	10	40	640
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	18	14	10	42	672
8	No Manure..	No Manure.	...	9	9	18	288
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	22	18	8	48	768
10	15 lbs. Floats..	240 lbs. Floats	...	14	6	20	320
11	6 lbs. Nitrate Soda, 15 lbs. Floats..........	96 lbs. Nitrate Soda, 240 lbs. Floats..........	14	10	6	30	480
12	No Manure....	No Manure	...	11	8	19	304
13	53 lbs. Green Cot. Seed	848 lbs. Green Cotton Seed	14	10	8	32	512
14	15 lbs. Floats, 53 lbs. Green Cot. See	240 lbs. Floats, 848 lbs. Green Cotton Seed	18	12	6	36	576
15	265 lbs. Stable Manure.	4,240 lbs. Stable Manure .	22	18	10	50	800
16	15 lbs. Acid Phosphate, 15 lbs. Cot'n Seed Meal	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal	20	16	8	44	704

EXPERIMENT BY MR. F. W. BRADLEY.

WALKER SPRINGS, CLARKE COUNTY.

Soil, Sandy; Sub-soil, Red Clay.

The best results obtained by Mr. Bradley in his two years experiments are from the use of cotton seed meal with acid phosphate. In 1891 plot No. 16 gave 276 pounds more than plot No. 9, and 1892 it is 288 pounds more. These results are very decided, and show that it is a waste of money for Mr. Bradley to use potash on his soil. Green cotton seed with floats give better results than nitrate of soda with floats, and for two years give larger yield than complete fertilizer. To purchase a fertilizer which contains potash is a waste of money for Mr. Bradley.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking	Lbs. cotton 2nd picking	Lbs. cotton 3rd picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda ..	96 lbs. nitrate soda ..	6	20	8	34	344
2	15 lbs. acid phosphate	240 lbs. acid phosphate	16	25	13	54	864
3	4 lbs. muriate potash.	64 lbs. muriate potash	32	21	10	44	704
4	No manure..........	No manure.	4	16	4	24	384
5	6 lbs. nitrate soda, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash	19	26	15	60	960
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate	28	24	18	70	1120
7	4 lbs. murate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 240 lbs. acid phosphate	33	21	14	68	1088
8	No manure. ...	No manure.....	8	12	6	26	416
9	6 lbs. nitrate soda, 15 lbs acid phosphate, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate.	35	16	21	72	1152
10	15 lbs. floats	240 lbs. floats	16	18	8	42	672
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	33	24	17	74	1184
12	No manure......	No manure.	6	16	2	24	384
13	53 lbs. green cotton seed	848 lbs. green cotton seed	19	23	18	60	960
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed	37	29	22	88	1408
15	265 lbs. stable manure..	4240 lbs. stable manure.	37	32	15	78	1248
16	15 lbs. acid phosphate, 15 lbs. cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal	37	33	20	90	1440

EXPERIMENT MADE BY D. L. BROWN,

RANDOLPH, BIBB COUNTY.

Soil, Sandy; Sub-soil, Clay.

While Mr. Brown's experiments were injured in 1891 by drought and overflow, yet when plot Nos. 6 and 16 are compared with plot No. 9 in 1891, and the same comparison is made in his experiment for 1892, it is cleaaly seen that Mr. Brown's soil does not need potash as his best results are obtained where nitrogen combined with acid phosphate are used and that money can be saved on such soils in buying only cotton feed meal and acid phosphate and mixing them on the farm. In Mr. Brown's experiments, floats with green cotton seed give better results each year than floats with nitrate of soda.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking	Lbs cotton 2nd picking	Lbs. cotton 3rd picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda ..	96 lbs. nitrate soda ...	16	12	8	36	576
2	15 lbs. acid phosphate.	240 lbs. acid phosphate	20	26	4	50	800
3	4 lbs. muriate potash	64 lbs. muriate potash	16	24	8	48	768
4	No manure.	No manure	6	10	6	22	352
5	6 lbs. nitrate soda, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash.	20	28	12	60	960
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate.	48	44	16	108	1728
7	4 lbs. muriate potash, 15 lbs. acid phosphate.	64 lbs. muriate potasc, 240 lbs. acid phosphate.	28	26	12	66	1056
8	No manure.	No manure	8	10	6	24	384
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate	44	36	12	92	1472
10	15 lbs. floats.... ...	240 lbs. floats	24	22	10	56	896
11	6 lbs. nitrate soda, 15 lbs. floats.	96 lbs nitrate soda, 240 lbs. floats..........	32	26	6	64	1024
12	No manure.........	No manure.	16	12	8	36	576
13	53 lbs green cotton seed	848 lbs. green cotton seed	32	28	12	72	1152
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed	36	42	14	92	1476
15	265 lbs. stable manure..	4240 lbs. stable manure.	32	44	12	88	1408
16	15 lbs. acid phosphate, 15 lbs. cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal	48	46	14	108	1728

EXPERIMENTS WITH FERTILIZERS, G. W. COMPTON,

Dixon's Mills, Marengo County.

Soil, Dark, Sandy; Sub-soil, Clay.

In Mr. Compton's experiments for two years, results are somewhat conflicting. His soil is most deficient in phosphoric acid, though the increased yield, when combined with nitrogen, is very marked. Floats, with green cotton seed, give best results for the two years, and give only 16 lbs. less than complete fertilizer in 1892.

Plot No.	Pounds of Fertilize per Plot.	Pounds of Fertilizer Per Acre.	Lbs. Cotton 1st. Picking.	Lbs. Cotton 2nd Picking.	Lbs. Cotton 3rd Picking.	Lbs. Cotton 4th Picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda	96 lbs. Nitrate Soda....	2	6	7	2	17	272
2	15 lbs. Acid Phosphate..	240 lbs. Acid Phosphate..	13	11	5	1½	30½	488
3	4 lbs. Muriate Potash...	64 lbs. Muriate Potash..	1½	5	4½	2½	13½	216
4	No Manure.	No Manure..........	½	3½	3½	2	9½	152
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash...	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash..	½	3	3	4	10½	168
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate..	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate..	22	9	3	½	34½	552
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate .	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	8	10½	4	1	23½	376
8	No Manure.	No Manure.	3	6	4	1½	14½	232
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash...	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	22	15	4	2	43	688
10	15 lbs. Floats..........	240 lbs. Floats	8½	13	6	3½	31	496
11	6 lbs. Nitrate Soda, 15 lbs. Floats...........	96 lbs. Nitrate Soda, 240 lbs. Floats..	11	11½	4	2	28½	456
12	No Manure............	No Manure...........	2	6½	4½	2½	15½	248
13	53 lbs. Green CottonSeed	848 lbs. Green CottonSeed	10	12	5	2	29	464
14	15 lbs Floats, 53 lbs. Green CottonSeed	240 lbs. Floats, 848 lbs. Green CottonSeed	18	15½	4½	4	42	672
15	265 lbs. Stable Manure	4,240 lbs. Stable Manure..	15	13½	4½	1½	34½	552
16	15 lbs. Acid Phosphate, 15 lbs. Cotton Seed Meal.	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal.	24	12½	3½	1	41	656

EXPERIMENT BY MR. A. F. CORY

Mulberry, Autauga County.

Soil, Red. Sub-soil, Red Clay.

It is clearly shown from Mr. Cory's experiment that his soil does not need potash. Plot 6, nitrate of soda with acid phosphate, gave **111** lbs. more than plot No. 9, complete fertilizer, while plot No. 16 gave an increase of 32 lbs. over plot No. 9.

Floats with green cotton seed give better results than floats with nitrate of soda, and both give larger yields than complete fertilizer.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer per Acre.	Lbs. eotton 1st picking	Lbs. cotton 2nd picking	Lbs. cotton 3rd picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda	96 lbs. nitrate soda	12	22	..	34	544
2	15 lbs. acid phosphate	240 lbs. acid phosphate	13	14	....	27	432
3	4 lbs. muriate potash	64 lbs. muriate potash	9	19	..	28	448
4	No manure	No manure	11	17	..	28	448
5	6 lbs. nitrate soda, 4 lbs. muriate potash.	96 lbs. nitrate soda 64 lbs. muriate potash	14	20	..	34	544
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate	30	14	...	44	704
7	4 lbs. muriate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 250 lbs. acid phosphate	15	9	....	24	384
8	No manure	No manure	8	12	...	20	320
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate	27	10	....	37	592
10	15 lbs. floats	240 lbs. floats	15	12	...	27	432
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	20	20	...	40	640
12	No manure	No manure	9	16	...	25	400
13	53 lbs. green cotton seed	848 lbs. green cotton seed	16	22	...	38	608
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed	25	23	...	48	768
15	265 lbs. stable manure	4240 lbs. stable manure	26	11	...	37	592
16	15 lbs. acid phosphate, 15 lbs cotton seed meal.	240 lbs, acid phosphate, 240 lbs. cotton seed meal	30	9	...	39	624

EXPERIMENT MADE BY R. H. CROSS,

LETOHATCHIE, LOWNDES COUNTY.

Soil, Sandy Loam; Sub-soil, Yellow Clay.

Mr. Cross gains nothing by the use of potash on his land. In 1891 complete fertilizer gave a slight increase over plot 6, nitrate soda and acid phosphate, but yields 160 lbs. less than plot 16, cotton seed meal and acid phosphate. In 1892, plots 6 and 9 gave the same. Plot 16 gave 304 lbs. more than either. The indications for the two years are that potash is not needed in this soil. Floats, with green cotton seed, gave better results for the two years than floats with nitrate soda.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. Cotton 1st Picking	Lbs. Cotton 2nd Picking.	Lbs. Cotton 3rd Picking.	Lbs Cotton 4th Picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda .	96 lbs. Nitrate Soda	12	16	14	9	51	816
2	15 lbs. Acid Phos ...	240 lbs. Acid Phosphate	16	20	21	11	68	1088
3	4 lbs. Muriate Potash	64 lbs. Muriate Potash.	8	10	14	9	41	656
4	No Manure......	No Manure	5	7	12	4	28	448
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash	18	22	16	8	64	1024
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate.	26	29	22	12	89	1424
7	4 lbs. Muriate Potash 15 lbs. Acid Phosphate	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate.	21	25	20	16	80	1280
8	No Manure.........	No Manure........	7	9	11	5	32	512
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate.	30	24	19	16	89	1424
10	15 lbs. Floats.......	240 lbs. Floats.... ...	12	21	26	18	77	1232
11	6 lbs. Nitrate Soda, 15 lbs. Floats.........	96 lbs. Nitrate Soda, 240 lbs. Floats	16	12	18	20	66	1056
12	No Manure	No Manure........	6	9	13	7	35	560
13	53 lbs. Green Cot. Seed	848 lbs. Green Cot. Seed	30	26	21	6	84	1344
14	15 lbs. Floats, 53 lbs. Green Cot. Seed	240 lbs. Floats, 848 lbs. Green Cot. Seed	33	24	20	8	85	1360
15	265 lbs. Stable Manure.	4240 lbs. Stable Manure.	40	34	21	7	102	1632
16	15 lbs. Acid Phosphate 15 lbs. Cot. Seed Meal,	240 lbs. Acid Phosphate, 240 lbs. Cot. Seed Meal.	41	41	20	6	108	1728

EXPERIMENT MADE BY MAJ. E. M. DAVIS,

PRATTVILLE, AUTAUGA COUNTY.

Soil, Sandy Loam; Subsoil, Red Clay.

In Maj. Davis's experiments results are conflicting. In 1891 the complete fertilizer gave the best results, while in 1892 nothing is gained by the use of potash as in plot No. 9. Floats with green cotton seed give the best results in 1891, while floats with nitrate of soda gave best results in 1892. Further experiment is necessary to determine anything for this soil.

Plot No.	POUNDS FERTILIZERS PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking.	Lbs. cotton 2nd picking.	Lbs. cotton 3rd picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda ...	96 lbs. nitrate soda ..	21	18	3	42	672
2	15 lbs. acid phosphate.	240 lbs. acid phosphate.	17½	9	½	27	432
3	4 lbs. muriate potash	64 lbs. muriate potash.	17	13	½	31	496
4	No manure	No manure	17	12	2	31	496
5	6 lbs. nitrate soda, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash.	19	22	3½	44½	722
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate.	26	20	1	47	752
7	4 lbs. muriate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 240 lbs. acid phosphate	18	24	2	44	704
8	No manure	No manure.	15	18	4	35	560
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate.	20	24	2½	46½	744
10	15 lbs. floats	240 lbs. floats	15	16½	2	33½	536
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	19	19	4	42	672
12	No manure.	No manure...........	17½	13	3	33½	536
13	53 lbs. green cotton seed	848 lbs. green cotton seed	22	16	3	41	656
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs green cotton seed	22	4	3	38	608
15	265 lbs. stable manure	4240 lbs. stable manure	27½	14	1	42½	680
16	15 lbs. acid phosphate, 15 lbs cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal	28	10	1	38	608

EXPERIMENT MADE BY J. F. DEER,

MONROEVILLE, MONROE COUNTY.

Soil, Gray Sandy; Sub-soil, Clay.

Mr. Deer failed to make a report last year, 1891, so we have only this year's work to compare. It is evident from this experiment for one year that it is a waste of money to apply potash as in plot 9 on land like Mr. Deer's. Floats with green cotton seed give better results for the one year than floats with nitrate of soda.

Plot No.	LBS. FERTILIZER PER PLOT.	LBS. FERTILIZER PER ACRE.	Lbs. Cotton 1st picking	Lbs. Cotton 2nd picking.	Lbs. Cotton 3rd picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda ..	96 lbs. nitrate soda	½	6	15	21½	344
2	15 lbs. acid phosphate	240 lbs. acid phosphate...	16	26	8	50	800
3	4 lbs. muriate potash.	64 lbs. muriate potash...	3½	13	7	23½	376
4	No manure.	No manure.....	1½	8	6	15½	248
5	6 lbs. nitrate soda, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash.	1½	10	14	25½	408
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate.	10	20	10	40	640
7	4 lbs. muriate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 240 lbs. acid phosphate...	8	17	8	33	528
8	No manure.	No manure...	3	11	5	19	304
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate...	9	20	6	35	560
10	15 lbs. floats	240 lbs. floats	5	14	3	22	352
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	5	16	5	26	416
12	No manure..........	No manure	2	11	4	17	272
13	53 lbs. green cotton seed	848 lbs. green cotton seed.	9	18	5	32	512
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed.	12½	20	5	37½	600
15	265 lbs. stable manure.	4240 lbs. stable manure...	16	19	4	39	624
16	15 lbs. acid phosphate 15 lbs. cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal.	16	18	1	35	560

EXPERIMENT MADE BY R. M. DICK.

Attalla, Etowah County.

Soil, Red Loam; Sub-soil, Red Clay.

In Mr. Dick's experiments for 1891 nitrate of soda with acid phosphate, as in plot No. 6, gives 48 lbs. more than complete fertilizers as in plot No. 9, while in 1892 the results are in favor of the complete fertilizer which gives 376 lbs. more than plot No. 6. The Floats with green cotton seed give better results for the two years than floats with nitrate of soda.

Plot No.	Pounds of Fertilizer per Acre.	Pounds of Fertilizer per Plot.	Lbs. cotton 1st picking	Lbs. cotton 2nd picking.	Lbs. cotton 3rd picking.	Total yield per Plot.	Total yield per Acre
1	6 lbs. Nitrate Soda	96 lbs. Nitrate Soda ...	8½	13	11	32½	520
2	15 lbs. Acid Phosphate	240 lbs. Acid Phosphate	22	24	13	59	944
3	4 lbs. MuriateP otash.	64 lbs. Muriate Potash.	12	15	14	41	656
4	No Manure	No Manure	9	13	11	33	528
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash.	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash..	10	19	13	42	672
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs Acid Phosphate	23	25	14½	62½	1000
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	24	26	14	34	1024
8	No Manure	No Manure	8	13½	11	32½	520
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash.	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	29	33	24	86	1376
40	15 lbs. Floats	240 lbs. Floats.	17	19	15	51	816
11	6 lbs. Nitrate Soda, 15 lbs. Floats	96 lbs. Nitrate Soda, 240 lbs. Floats	16	22	13	51	816
12	No Manure	No Manure.......	10	14	12½	30½	584
13	53 lbs. Green Cot. Seed	848 lbs. Green Cot. Seed	16	21½	17	54½	872
14	15 lbs. Floats, 53 lbs. Green Cot. Seed	240 lbs Floats, 848 lbs. Green Cot. Seed	22	26	16½	64½	1032
15	265 lbs. Stable Manure..	4240 lbs. Stable Manure.	26	26	18	70	1120
16	15 lbs. Acid Phosphate, 15 lbs. Cot. Seed Meal..	240 lbs. Acid Phosphate 240 lbs. Cot. Seed Meal...	27	23½	12½	63	1008

EXPERIMENT MADE BY J. M. ELLISON,

CREEKSTAND, MACON COUNTY.

Soil, Sandy; Sub-soil, Sandy.

Results are conflicting in the experiments made by Mr. Ellison. In 1891 nothing was gained by the use of potash as in plot No. 9, while in 1892 plot No. 9 gives an increase over plot No. 6 of 224 pounds. Floats, with sodium nitrate, gives better results for the two years than floats with green cotton seed.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. Cotton 1st Picking.	Lbs. Cotton 2nd Picking.	Lbs. Cotton 3rd Picking.	Lbs. Cotton 4th Picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda..	96 lbs. Nitrate Soda ..	5	17	12	7	41	656
2	15 lbs. Acid Phos	240 lbs. Acid Phosphate	5	9	18	7	39	624
3	4 lbs. Muriate Potash	64 lbs. Muriate Potash.	6	21	20	14	61	976
4	No Manure..... ...	No Manure.	6	12	20	13	51	816
5	6 lbs. Nitrate Soda,.. 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash	19	17	10	16	62	992
6	6 lbs. Nitrate Soda, 5 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate.	13	18	20	21	72	1152
7	4 lbs. Muriate Potash 15 lbs. Acid Phosphate	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate.	13	22	13	19	67	1072
8	No Manure..........	No Manure........	9	15	10	17	51	816
9	6 lbs Nitrate Soda, . 15 lbs. Acid Phosphate 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate.	14	22	18	27	81	1296
10	15 lbs. Floats.........	240 lbs. Floats..........	9	14	18	33	74	1184
11	6 lbs. Nitrate Soda, 15 lbs Floats.	96 lbs. Nitrate Soda, 240 lbs. Floats	14	20	16	28	78	1248
12	No Manure	No Manure........	11	12	12	16	51	816
13	53 lbs Green Cot. Seed	848 lbs. Green Cot. Seed	12	12	14	18	56	896
14	15 lbs. Floats, 53 lbs. Green Cot. Seed	240 lbs. Floats, 848 lbs. Green Cot. Seed	10	12	13	15	50	800
15	265 lbs. Stable Manure.	4240 lbs. Stable Manure.	17	13	10	10	50	800
16	15 lbs. Acid Phosphate 15 lbs Cot. Seed Meal,	240 lbs. Acid Phosphate. 240 lbs. Cot. Seed Meal.	18	10	6	8	42	672

EXPERIMENT MADE BY MR. DAN GILLIS,

IN CHARGE OF SOUTHEAST ALABAMA EXPERIMENT STATION, ABBEVILLE, HENRY COUNTY.

Soil, Sandy; Sub-soil, Sand and Clay Mixed.

It is clearly shown by the results of this experiment that the soil on the Southeast Alabama Experiment Station is deficient in the three main elements of plant food. In 1891 plot No. 9 gives largest yield of any except Plot No. 15—stable manure—and gives an increased yield over average of no manure, of 735 pounds per acre. While in 1892 the increase is not so large (414 pounds) yet the facts indicate best results from the use of complete fertilizer. Floats with green cotton seed give better results for the two years than floats with nitrate of soda.

Plot No.	POUNDS OF FERTILIZE PER PLOT.	POUNDS OF FERTILIZER PER ACRE.	Lbs. Cotton 1st Picking	Lbs. Cotton 2nd Picking	Lbs. Cotton 3rd Picking.	Lbs. Cotton 4th Picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda . .	96 lbs. Nitrate Soda. . .	. .	4	9½	9½	23	368
2	15 lbs. Acid Phosphate.	240 lbs. Acid Phosphate.	. .	5	8	9	22	352
3	4 lbs. Muriate Potash. .	64 lbs. Muriate Potash. .	. .	5	7	10	22	352
4	No Manure.	No Manure	. .	4	6½	11	21½	344
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash. . .	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash. .	. .	7	9	9	25	400
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate. .	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate. .	4	14	14	8	40	640
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate .	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate.	3	8½	10	6½	28	448
8	No Manure.	No Manure.	. .	4	6	7	17	272
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash. . .	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	4	16	17	7½	44½	712
10	15 lbs. Floats.	240 lbs. Floats	. . .	5	8½	6	19½	312
11	6 lbs. Nitrate Soda, 15 lbs. Floats.	96 lbs. Nitrate Soda, 240 lbs. Floats.	. .	6	7	7	20	320
12	No Manure.	No Manure.		4	8	5	17	272
13	53 lbs. Green CottonSeed	848 lbs. Green CottonSeed	5	11	9	5	30	480
14	15 lbs Floats, 53 lbs. Green CottonSeed	240 lbs. Floats, 848 lbs. Green CottonSeed	7	10½	8	3	28½	456
15	265 lbs. Stable Manure. .	4,240 lbs. Stable Manure.	8	17	13	6	44	704
16	15 lbs. Acid Phosphate, 15 lbs. Cotton Seed Meal.	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal.	8	14	10	4	36	576

EXPERIMENT MADE BY DR. J. GORDON,

HEALING SPRINGS, WASHINGTON COUNTY.

Soil, Sandy Loam; Sub-soil, Sandy Loam.

In the experiment made by Dr. Gordon for 1 91, plot No. 2, acid phosphate, gave 80 pounds more than plot No. 9, complete fertilizer; 336 pounds more than plot No. 6, nitrate of soda with acid phosphate, but 184 pounds less than plot No. 16, cotton seed meal with acid phosphate, while in 1892 plot No. 2 gives 152 pounds less than plot No. 6, 96 lbs. less than plot No. 9, but 112 pounds more than plot 16. The results of these experiments are so conflicting that no conclusion can be made. Floats with green cotton seed give a slight increase over floats with nitrate of soda for the two years.

Plot No.	POUNDS OF FERTILIZER PER ACRE.	POUNDS OF FERTILIZER PER PLOT.	Lbs. cotton 1st picking.	Lbs. cotton 2nd picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda ...	96 lbs. Nitrate Soda	10	5	15	240
2	15 lbs. Acid Phosphate ...	240 lbs. Acid Phosphate .	20	6½	26½	424
3	4 lbs. MuriateP otash...	64 lbs. Muriate Potash....	8	9	17	272
4	No Manure	No Manure	7	8½	15½	248
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash.....	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash.....	9	6½	15½	248
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate ...	96 lbs Nitrate Soda, 240 lbs Acid Phosphate ...	26	10	36	576
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate ..	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate ...	26	8½	34½	552
8	No Manure	No Manure	6	6	12	192
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash...	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate....	26	6½	32½	520
10	15 lbs. Floats	240 lbs. Floats.	30	6½	36½	584
11	6 lbs. Nitrate Soda, 15 lbs. Floats	96 lbs. Nitrate Soda, 240 lbs. Floats	25	8½	33½	536
12	No Manure.	No Manure...........	8	8	16	256
13	53 lbs. Green Cot. Seed..	848 lbs. Green Cot. Seed..	21	9	30	480
14	15 lbs. Floats, 53 lbs. Green Cot. Seed...	240 lbs Floats, 848 lbs. Green Cot. Seed...	27½	9	36½	584
15	265 lbs. Stable Manure.....	4240 lbs. Stable Manure...	26	7	33	528
16	15 lbs. Acid Phosphate, 15 lbs. Cot. Seed Meal...	240 lbs. Acid Phosphate 240 lbs. Cot. Seed Meal.....	13	6½	19½	312

EXPERIMENT MADE BY MR. URIAH JOHNSON.

TRINITY STATION, MORGAN COUNTY.

Soil, Red Sandy Loam; Sub-soil, Red Clay.

In Mr. Johnson's two years experiments it is clearly shown by the increased yield of plot No. 2 over 1 and 3, that phosphoric acid is the element most deficient in his soil, but in combination results are conflicting. In 1891 plot No. 9 gave 128 pounds more than plot No. 6, while in 1892 plot 6 gives 352 pounds increase over plot No. 9. Floats, with green cotton seed, give the best results in 1891, while floats with nitrate of soda give best results in 1892. Further experiments are necessary to be made on this soil before any conclusions can be drawn.

Plot No.	POUNDS OF FERTILIZER PER ACRE.	POUNDS OF FERTILIZER PER PLOT.	Lbs. cotton 1st picking.	Lbs. cotton 2nd picking.	Total yield per Plot.	Total yield per Acre
1	6 lbs. Nitrate Soda.......	96 lbs. Nitrate Soda	16	8	24	384
2	15 lbs. Acid Phosphate ...	240 lbs. Acid Phosphate .	34	6	40	640
3	4 lbs. MuriateP otash....	64 lbs. Muriate Potash....	14	8	22	352
4	No Manure.............	No Manure	12	8	20	320
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash....	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash....	18	10	28	448
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate ...	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate ...	32	10	62	992
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate ...	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate ...	34	8	42	672
8	No Manure.............	No Manure	12	8	20	320
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash....	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate ...	28	12	40	640
10	15 lbs. Floats	240 lbs. Floats.	22	6	28	448
11	6 lbs. Nitrate Soda, 15 lbs. Floats............	96 lbs. Nitrate Soda, 240 lbs. Floats	32	8	40	640
12	No Manure.	No Manure...........	12	8	20	320
13	53 lbs. Green Cot. Seed...	848 lbs. Green Cot. Seed..	24	10	38	608
14	15 lbs. Floats, 53 lbs. Green Cot. Seed...	240 lbs. Floats, 848 lbs. Green Cot. Seed...	36	8	34	544
15	265 lbs. Stable Manure.....	4240 lbs. Stable Manure...	40	4	44	704
16	15 lbs. Acid Phosphate, 15 lbs. Cot. Seed Meal....	240 lbs. Acid Phosphate 240 lbs. Cot. Seed Meal.....	....	..	44	704

EXPERIMENT MADE BY J. C. KILLEBREW,

NEWTON, DALE COUNTY.

Soil, Sandy Loam; Subsoil, Red Clay.

In Mr. Killebrew's experiment for 1891, nothing is gained from the use of acid phosphate, as is shown when plot No. 6 is compared with plot No. 9, while in 1892 it is clearly seen that phosphoric acid is the leading element needed. The increase of plot No. 2 over average of unmanured plots 4, 8 and 12, is 256 pounds per acre. Plot No. 6 gives an increase of 288 pounds, and plot No. 9 gives 576 pounds increase. The results from plot No. 16 are very marked. In 1891 the increase over plot No. 9 is 16 pounds, but in 1892 it is 160 pounds per acre. Floats with green cotton seed, and floats with nitrate of soda, give same results in 1891, but in 1892 floats with green cotton seed give 544 pounds more than floats with nitrate of soda, but no more than green cotton seed alone, as in plot No. 13.

Plot No.	POUNDS OF FERTILIZER PER ACRE.	POUNDS OF FERTILIZER PER PLOT.	Lbs. Cotton 1st picking.	Lbs. Cotton 2nd picking.	Lbs. Cotton 3rd picking.	Total yield per plot.	Total yield per acre.
1	6 lbs. Nitrate Soda....	96 lbs. Nitrate Soda. ...	14	20	8	42	672
2	15 lbs. Acid Phosphate	240 lbs. Acid Phosphate..	20	18	12	50	800
3	4 lbs. Muriate Potash.	64 lbs. Muriate Potash...	12	10	12	34	544
4	No Manure..........	No Manure..........	14	10	10	34	544
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash.	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash..	16	14	12	42	672
6	16 lbs. Nitrate Soda, 5 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate..	24	16	12	52	832
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	16	20	12	48	768
8	No Manure.........	No Manure.........	12	12	8	32	512
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	26	24	20	70	1120
10	15 lbs. Floats.........	240 lbs. Floats	14	16	6	36	576
11	6 lbs. Nitrate Soda, 15 lbs. Floats..........	96 lbs. Nitrate Soda, 240 lbs. Floats...........	16	16	12	44	704
12	No Manure.........	No Manure	12	14	10	36	576
13	53 lbs. Green Cot. Seed	848 lbs. Green Cotton Seed	30	28	20	72	1248
14	15 lbs. Floats, 53 lbs. Green Cot. See.	240 lbs. Floats, 848 lbs. Green Cotton Seed	28	26	24	78	1248
15	265 lbs. Stable Manure.	4,240 lbs. Stable Manure..	32	36	20	88	1408
16	15 lbs. Acid Phosphate, 15 lbs. Cot'n Seed Meal	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal	32	30	18	80	1280

EXPERIMENT MADE BY J. A. LOGAN,

CLANTON, CHILTON COUNTY.

Soil, Mulatto and Sandy; Sub-soil, Red Clay.

It is clearly shown by the results of two years' experiments made by Mr. Logan that his soil does not need potash. In 1891 plot 6 gave an increase over plot 9 of 112 pounds, and over plot No. 16 of 48 pounds; while in 1892 plot No. 6 gave 16 pounds more than plot No. 9, and 8 pounds more than plot No. 16.

These amounts are small but they are valuable facts, and show that it is a waste of money to use potash on such soils, as the yield of cotton is decreased. It should be stated here that cotton seed meal contains some potash, is why the comparison is made between plot No. 6 and plot No. 16. Floats with green cotton seed gave better results for the two years than floats with nitrate of soda.

Plot No.	LBS. FERTILIZER PER PLOT.	LBS. FERTILIZER PER ACRE.	Lbs. Cotton 1st picking	Lbs. Cotton 2nd picking.	Lbs. Cotton 3rd picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda ..	96 lbs. nitrate soda	11	20	4	38	608
2	15 lbs. acid phosphate	240 lbs. acid phosphate...	20	19	3	42	672
3	4 lbs. muriate potash.	64 lbs. muriate potash...	12½	19½	5½	37½	600
4	No manure.	No manure.....	10	17	5½	32½	520
5	6 lbs. nitrate soda, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash..	10½	25	8½	42	672
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate...	30	28	6	64	1024
7	4 lbs. muriate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 240 lbs. acid phosphate,.	20	26½	7	54½	·872
8	No manure.	No manure..........	10½	18½	6	35	560
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate...	23	33	7	63	1008
10	15 lbs. floats	240 lbs. floats	16	25	6	67	752
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	15	27½	80½	53	848
12	No manure..........	No manure..........	11½	20	8½	39	624
13	53 lbs. green cotton seed	848 lbs. green cotton seed	15	25½	15½	56	896
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed.	19½	28½	10	58	928
15	265 lbs. stable manure.	4240 lbs. stable manure...	28	30½	10½	69	1104
16	15 lbs. acid phosphate 15 lbs. cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal.	22½	33	8	63½	1016

EXPERIMENT MADE BY MR. WILLIAM MARTIN,

GREENSBORO, HALE COUNTY.

Soil, Sandy Loam; Subsoil, Clay.

No conclusions can be made from Mr. Martin's work, as we have only one year's experiment to compare. The following statement shows the results for 1892.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking	Lbs cotton 2nd picking	Lbs. cotton 3rd picking	Total yield per Plot	Total yield per Acre
1	6 lbs. nitrate soda	96 lbs. nitrate soda ..	30	10	8	48	768
2	15 lbs. acid phosphate	240 lbs. acid phosphate	20	20	4	44	704
3	4 lbs. muriate potash	64 lbs. muriate potash	30	10	6	46	736
4	No manure.	No manure	16	10	4	30	480
5	6 lbs. nitrate soda, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash.	32	14	6	52	832
6	6 lbs. nitrate soda, 15 lbs. acid phosphate	96 lbs. nitrate soda, 240 lbs. acid phosphate.	36	32	10	78	1248
7	4 lbs. muriate potash. 15 lbs. acid phosphate	64 lbs. muriate potasc, 240 lbs. acid phosphate.	68	16	20	104	1664
8	No manure.	No manure	30	18	8	56	896
9	6 lbs. nitrate soda, 15 lbs acid phosphate, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate	50	20	14	84	1344
10	15 lbs. floats ...	240 lbs. floats	52	16	16	84	1344
11	6 lbs nitrate soda, 15 lbs. floats.	96 lbs nitrate soda, 240 lbs. floats...........	32	10	12	54	864
12	No manure.	No manure	42	16	8	66	1056
13	53 lbs green cotton seed	848 lbs.green cotton seed	68	16	12	96	1536
14	15 lbs. floats, 53 lbs.green cotton seed	240 lbs. floats, 848 lbs.green cotton seed	34	8	10	52	832
15	265 lbs. stable manure.	4240 lbs. stable manure	28	14	6	48	768
16	15 lbs. acid phosphate, 15 lbs cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal	36	12	10	58	928

EXPERIMENT MADE BY J. W. MIZE,

Remlap, Blount County.

Soil, Red Sandy; Sub-soil, Sticky, Mineral Nature.

In the experiments made by Mr. Mize nothing is gained by the use of potash. In 1891 plot No. 6 gave 144 pounds more than plot No. 9, and plot 16 gave 176 pounds increase over plot No. 9, while in 1892 plot No. 9 gives an increase of 8 pounds over plot No. 6 and 98 pounds over plot No. 16.

These results are conflicting, and no conclusion can be drawn. Floats, as in plots No. 11 and 14, gave same yield in 1891, while in 1892 floats, with green cotton seed, give an increase of 224 pounds over nitrate of soda with floats.

Plot No.	Lbs Fertilizer Per Plot.	Lbs. Fertilizer Per Acre.	Lbs. Cotton 1st picking	Lbs. Cotton 2nd picking	Lbs. Cotton 3rd picking	Total yield per Plot	Total yield per Acre.
1	6 lbs. nitrate soda	96 lbs. nitrate soda......	4	7	2	13	208
2	15 lbs. acid phosphate	240 lbs. acid phosphate...	15	16½	8	39½	632
3	4 lbs. muriate potash.	64 lbs. muriate potash...	4½	7½	2½	14½	232
4	No manure..........	No manure...............	3½	5	2	10½	168
5	6 lbs. nitrate soda, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash...	5½	8	4	17½	280
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate...	16½	19	10	45½	728
7	4 lbs. muriate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 240 lbs. acid phosphate...	12½	15½	6	34	544
8	No manure..........	No manure..........	4	6½	1½	12	192
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate...	18	20	8	46	736
10	15 lbs. floats..........	240 lbs. floats	6	8½	3	17½	280
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	5	6½	3½	15	240
12	No manure..........	No manure..........	3½	7	4	14½	232
13	53 lbs. green cotton seed	848 lbs. green cotton seed.	4½	6	3½	14	224
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed.	10½	13	5½	29	464
15	265 lbs. stable manure..	4240 lbs. stable manure...	12	15½	6	33½	536
16	15 lbs. acid phosphate. 15 lbs. cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal.	14½	17	9	40½	648

EXPERIMENT MADE BY W. H. NEWMAN.

REPORTED BY B. M. DUGGAR, CANEBRAKE EXPERIMENT STATION,
UNIONTOWN, PERRY COUNTY.

The following tabulated statement is the result of the experiment as conducted on the Uniontown Experiment Station:

Plot No.	POUNDS OF FERTILIZE PER PLOT.	POUNDS OF FERTILIZER PER ACRE.	Lbs. Cotton 1st Picking.	Lbs. Cotton 2nd Picking.	Lbs. Cotton 3rd Picking.	Lbs. Cotton 4th Picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda ...	96 lbs. Nitrate Soda.....	9	35½	17	....	61½	984
2	15 lbs. Acid Phosphate..	240 lbs. Acid Phosphate..	16½	54½	22½	..	93½	1496
3	4 lbs. Muriate Potash...	64 lbs. Muriate Potash...	17	37½	19	..	73½	1176
4	No Manure..............	No Manure...........	14½	42½	20½	..	77½	1240
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash...	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash..	14½	30	14	..	58½	936
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate..	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate..	13½	24½	11½	..	49½	792
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate .	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate.	6½	24½	9	..	40	640
8	No Manure............	No Manure..........	9	31	21	..	60	960
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash..	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	12	32½	21	....	65½	1048
10	15 lbs. Floats............	240 lbs. Floats	15	24½	10½	..	50	800
11	6 lbs. Nitrate Soda, 15 lbs. Floats.........	96 lbs. Nitrate Soda, 240 lbs. Floats..	14	25½	8	....	47½	760
12	No Manure...........	No Manure............	18	29	13	...	60	960
13	53 lbs. Green CottonSeed	848 lbs. Green CottonSeed	12	24½	7	...	43½	696
14	15 lbs. Floats, 53 lbs. Green CottonSeed	240 lbs. Floats, 848 lbs. Green CottonSeed	15	31½	8½	..	55	880
15	265 lbs. Stable Manure	4,240 lbs. Stable Manure.	13	23½	4½	...	41	656
16	15 lbs. Acid Phosphate, 15 lbs. Cotton Seed Meal	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal.	15	17	3½	....	35½	568

EXPERIMENT MADE BY J. P. OLIVER,

DADEVILLE, TALLAPOOSA COUNTY.

Soil, Gray Sandy; Subsoil, Clay.

In Mr. Oliver's experiments for the two years the indications are that his soil is deficient in the three main elements of plant food. In 1891 plot No. 9 gave best results, and in 1892 plots No. 9 and 16 gave the same yield. Floats with green cotton seed gave best results in 1891, while floats and nitrate of soda gave best results in 1892.

Plot No.	POUNDS FERTILIZERS PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking.	Lbs. cotton 2nd picking.	Lbs. cotton 3rd picking.	Lbs. cotton 4th picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda...	96 lbs. nitrate soda	0	5	3	6½	34½	232
2	15 lbs. acid phosphate	240 lbs. acid phosphate.	7	3	5	3	18	288
3	4 lbs. muriate potash	64 lbs muriate potash.	0	4	3½	8	15½	248
4	No manure ...	No manure	0	1	2	8	11	176
5	{ 6 lbs nitrate soda, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash	0	3	2½	9	14½	232
6	{ 6 lbs. nitrate soda, 15 lbs. acid phosphate	96 lbs. nitrate soda, 240 lbs. acid phosphate	17	23	6	3	49	784
7	{ 4 lbs. muriate potash 15 lbs. acid phosphate	64 lbs. muriate potash, 240 lbs. acid phosphate	8	19	7	5	39	624
8	No manure	No manure.	0	2	3	6	11	176
9	{ 6 lbs. nitrate soda, 15 lbs. acid phosphate 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate.	14	24	7	7	52	832
10	15 lbs. floats	240 lbs. floats	6	16½	7½	8	38	608
11	{ 6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	12	22½	9	8	51½	824
12	No manure.	No manure.	0	4	4	9	17	272
13	53 lbs. green cot. seed	848 lbs. green cotton seed	12	16	7½	6	41½	664
14	{ 15 lbs. floats, 53 lbs. green cot. seed	240 lbs. floats, 848 lbs. green cotton seed	12	16	8½	4	40½	648
15	265 lbs. stable manure	4240 lbs. stable manure	18	23	6½	3	50½	808
16	{ 15 lbs. acid phosphate 15 lbs. cot. seed meal.	240 lbs. acid phosphate, 240 lbs. cotton seed meal	22	22	6	2	52	832

EXPERIMENT MADE BY J. C. OTT,

Florence, Lauderdale County.

Soil, Grey and Gravelly; Subsoil, Clay.

No experiment was reported by Mr. Ott for 1891. Conclusions cannot be drawn from one year's work. The following statement shows results for 1892.

Plot No.	Pounds Fertilizer per Plot.	Pounds Fertilizer Per Acre.	Lbs. Cotton 1st Picking	Lbs. Cotton 2nd Picking	Lbs. Cotton 3rd Picking.	Lbs Cotton 4th Picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. Nitrate Soda .	96 lbs. Nitrate Soda	12	12	16	10	50	800
2	15 lbs. Acid Phos . . .	240 lbs. Acid Phosphate	12	10	12	8	42	672
3	4 lbs. Muriate Potash	64 lbs. Muriate Potash.	8	10	14	8	40	640
4	No Manure	No Manure	6	8	12	8	34	544
5	6 lbs. Nitrate Soda,. 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash	10	14	14	10	48	768
6	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate.	18	16	20	12	66	1058
7	4 lbs. Muriate Potash 15 lbs. Acid Phosphate	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate.	14	14	14	10	52	832
8	No Manure.	No Manure.	10	10	12	8	40	640
9	6 lbs. Nitrate Soda, . 15 lbs. Acid Phosphate 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	18	18	22	14	72	1132
10	15 lbs. Floats .	240 lbs. Floats.	10	10	16	10	46	736
11	6 lbs. Nitrate Soda, 15 lbs. Floats.	96 lbs. Nitrate Soda, 240 lbs. Floats	12	12	22	10	56	896
12	No Manure	No Manure . .	8	8	14	8	38	608
13	53 lbs. Green Cot. Seed	848 lbs. Green Cot. Seed	14	18	18	12	62	992
14	15 lbs. Floats, 53 lbs. Green Cot. Seed	240 lbs. Floats, 848 lbs. Green Cot. Seed	12	12	14	10	48	768
15	265 lbs. Stable Manure	4240 lbs. Stable Manure.	12	10	16	10	48	768
16	15 lbs Acid Phosphate 15 lbs. Cot. Seed Meal,	240 lbs. Acid Phosphate 240 lbs. Cot Seed Meal	18	18	12	10	58	928

EXPERIMENT MADE BY J. W. PITTS,

CRESWELL STATION, SHELBY COUNTY.

Soil, Thin Brown or Mulatto; Sub-soil, Stiff Clay.

In this experiment it is clearly shown in two years' results that potash is not needed in this soil. Comment seems unnecessary. In 1891 plot No. 6 gave an increase over plot No. 9 of 48 pounds, and plot 16 gave 112 pounds more than plot No. 9. In 1892 plot No. 6 gave 208 pounds more than plot No. 9, and plot No. 16 gave 192 pounds more than plot No. 9. These are not large amounts, but they are hard facts, and Mr. Pitts is wasting money when he buys potash for his soil.

Floats with green cotton seed give best results in 1891, while floats with nitrate of soda give an increase in 1892.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking	Lbs. cotton 2nd picking	Lbs. cotton 3rd picking	Total yield per Plot.	Total yield pr Acree.
1	6 lbs. nitrate soda ...	96 lbs. nitrate soda ...	9	10	9	28	448
2	15 lbs. acid phosphate..	240 lbs. acid phosphate..	29	21	10	60	960
3	4 lbs. muriate potash. .	64 lbs. muriate potash	7	10	11	28	448
4	No manure.........	No manure	2	7	4	13	208
5	6 lbs. nitrate soda, 4 lbs. muriate potash.	96 lbs. nitrate soda 64 lbs. muriate potash	2	3	6	11	176
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate .	35	17	5	57	912
7	4 lbs. muriate potash, 15 lbs. acid phosphate..	64 lbs. muriate potash, 250 lbs. acid phosphate	21	13	5	39	624
8	No manure.........	No manure..........	3	3	4	10	160
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate .	28	13	3	44	704
10	15 lbs. floats..........	240 lbs. floats	13	9	5	27	432
11	6 lbs. nitrate soda, 15 lbs. floats..........	96 lbs. nitrate soda, 240 lbs. floats	23	14	7	44	704
12	No manure....... .	No manure	5	4	4	13	208
13	53 lbs. green cotton seed	848 lbs. green cotton seed	8	6	6	20	320
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed	17	13	8	38	608
15	265 lbs. stable manure..	4240 lbs. stable manure	46	25	8	79	1364
16	15 lbs. acid phosphate, 15 lbscotton seed meal.	240 lbs, acid phosphate, 240 lbs. cotton seed meal	41	12	3	56	896

EXPERIMENT MADE BY S. A. PRUITT,

Chess, Pike County.

Soil, Light Sandy; Sub-soil, Red and Yellow Sandy.

The best results in this experiment for the two years are from plot 16—cotton seed meal with acid phosphate. Plot No. 9, complete fertilizer, gave a marked increase over plot No. 6 for each year, and the indications are that the soil is deficient in the three main elements of plant food. Floats with green cotton seed give a decided increase over floats with nitrate of soda for the two years

Plot No.	Pounds Fertilizer Per Plot.	Pounds Fertilizer Per Acre.	Lbs. cotton 1st picking	Lbs. cotton 2nd picking	Lbs. cotton 3rd picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda ..	96 lbs. nitrate soda ..	24	14	...	38	608
2	15 lbs. acid phosphate	240 lbs. acid phosphate	40	40	..	80	1280
3	4 lbs. muriate potash.	64 lbs. muriate potash	28	14	....	42	672
4	No manure..........	No manure.........	28	16	....	44	704
5	6 lbs. nitrate soda, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash	30	18	..	48	763
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate	40	22	..	62	992
7	4 lbs. murate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 240 lbs. acid phosphate	28	12	..	40	640
8	No manure.........	No manure..........	32	12	...	44	704
9	6 lbs. nitrate soda, 15 lbs acid phosphate, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate	52	24	...	76	1216
10	15 lbs. floats.........	240 lbs. floats.........	36	18	...	54	864
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	40	22	..	62	992
12	No manure.	No manure..	32	12	...	44	704
13	53 lbs. green cotton seed	848 lbs. green cotton seed	36	22	..	58	928
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs. green cotton seed	40	30	...	70	1120
15	265 lbs. stable manure..	4240 lbs. stable manure..	52	28	..	80	1280
16	15 lbs. acid phosphate, 15 lbs. cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal	56	28	...	84	1344

EXPERIMENT MADE BY J. H. RADNEY,

ROANOKE, RANDOLPH COUNTY.

Soil, Sandy Loam; Subsoil, Clay.

Results of Mr. Radney's experiments are so conflicting that further work will have to be done before any conclusions can be drawn. His best results in 1891 are from plot No. 6, nitrate of soda with acid phosphate; while in 1892, plot No. 9, complete fertilizer, gives 136 pounds more than plot No. 6, and plot 16 gives an increase of 398 pounds over plot No. 6. Where floats with nitrogen are compared, floats with nitrate of soda give best results in 1891, while floats with green cotton seed give best results in 1892.

Plot No.	POUNDS FERTILIZER PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking	Lbs. cotton 2nd picking	Lbs. cotton 3rd picking	Lbs. cotton 4th picking	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda .	96 lbs. nitrate soda . .	2	5	6	2	15	240
2	15 lbs. acid phosphate	240 lbs. acid phosphate	10	12	14	3	39	624
3	4 lbs. muriate potash	64 lbs. muriate potash	3	6	5	2	16	256
4	No manure.	No manure.	2	4	6	1	13	208
5	6 lbs. nitrate soda, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash	2	5	8	2	17	272
6	6 lbs. nitrate soda, 15 lbs. acid phosphate	96 lbs. nitrate soda, 240 lbs. acid phosphate	16	15	10	2½	43½	696
7	4 lbs. murate potash, 15 lbs. acid phosphate	64 lbs. muriate potash, 240 lbs. acid phosphate	6	8	12	1	27	432
8	No manure. ...	No manure..........	1	4	7	2	16	256
9	6 lbs. nitrate soda, 15 lbs acid phosphate, 4 lbs. muriate potash	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate	13	20	18	1	52	832
10	15 lbs. floats	240 lbs. floats	2	4	3	2	11	176
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs floats	9	12	8	3	32	512
12	No manure.	No manure.	1	5	4	2	12	192
13	53 lbs. green cot. seed.	848 lbs. green cotton seed	...	...	..		.	...
14	15 lbs. floats, 53 lbs. green cot. seed	240 lbs. floats, 848 lbs. green cotton seed	17	15	10	3	45	720
15	265 lbs. stable manure	4240 lbs. stable manure.	...	.	...	..	..	...
16	15 lbs. acid phs'phate, 15 lbs. cot. seed meal.	240 lbs. acid phosphate, 240 lbs. cotton seed meal	23	25	20	1	69	1094

EXPERIMENT MADE BY W. H. SELLERS.

GENEVA, GENEVA COUNTY.

Soil, Sandy; Subsoil, Red Clay and Sand.

The indications are, from results of two years' experiments by Mr. Sellers, that his soil is deficient in the three main elements of plant food, as plot No. 9 gives best results for the two years' work. No comparison can be made as to floats with nitrogen. No results having been reported from floats and green cotton seed in 1891.

Plot No.	POUNDS OF FERTILIZER PER ACRE.	POUNDS OF FERTILIZER PER PLOT.	Lbs. Cotton 1st picking	Lbs. Cotton 2nd picking	Lbs. Cotton 3rd picking	Total yield per plot.	Total yield per acre.
1	6 lbs. Nitrate Soda....	96 lbs. Nitrate Soda. ..	...		..	8½	136
2	15 lbs. Acid Phosphate	240 lbs. Acid Phosphate.	..	...	..	18	288
3	4 lbs. Muriate Potash	64 lbs. Muriate Potash...	.	...	..	13	208
4	No Manure.	No Manure		.	..	9	144
5	6 lbs. Nitrate Soda, 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash..	..			13	208
6	6 lbs. Nitrate Soda, 5 lbs. Acid Phosphate	96 lbs. Nitrate Soda, 240 lbs. Acid Phosphate	..	...	..	26	416
7	4 lbs. Muriate Potash, 15 lbs. Acid Phosphate	64 lbs. Muriate Potash, 240 lbs. Acid Phosphate..	...	...	..	21	336
8	No Manure..	No Manure.	...	..	..	8½	136
9	6 lbs. Nitrate Soda, 15 lbs. Acid Phosphate, 4 lbs. Muriate Potash	96 lbs. Nitrate Soda, 64 lbs. Muriate Potash, 240 lbs. Acid Phosphate	...	...	..	28	448
10	15 lbs. Floats..	240 lbs. Floats	...	...	..	13	208
11	6 lbs. Nitrate Soda, 15 lbs. Floats..........	96 lbs. Nitrate Soda, 240 lbs. Floats...........	..	..	...	17	272
12	No Manure....	No Manure	...	...	..	9	144
13	53 lbs. Green Cot. Seed	848 lbs. Green Cotton Seed	...	..	..	13	208
14	15 lbs. Floats, 53 lbs. Green Cot. See	240 lbs. Floats, 848 lbs. Green Cotton Seed	..	...	..	17	272
15	265 lbs. Stable Manure.	4,240 lbs. Stable Manure .	..	..	...	17	272
16	15 lbs. Acid Phosphate, 15 lbs. Cot'n Seed Meal	240 lbs. Acid Phosphate, 240 lbs. Cotton Seed Meal	..	...	..	17½	280

EXPERIMENT MADE BY T. A. SNUGGS.

HOLLY POND, CULLMAN COUNTY.

Soil, Sandy and Gravelly; Subsoil, Yellow Sandy.

The two years work of Mr. Snuggs clearly shows that his soil is deficient in the three main elements of plant food, as plot No. 9 gave a large increase over everything for the two years, when floats with nitrogen are compared. Floats with green cotton seed give best results for each year.

Plot No.	POUNDS FERTILIZERS PER PLOT.	POUNDS FERTILIZER PER ACRE.	Lbs. cotton 1st picking.	Lbs. cotton 2nd picking.	Lbs. cotton 3rd picking.	Total yield per Plot.	Total yield per Acre.
1	6 lbs. nitrate soda....	96 lbs. nitrate soda ..	15	16	6½	37½	600
2	15 lbs. acid phosphate.	240 lbs. acid phosphate.	22	17½	6	45½	728
3	4 lbs. muriate potash	64 lbs. muriate potash.	12½	16½	10½	39½	632
4	No manure	No manure	13	16½	11	40½	648
5	6 lbs. nitrate soda, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash.	12½	19	14	45½	728
6	6 lbs. nitrate soda, 15 lbs. acid phosphate.	96 lbs. nitrate soda, 240 lbs. acid phosphate.	31	23	8½	62½	1000
7	4 lbs. muriate potash, 15 lbs. acid phosphate.	64 lbs. muriate potash, 240 lbs. acid phosphate.	28	23½	8½	60	960
8	No manure	No manure..........	14½	18	9½	42	672
9	6 lbs. nitrate soda, 15 lbs. acid phosphate, 4 lbs. muriate potash.	96 lbs. nitrate soda, 64 lbs. muriate potash, 240 lbs. acid phosphate.	32½	23½	9½	65½	1048
10	15 lbs. floats	240 lbs. floats	14	17	9	40	640
11	6 lbs. nitrate soda, 15 lbs. floats	96 lbs. nitrate soda, 240 lbs. floats	16½	25½	17	59	944
12	No manure.........	No manure...........	13½	17	12	42½	680
13	53 lbs. green cotton seed	848 lbs. green cotton seed	18	21	10	49	784
14	15 lbs. floats, 53 lbs. green cotton seed	240 lbs. floats, 848 lbs green cotton seed	16	20½	14	50½	808
15	265 lbs. stable manure	4240 lbs. stable manure	30	24½	10½	65	1040
16	15 lbs. acid phosphate, 15 lbs. cotton seed meal	240 lbs. acid phosphate, 240 lbs. cotton seed meal	20	18½	11	49½	792

Bulletin No. 43, : : : May, 1893.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

EYE DISEASES OF DOMESTIC ANIMALS,

BY C. A, CARY.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

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ERRATA.

Page 6, line 7 of explanation of fig. 1, for "equeous" read *aqueous.*

Page 6, line 13 of explanation of fig. 1, for "samal" read *small.*

Page 10, lines 22, 24, 32 for "agueous" read *aqueous.*

Page 11, line 1 for "agueous" read *aqueous.*

Page 11, lines 23, 28 for "vitrious" read *vitreous.*

Page 11, line 33 for "Membrane" read *Membrana.*

Page 12, line 19 for "membrane" read *membrana.*

Page 15, line 4 for "Costic" read *Caustic.*

Page 15, line 13 for "stiches" read *stitches.*

Page 17, line 10 for "conjested" read *congested.*

Page 21, line 31 for "incision" read *excision.*

Page 23, line 14 for "diptheretic" read *diptheritic.*

Page 23, line 15 for "conjunctivitas" and "fallicular" read *conjunctivitis* and *follicular.*

Page 27, line 18 for "conjested" read *congested.*

Page 29, line 3 for "agueous" read *aqueous.*

Page 30, line 2 for "conjested" read *congested.*

Page 30, line 6 for "is" read *are.*

Page 43, line 1 of explanation of fig. 13, for "Luxuration" read *Luxation.*

Page 48, line 17 for "Exothalmus" read *Exopthalmus.*

Page 50, line 4 after "is" insert *found.*

Page 59, line 10 for "Wallach" read *Willach.*

Page 63, line 2 for "appearances" read *appearance.*

Page 64, line 12 for "attscks" read *attacks.*

ANATOMY OF THE HORSE'S EYE.

[When reading note the location of the parts of the eye as illustrated in Fig. 1.]

The eyeball or globe is a spherical shell whose interior is filled with liquid or semi-liquid parts, called the humors or refracting media of the eye.

The wall or shell of the eye is formed by three distinct coats—the external, the middle and the internal.

The outer or external coat is divided into two distinct parts—the sclerotica and the cornea.

The sclerotic is a very tough, white membrane, forming about four-fifths of the outer coat of the eye. The muscles that move the eyeball are attached to the back part and the outer surface of the sclerotica. Its internal surface is loosely united to the middle or choroid coat of the eye by small blood vessels, nerves and loose fibrous tissue. In front, the sclerotica shows an elliptical opening with its greatest diameter from side to side and shortest diameter from above to below; the edge or border of this opening is bevelled on the inner side, and the cornea fits in it as the watch crystal fits in the watch case.

The sclerotic is well supplied with blood vessels and nerves, and a little below the middle of the back part, the optic nerve passes through it and the choroid to form the retina or internal coat.

The cornea is a very transparent membrane forming the anterior part (about one-fifth) of the external coat of the eye. Its outline is elliptical, like the opening it closes. It consists, from without to within, of the following layers:

The external layer is the conjunctival epithelium spread over the outer surface of the cornea; in some animals this layer is not separated from the middle layer by a thin elastic limitary membrane, called Bowman's membrane.

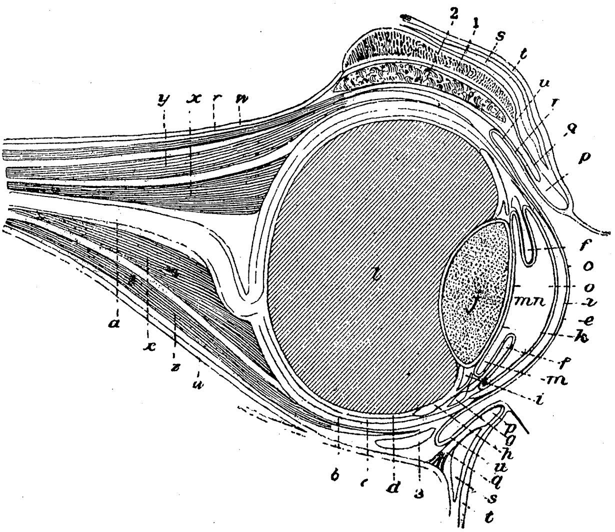

FIG. 1.

Diagramatic Section of the Horse's Eye (after D'Arboval) showing the relative position of the various parts. In reading the description of the anatomy of the eye frequent reference should be made to this cut.

---

a, Optic nerve; *b*, Sclerotic; *c*, Choroid; *d*, Retina; *e*, Cornea; *f*, Iris; *g*, *h*, Ciliary circle, (or ligament) and processes given off by the choroid though represented as isolated from it, in order to indicate their limits more clearly; *i*, insertion of the ciliary processes on the crystalline lens; *j*, Crystalline lens; *k*, Crystalline capsule; *l*, Vitreous body; *m*, *n*, Anterior and posterior chambers; *o*, Theoretical indication of the membrane of the equeous humour; *p*, *p*, Tarsi; *q*, *q*, Fibrous membrane of the eyelids; *r*, Elevator muscle of the upper eyelid; *s*, *s*, Orbicularis muscle of the eyelids; *t*, *t*, Skin of the eyelids; *u*, Conjunctiva; *v*, Epidermic layer of this membrane covering the Cornea; *x*, Posterior rectus muscle; *y*, Superior rectus muscle; *z*, Inferior rectus muscle; *w*, Fibrous sheath of the orbit (or orbital membrane); 1, Section of orbital arch; 2, Lachrymal gland; 3, Section of samal oblique muscle.

The middle layer is the principal and the thickest part of the cornea; it is fibrous, tough, unyielding and continuous, with the sclerotic; its external surface, in most animals, is covered with Bowman's elastic limitary membrane and its inner surface is separated from the internal layer of the cornea by Descemet's elastic limitary membrane.

The internal layer is composed of a single layer of many sided cells which contain large neuclei. The cornea has but few blood vessels. The vessels form loops around its border, and in the sheep they advance to the middle of its surface.

The middle coat of the eyeball consists of the choroid, the ciliary processes and the iris.

The choroid is a thin, vascular, dark colored membrane, spread over the inner surface of the sclerotic, investing the posterior four-fifths of the eyeball, and terminating, in front, at the ciliary ligament; there bending inward to form the ciliary processes.

The choroid is divided into two zones or unequal parts by the *ora serrata*—a zigzag line that corresponds to the point where the retina changes its character or near the anterior border of the retina. The posterior zone or part, in the horse, is not uniform in color, being perfectly black in the lower part; this is abruptly terminated at a horizontal line that passes about one-eighth of an inch above the place where the optic nerve passes through the sclerotic and choroid. From this line on the segment of a circle from two to three-fifths of an inch in height it shows most brilliant colors: at first blue, then an azure-blue, afterwards a brownish blue, and after this the remainder of the eye is occupied by an intense black. The bright portion, or upper half of the choroid is the *tapetum*. The anterior zone or ciliary part of the choroid includes the ciliary ligament and the ciliary body. The ciliary muscle circle or ligament is a grayish circular band of unstriped muscular fibres about one-sixteenth of an inch broad; the fibres are radial and circular, the former arises from the junction of the cornea and sclerotic to pass back to the choroid opposite the ciliary processes; the latter are internal and pursue a circular course arouud the place of attachment of the iris.

By the contractions of this muscle, it plays an important part in accommodating or adjusting the eye to the perception of objects at different distances.

The ciliary body forms a ring which overlaps before and behind the ciliary muscle and lies between the choroid and iris, or rather it connects the choroid to the iris.

The *ciliary processes* consist of 110 to 120 radiating folds formed by the plaiting and folding inward of the choroid at its anterior margin; these are received between the corresponding folds of the suspensory ligament of the lens.

The dark color of the choroid is due to the coloring matter, pigment in the cellular or internal layer of this membrane. The pigment absorbs the rays of light which pass through the retina and thus prevents their becoming reflected and confusing the vision. The brilliant metallic colored tapetum is generally observed in nocturnal animals (horse, etc.), and especially in the carnivora. It is believed that by reflecting rays of light a second time through the retina, it gives the animal a clearer and better vision at night.

This is the cause of the glare or "balls of fire" perceived in the eyes of the cat and other carnivora in the dark.

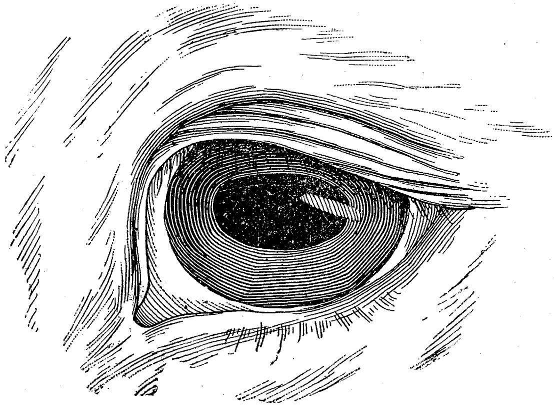

FIG. 2.
Normal Horses Eye (after Goubaux and Barrier).

The iris is elliptical in shape like the cornea; it is a thin, perforated, contractile curtain, suspended behind the cornea in the aqueous humor, in front of the crystalline lens, forming the anterior portion of the middle coat of the eyeball; it is composed of radiating and circular muscular fibres and a fibrous frame work. Its anterior surface is covered by a layer of polyhedral cells on a fine basement membrane; its posterior face is opposite the lens and ciliary processes, and is covered by a thick layer of pigment called the uvea; loose preduunculated portions of this pigmented layer may project through the pupillary aperture; they most frequently project from the superior border of the pupil and extend into the anterior part of the aqueous chamber, where they are known as "soot balls" or *corpora nigra.* These black, spongy masses may obstruct the passing of the light into the eye, but if they are small, little harm is done by them. These "soot balls" are brownish black and are larger when along the upper border of the pupil than when at the lower border.

The color of the eye depends upon the quantity of pigment in the uveal layer of the iris. In man, the color of the iris varies with the different individuals; while in the horse it is generally of a brownish yellow hue; sometimes, however, it is nearly white or bright gray—the animal possessing such eyes is said to be "wall eyed." The aperture or elliptical central opening in the iris forms the pupil, which is expanded or enlarged when the radial muscular fibres of the iris contract; and it is contracted or decreased in size when the circular muscular fibres contract. Strong sunlight produces contraction of the pupil; while weak light or darkness causes the pupil to expand.

The internal coat of the eyeball or shell is the retina. It lies on the inner surface of the choroid to which it loosely adheres.

This most essential, delicate, grayish, transparent, nervous membrane is thicker behind than in front, and extends as far forward as the ciliary body, terminating in a ragged edge—called the *ora serrata.* The retina is formed by the expansion of the optic nerve; the nervous elements are imbedded in and spread over a fibrous frame-work. At the point of entrance of the optic nerve is found, on the retina, a small oval elevation, known as *optic pupilla.* From its centre and its border emerge and radiate the blood vessels of the retina. This disc or elevation is the only portion of the retina where the sense of vision is wanting, and is, in consequence, called the *blind spot.* In the exact centre of the retina posteriorly corresponding to the axis of the eye, is a triangular yellow space called the *macula lutea*—the spot where vision is most distinct and perfect. The extreme complexity in the arrangement of the nervous elements of the retina may be partially comprehended by the fact that they are divided into ten different microscopic layers. These various nervous elements receive the impression of the inverted image or picture of the object or objects in the field of vision and the optic nerve conveys this impression or perception to the brain.

The humors or semiliquids of the eye are the Agueous Humor, the Vitreous Humor and the Crystalline Lens.

The agueous humor is a watery liquid that is found in the small chambers in front and behind the iris. It is secreted by Descemet's membrane, which lines the chambers containing the humor. This humor maintains the convexity of the cornea, facilitates movements of the iris and the lens, and, to some extent, assists in the refraction of the light passing through it to the lens and the retina.

If by surgical operation, accident or disease, this humor is permitted to escape from the agueous chambers, it is rapidly regenerated.

The crystalline lens is a double convex, clear, semi-solid body, and lies behind the pupil with its anterior surface immersed in the agueous humor and its posterior face imbedded in the vitrious.

The suspensory ligament extends from its periphery to the ciliary body and thus assists in holding the lens in position and establishes a union between it and the ciliary muscle. The lens is enveloped by an elastic capsule very like Descemet's layer of the cornea. The proper tissue of the lens is arranged in concentric layers that under the microscope are found to be composed of fibres; the external layers of the lens are almost liquid, but they gradually increase in hardness toward the center. The lens receives neither blood vessels nor nerves; it absorbs its nutriment from its capsule through a delicate layer of cells on its surface.

The anterior surface of the lens is flatter or less convex than its posterior surface. By the contraction of the ciliary muscle the convexity of the lens is changed and the degree of refraction varies; thus the eye is adjusted for, or made to accommodate itself to, different distances. The chief use of the lens is to refract (change the direction of or bend) the rays of light, which enter the eye. It causes the rays to converge or unite or focus upon the retina.

The vitrious humor occupies about two-thirds of the interior of the eye—all of the cavity of the eye behind the crystalline lens. It is transparent, colorless, jelly-like in consistency and contains a few embryonic cells, while its major part is amorphous or without distinct parts. The hyaloid membrane envelopes the vitrious mass and is in contact externally with the retina and the posterior convex surface of the lens. This humor assists in the refraction of light. If it escapes, it is not regenerated.

The accessory organs of the eye are the Orbital Cavity, the Muscles of the Eye, the Eye Lids, the Membrane Nictitans and the Lachrymal Apparatus.

The orbital cavity is situated at the side of the head, near the union of the cranium and face; it has the form of a long and fibrous cone open at the base or in front, with the optic nerve entering the small foramen at its âpex or back part.

The muscles of the eye are seven in number: the posterior, the superior, the inferior, the external, the internal, the superior great oblique and the inferior small oblique. These muscles all lie in the orbital cavity behind the eyeball; their posterior ends are attached to bony walls of the posterior part of the orbital cavity; while their anterior ends are attached to the surface of the sclerotic—each one to that part of the sclerotic surface indicated by its special name.

The eyeball is turned upward, downward, outward, inward, etc., according the contraction of one of these special muscles. If the internal muscle is stronger or shorter than the external the eye is turned inward, and if held in that relative position constantly the condition of "cross eye" is produced.

The protective organs of the eye are the eye lids and the membrane nictitans. The eyelids are two movable curtains covering and protecting the front of the eye. They are attached by their external borders to the rim of the bony orbit; their external surfaces are covered by the skin; their internal faces are moulded on the anterior surface of the eye, and are lined by the conjunctiva—a mucous membrane which is also reflected above and below on the eyeball—(the conjunctiva is very sensitive and vascular and is painfully irritated by small seeds, particles of dirt, etc., that may get "into the eye"). The framework of the lids is formed by a fibrous plate attached to the orbital rim and terminating at the free border of each lid by a small tendinous arch called the tarsus. Attached to the outer surface of this fibrous plate, common to both lids, is the orbicular or sphincter muscle of the eyelids, which by its contraction "closes the eye" or brings the free borders of the eyelids together. The elevator muscle pulls the superior lid upward, and the lower lid drops when the orbicular muscle ceases to contract; thus the eye is opened.

On the outer part of the free border of the upper lid are large eye lashes—but the lashes of the lower lid are fewer in number and smaller. On the inner part of the free border of each lid are little oil glands which lubricate the free margins of the lids and keep them from growing together or adhering to one another during sleep.

The membrana nictitans, third eyelid, the "haw," or the eye washer," is placed at the inner angle of the eye; its framework is a fibro-cartilage, elastic and irregular in shape, thick at its back part, and thin at its anterior or free part, which is covered by the conjunctiva. This lid is continued behind by a strong, fatty cushion, which insinuates itself between all the muscles of the eye. This lid is moved over the anterior surface of the eyeball to remove dust particles, small seeds, etc. It has no special muscle, but is pushed over the eye when the eyeball is drawn backward into the orbital cavity or socket by the posterior muscle of the eye. When this lid is continually drawn, or pushed out, over the eye, as in tetanus, lock jaw, etc., some persons say the horse is affected with the "hooks;" and occasionally the barbarous treatment of cutting off these protecting and useful lids is practiced. It would be about as sensible to cut off the hands of a man to keep him from rubbing his eye when it becomes irritated by dust, etc.

The Lachrymal Apparatus comprises the gland which secretes the tears and the canals which carry the extra tear fluid to the external openings of the nasal cavity. The lachrymal or tear gland is situated above the eyeball and below the rim of the orbit; it secretes the tear fluid which is carried to the surface of the eye by little ducts or canals that open in the inner surface of the eyelids. The tears are spread over the eye by the movement of the lids called winking. At the inner or nasal angle of the eye is a little round body, usually black or brown; it is a fold of the conjunctiva and is designed to direct the tears toward the opening, located in each eyelid near the internal angle, by which the tears pass into the lachrymal ducts that carry the superfluous tears to the lachrymal sack. This tear sack is a little reservoir which receives the tears from the ducts of the upper and lower lids, and passes the tears into the lachrymal canal. The lachrymal canal passes downward and slightly inward, at first through a bony canal, and terminates on the inner surface of the outer wing of the nostril; the opening or orifice of this canal looks as if it were punched out of the tissues and is sometimes mistaken for an ulcer.

DISEASES OF THE EYELIDS.

Tumors of various kinds are occasionally found on the eyelid. The upper lid is a favorite place for warts—diseased, excessive growths of the outer layers of the skin. The exciting cause of warty growths is at present thought to be a very minute plant or animal parasite. It is best to excise them with the knife; or, if small, to snip them off with the scissors, being careful not to cut deeper into the eyelid than the thickness of the skin. After the bleeding has partially ceased and the blood has been wiped away with a clean, moist sponge or cloth, the raw surface may be touched or cauterized with lunar caustic or a small pledged of cotton dipped in strong carbolic acid. Melanotic (black, pigmented) tumors are occasionally found on the eyelids of white horses. If they are small and are removed in the early stage of growth, they are not so liable to return; but if they involve considerable tissue or are of long existence, they are very liable to return after removal. All small tumors of the eyelids may be removed in a manner similar to that described for warts.

Pedunculated tumors may be ligated by tying a strong cord around the pedicile close to the skin; if it does not fall off in a few days another strong thread may be tightly tied around it at the same place. Caustic medicines (Lunar Costic or Tri-Chlor-Acetic Acid) may be applied, once every four or five days, until the tumor can be pulled away by the fingers. Care must be taken not to get these caustics into the eye; it is best not to use caustics except on tumors with large, thick bases that cannot be ligated or excised.

WOUNDS OF THE EYELIDS.

These occur through bites, tearing on nails, harness, hooks of snaps, barbs of wire fences and other projecting points, about the stable or stall. If the wound is fresh the edges may be brought together by stiches one-third of an inch apart; ordinary white silk thread may be used.

INFLAMMATION OF THE EYELIDS.

Various injuries and bruises of the eyelids may occur when a horse is rolling or throwing his head during colic attacks, or other painful diseases; or neighboring tissues may be injured or bruised and the inflammation extend to the eyelids.

The writer has repeatedly observed the eyelids of cattle attacked by ringworm, a transmissable parasitic disease of the skin, causing not only inflammation of the eyelids but also of the conjunctiva, extending at times to the cornea.

Constitutional diseases (authrax, Texas fever, purpura) may be attended by swollen and inflamed eyelids. Small wounds may admit germs into the tissues of the eyelids and produce inflammatory swellings.

Inflammation, resulting from wounds, bruises, etc., may be reduced by bathing the eye in cold water and applying antiseptic solutions. In ringworm the crusts and scales must be washed and scraped from the skin and then a one per cent. solution of corrosive sublimate may be applied, once per day for three or four days. Other parts of the body and other animals affected with ringworm must be treated in the same way; since this parasitic skin disease is transmissible. Inflamed, swollen eyelids from constitutional diseases may be remedied by treating the disease with which they are associated.

ENTHROPITM—FOLDING INWARD OF THE LID.

The free margin of the lid is folded in against the eyeball; generally the entire margin of the lid is rolled inward, but, at times, only that half near the inner or nasal angle of the eye is thus affected.

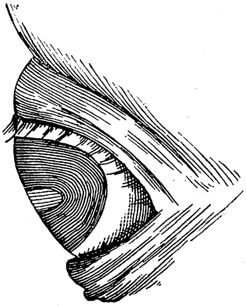

FIG. 3.

Entropium—Folding inward of the lower lid; the eye-lashes and hair rub over the conjunctiva and cornea, when the eye lid or eye-ball is moved, producing inflammation by constant friction.

This disease occurs most freqently in the dog but occurs also in the horse, the ox and the sheep. It has been observed in some animals at birth; and, no doubt, a tendency toward this disease is inherited—especially among dogs. Spasmodic contractions of the orbicular muscle that closes the eye, a relaxation or loose condition of the skin and an excessive development of the skin and tarsus of the lid, are said to be prominent factors in producing entropium. Scar tissue—resulting from wounds, ulcers, etc., on the inner surface of the lid—contract, or make tense, the conjunctiva to such a degree that it pulls the free border of the lid inward; while the contraction of the orbicular muscle (in winking) would roll or fold the lid.

One or both lids of one or both eyes of the dog may be affected; but, as a rule, only the lower lid of one eye in the horse is so diseased. The constant friction, occasioned by the continual rubbing of the eyelashes over the conjunctiva and the cornea, produces great irritation, which, if long continued, results in inflammation. The conjunctiva becomes conjested, light red and slightly swollen; the cornea may be clouded and at times ulcers form on its surface; the tears flow in excess; and the animal constantly attempts to close the eye. As soon as the lid or lids are returned to their normal position, the inflammation, cloudiness, etc., begin to disappear and the eye to retain its normal condition. Treatment consists in removing by excision a portion of the relaxed and loose skin. In the horse a strip of skin, one-fourth to one-half inch broad, is cut away parallel to, and about one-half inch from, the margin of the lid. The elliptical strip may be removed by using small, sharp shears. The free edges of the skin are then brought together by silk stitches, about one-half inch from one another. As a rule, in the course of a week the stitches may be removed. In the dog the relaxed skin may be excised much farther from the margin of the lid and the gaping wound may be left to heal without bringing the edges of the skin together with stitches. It is, however, safer and better to stitch up the wound.

ECTROPIUM—ROLLING OUTWARD OF THE LID.

In this disease the eyelid is drawn away from the eyeball, the conjunctival surface turned outward, the free border (lower lid) downward; the eyelid is rolled outward and downward, leaving the eye unprotected, subject to constant irritation from air and dust and rapid evaporation of tears. This condition produces chronic inflammation of the conjunctiva and leads to the formation of clouded spots and vascularity of the cornea. This disease also occurs most frequently in dogs, but may appear in the horse, ox and sheep. It is caused mostly, in the horse, by scar tissue in the neighborhood of the lower eyelid; this makes the skin so tense that the traction pulls the lid from the eyeball. Inflammatory swellings and new growths on the conjunctiva may also cause it. Dogs with deep set eyes and in a poorly nourished condition suffer with this disease. Ectropium is treated by cutting away a narrow strip of the conjunctiva parellel with margin of the lid. The shears may be used, but no stitches are required.

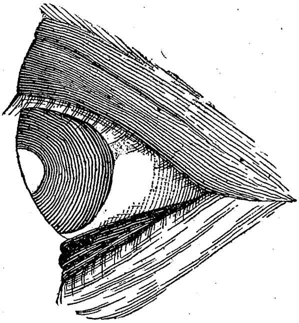

FIG. 4.

Ectropium—Folding outward of the lower lid.

PTOSIS—FALLING OF UPPER LID.

When the upper lid hangs abnormally downward and outward from the eyeball, without folding or rolling, it is called drooping of the lid or Ptosis. It is usually associated with paralysis of the facial nerve, and may occur on one or both sides. In paralysis of both nerves there is constant dribbling of saliva, paralysis of the lips, the nostrils and the upper eyelids. This is said to result from an injury of the facial nerve or some of its larger branches. The injury is usually produced by bruises or due to pressure of the bridle or of a yoke. In the first stages of the paralysis, it may be improved by reducing the inflammation or by removing the pressure on the nerve or its branches. But, as a rule, paralysis of one or both facial nerves is incurable. Yet the drooping of the eyelid may be removed by a surgical operation too complicated and difficult for unskilled hands.

DISEASES OF THE HAW OR MEMBRANA NICTITANS.

The conjunctival mucous membrane which covers the haw may be inflamed when the other parts of the conjunctiva are diseased. Also the haw may be pushed out over the eye when the eyeball is drawn back into the socket, which is done in certain eye diseases and for protection. In such cases uninformed persons say the horse has the "hooks" and at once proceed to cruelly cut them out. It is scarcely necessary to remark that nearly every case of so-called "hooks" is only a symptom of another disease and would certainly disappear if the real disease were removed.

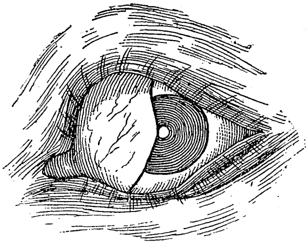

FIG. 5.

Abnormal extension of the haw or "eye-washer" as observed in tetanus (lockjaw) inflammation of the haw, etc. This continued projection of the haw, is many times called "hooks."

In some instances the haw is injured by being torn at the upper part of its free margin or it may be torn or cut in other places by injuries. Nearly all cases of injury recover without treatment, but should the separated or divided haw continue to irritate other parts of the eye, it may be removed. Occasionally tumors appear on the haw or eye-washer; if small and harmless they may be left undisturbed or clipped off with the shears; but if large and harmful, the entire haw (if necessary) may be removed. In cutting away the torn haw, or the tumor and haw, the animal should be securely and safely confined (by casting or otherwise) and a few drops of a ten per cent. solution of cocaine may be put into the eye; after waiting a few minutes for the cocaine to take effect, the haw or tumor may be grasped with small forceps and completely excised with the shears; during the next few days cleanse the eye, two times per day, with warm water, and a one per cent. solution of carbolic acid. After repeated or severe attacks of inflammation of the conjunctiva, or repeated attacks of moonblindness, the haw remains more prominent and farther projected over the eyeball than normal. In tetanus, or lock-jaw, in horses, the haws are partially or completely extended over the eyeball—especially on exposure to strong light or when the head is elevated.

DISEASES OF THE TEAR APPARATUS.

In all cases where the tears are running down over the side of the cheek and there is no swelling or redness of the lids in their normal position, it is wise to examine carefully the lachrymal or tear apparatus. Most frequently the lachrymal canal is obstructed at its opening into the nostril; this may be relieved, as a rule, by removing the dirt and pus-like matter which clogs the opening.

Sometimes the canal is obstructed in its superior part near the tear sack; then it is best to inject by means of a small syringe, carbolized water or a two per cent. solution of boracic acid, into the canal at its lower or nasal opening. If the tear canal, tear sack and tear ducts are open or pervious, the water will pass out at the tear points near the inner angle of the eye on the margin of each lid. Occasionally the canal or the tear ducts are obliterated, resulting from catarrhal or infectious inflammation and from fractures of bones along the course of the canal. In such cases it may be made pervious by forcing a small silver probe into the canal; but sometimes the canal is so completely obliterated that it is impossible to open the old passage way for the tears. When the conjunctiva or the eye lids are inflamed and when the under lid is everted in ectropium, the openings of the tear ducts are closed or are so displaced as to prevent the passing of the tears into the ducts. After recovery from these diseases, the tears cease to flow over the cheek.

DISEASES OF THE TISSUES SURROUNDING THE EYE AND IN THE ORBITAL CAVITY.

Fractures, bruises and wounds may take place in the bones and tissues surrounding the eye, and must be treated according to the conditions presented. Generally speaking, continual application of cold water baths or fomentations to the injured parts will materially reduce and prevent inflammation. Tumors or new growths of various kinds may appear in the orbital cavity outside of the eye ball. As a rule, they are very serious and eventually necessitate the removal of the eye ball with its surrounding tissues and sometimes requires excision of the eye lids and the skin with other tissues in the neighborhood of the eye. Whenever cancerous growths begin to spread or extend to the parts around the eye it is well to cut away all the parts involved. Such malignant growths are liable to return, even after several removals. Deep seated, spreading tumors of the orbital region should always be considered as very serious and as nearly always incurable without complete incision.

DISEASES OF THE CONJUNCTIVA.

Conjunctivitis.—Inflammation of the mucous membrane lining the eye lids and reflected over the eye ball around the cornea.

Causes.—1. Mechanical and chemical irritants.—Small seeds, pieces of hay, straw, glumes, wheat or barley beards, small insects, coal dust and other kinds of dust, sand, hair, smoke, entropium, parasites—all foreign bodies that act as mechanical or chemical irritants may produce conjunctivitis. Not infreqnently has the writer observed this disease in a very severe form, resulting from injudicious and ignorant application of caustic and blistering salves, liniments or quack eye washes. Striking the animal in the eye with a whip, or stick; bruising or wounding the eye lid or parts near the eye may excite inflammation in the conjunctiva. Cold, sharp or excessively dry winds may also cause it.

2. It is associated with other diseases, as—ulceration of the cornea, periodic opthalmia, occasionally with Texas fever and anthrax, influenza, strangles (distemper in horse), rinderpest, and, now and then, in the course of other infectious diseases; often it is associated with catarrhal inflammation of the mucous membrane of the nasal passages, sinuses of the head and of the lachrymal canal and ducts. Inflammation of the conjunctiva and the cornea is quite often observed in sheep when they are affected with "head scab," or parasitic skin disease, confined to the short wool regions of the sheep. Conjunctivitis is also associated with sheep pox. Cattle are attacked by an enzootic inflammation of the conjunctiva and cornea, which is considered in detail under diseases of the cornea. Diptheritic conjunctivitis appears in fowls.

Symptoms.—On the irritated and inflamed spot of the conjunctiva there will be red streaks of strongly congested blood vessels, the mucous membrane will be slightly swollen; this inflammation may in a short time extend to all parts of the conjunctiva and involve the circumference of the cornea; the eye is very sensitive to light, and is kept closed continually. During the early stages the secretion of tears is greatly increased and they flow in profusion over the cheek, but during the more intensive or severe inflammation a mucus exudate appears, which is of light gray color and contains small semi-transparent flaky particles. If the inflammation is still more severe the exudate or secretion appears as a grayish yellow or a green fluid which consists of pus cells and tears. At one time, in severe cases, the secretion may be pus mixed with serun, and at another it may be pus mixed with mucus. An organized membraneous exudate is present in diptheretic conjunctivitas and to a limited extent in fallicular conjunctivitis. The superficial layer may be involved in severe cases, while in other instances all the layers and the submucous tissue may be involved in the inflammation; these distinctions are not always well defined; but as a rule, great intensity and long duration of the inflammation indicate that the entire conjunctiva and submucous tissues are affected.

TREATMENT.—The first thing to do is to remove the cause if it can be discovered. If the animal is very sensitive about having the eye examined, it is best to put a twitch on his nose. Place the thumb on the lower lid and the index finger on the upper; by gradual and firm pressure, open the eye and look carefully for a hay seed or any foreign body or irritating particles that may be in view. After completely cleansing the index finger and removing the long, rough or sharp margin of the finger nail, it may be pushed around under the lids and under the haw in search of the irritant; this must be done with great care, and it is always best to put a few drops of a three per cent. solution of cocaine into the eye before introducing the finger. Following this search and the removal of the irritant, the eye may be washed with pure cold water or with a solution of corrosive sublimate 1 part and pure water 5000 parts. Bathing the eye in very warm water will relieve the pain and sensitiveness; while cold water fomentations will remove the fever. A great many cases of conjunctivitis readily yield to the simple method of adjusting a large, clean wet cloth over the eye, keeping it moist by pouring cold water on it every hour. It is generally best to put the animal in a dark stall, but unless such a place is well ventilated I prefer the open and well ventilated box stall. The following prescription has met with great favor in Germany:

Borax, 6 grains; Aqua Amygdalæ Amaræ, 2 drachms; Gum Arabic, 2 drachms; Pure Water, 2 ounces. Apply to the conjunctiva by putting several drops into the eye twice per day.

In purulent conjunctivitis, when pus is present in the eye secretion, one may employ corrosive sublimate 1 part, water 1000; or nitrate of silver 4 grains and water 1 ounce. In a few seconds after applying the nitrate of silver solution, the eye may be washed with a weak watery solution of common salt; this checks the burning irritation of the silver nitrate. It is safer to use the solution of corrosive sublimate. Diptheritic conjunctivitis develops in chickens, doves and other fowls that are affected with diptheria of the mouth, the throat and the nose. The healthy should be separated from the diseased fowls; the diptheritic membranes should be removed from the mouth and eye; and the mucous membranes should be covered or penciled over (by means of a feather or small brush) with a 1 to 2 per cent. solution of corrosive sublimate or with 1 to 2 per cent. solution of silver nitrate. In 20 to 30 seconds after applying the nitrate of silver solution, bathe the eye and other affected parts with a weak solution of salt water. When chronic inflammation of the follicles of the inner surface of the haw is present, it may be relieved by using a 1 per cent. solution of corrosive sublimate; this should be applied as previously directed, being very careful that the fluid does not come in contact with other parts of the eye. As a rule, follicular conjunctivitis occurs only in dogs. When it will not yield to medical treatment, the inflamed follicular spots are clipped off; or part or all of the haw may be removed. Nitrate of silver solutions should be discarded in all cases where the cornea is also involved, since it is liable to leave permanent opacities of the cornea.

DISEASES OF THE CORNEA.

WOUNDS.

The transparent cornea may be injured by a stroke of the whip, by hard straw or hay stems, by thistles, and occasionally by sharp objects—glass, nails, splinters, hedge thorns, and wire barbs. Small rough or sharp objects that get into the eye not only injure the conjunctiva but also may scratch or even penetrate the cornea. In fact, many of the chemical and physical causes of injuries to the conjunctiva in like manner effect the cornea.

The shunning of light by closing the eye and an extra secretion of tears are always present during the active stages of the inflammation. The seriousness or severity of an injury depends upon the extent of surface affected and whether the outer or middle layers are separately or conjointly injured; or whether the entire thickness of the cornea is perforated. If there be but a small spot of the outer layer injured, recovery takes place in a few days, by keeping the eye covered with a clean cotton or linen cloth saturated in a solution of 1 part carbolic acid to 100 parts of water. If the deeper or middle layer of the cornea be injured, it will require more time for healing and is liable, in the horse, to leave a scar—a whitish upaque spot. Treatment may consist in the continued application of the 1 per cent. carbolic acid solution, or in applying continually a cloth saturated with a solution of 5 to 10 parts of antipyrine and 100 parts of water. After the painful and feverish stage is past a few drops of a solution of 2 parts of potassium iodide and 100 parts of water may be used two times per day. If the cornea be perforated the aqueous humor escapes, and this leads, in most cases, to inflammation of the entire eye, resulting in loss of sight and generally in the destruction of the eyeball.

Occasionally a perforating wound heals by granulation, the iris becomes free and sight is restored. But most frequently in such cases the iris remains attached to the wound or scar tissue of the cornea and prohibits the light from passing into the eye. If the perforation is near the margin of the cornea, a few drops of a solution of 1 gr. of eserine to 1 ounce of water may be applied, two times per day. But if the perforation is near the centre of the cornea a few drops of a solution of atropine 1 gr. to water 1 oz. may be used, night and morning. By the use of eserine the pupil is contracted and the free borders of the iris are taken away from the marginal wound in the cornea. By the use of atripine the pupil is expanded and the borders of the iris are removed from the edges of the central corneal wound. Infectious and general inflammation of the eye may be obviated by adjusting over the eye a cotton or linen cloth moistened every half hour with a solution of carbolic acid 1 part to water 100 parts; or corrosive sublimate 1 part and water 1000 parts.

KERATITIS OR CORNEITIS.

INFLAMMATION OF THE CORNEA may involve the superficial layer, or the middle layer of the cornea; it may embrace only part of the cornea or may be diffuse—extend over the entire cornea. The partial or limited form is generally the result of injuries of the cornea. The friction of the eyelashes in entropium, small sharp substances, and irritating salves, are common causes of local inflammation of the cornea. Diffuse inflammation is associated, as a rule, with infectious conjunctivitis in cattle and sheep; and, at times, appears in the course of cow-pox and sheep-pox, and of diptheria in fowls; and in the course of influenza and the acute attacks of moon-blindness, in the horse.

Symptoms when the outer layer alone is affected: As soon as the cornea becomes inflamed, the animal avoids the irritating light by partially or entirely closing the eye, and tears flow down over the cheek. The cornea becomes opaque at a not sharply limited spot or over its entire surface; this opacity may be grayish blue, gray or light gray in color. One may see this opacity best by viewing it, not from directly in front of the eye, but from one side. If the inflammation is of long duration blood vessels will be found in the cornea, which may be seen in their conjested condition near its border. When the opacity and the other symptoms appear suddenly (without blood vessels forming in the cornea), recovery is quite certain to occur in a few days. The darker the opacity or cloudiness the weaker the infiltration or the less damage in the cornea to be repaired. Light gray and white colored opacities denote intensive changes which require eight to ten days for their complete removal. If blood vessels form in the cornea of the horse, a permanent opaque spot may remain; but in the dog the complete removal of the opacity will usually occur.

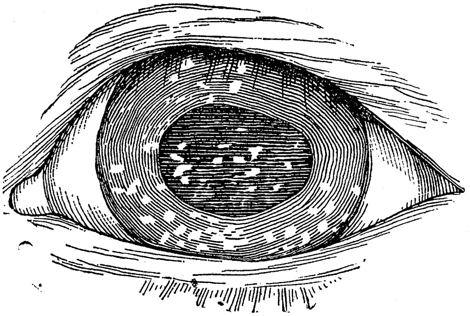

Fig. 6.

Keratitis Punctata—Inflammation of the internal or posterior layer of the cornea produces a spotted apacity; the dots or opaque white spots may be larger or smaller than those in the cut and may extend over the entire surface of the cornea. Another form of keratitis punctata is developed as mentioned in the text.

If the middle layer or principal part of the cornea be inflamed, the opacity develops slowly, is grayish blue, gray or light gray in color. The opacity is generally irregular in form—cloudy, striped or ray shaped; these points or spots extend over the entire cornea. When inflammation produces such spotted or irregular dotted opacity, it is designated *keratitis punctata* (see Fig. 6). This spotted appearance of the cornea is due to the dotted opacities in the outer layer while the inner layer may be evenly clouded in all its parts. The deeper seated opacity may be observed by viewing the cornea from one side; this is perceived best by illuminating the eye in a dark stall or room. A yellow colored, sharply limited opacity, announces the formation of a corneal abscess.

Shunning the light and an excessive flow of tears are always present during inflammation of the outer surface of the cornea or the formation of an abscess. In acute cases the opacity may entirely or partially disappear in three to six weeks. Should the opacity continue longer, from improper treatment or non-disappearance of the cause, vascularization (formation of blood vessels) with abscess formation or ulceration of the cornea appears; thus the prospects of recovery are decreased, while the danger of a pus-like exudate appearing in the agueous humor or the perforation of the cornea increases. Not infrequently do these bad results appear in cow-pox, sheep-pox or infectious conjunctivitis and keritities among cattle and sheep.

TREATMENT.—Examine the eye critically, being especially careful to discover and remove any irritating foreign body or particles. Bathing the eye in very warm water twice per day and then adjusting over it a clean cloth, saturated with a 1 per cent. solution of carbolic acid, will, in most cases, be sufficient. But, should there be an abscess or an ulcer present, the cloth might be saturated with a solution of corrosive sublimate 1 part and water 1000 parts; and during the reparative stages warm water baths night and morning, and the application of the following salve, will aid in the removal of the opacity: Calomel, 30 grains; iodoform, 30 grains; vaseline, 5 drachms. Instead of this salve one may apply with a feather a small quantity of equal parts of pulverized calomel and iodoform.

INFECTIOUS CONJUNCTIVITIS AND KERATITIS, OR INFECTIOUS INFLAMMATION OF THE CONJUNCTIVA AND CORNEA.

This eye disease is most frequently found in cattle, but may appear in sheep, horses and goats. It is said to occur only during the summer months, but the writer saw it in a herd of cattle in February and March in south-eastern Iowa. That winter was exceptionally warm. It attacked cattle of all ages; but calves and the young cattle seemed to be predisposed to it. A number of young colts, running in the same field with the cattle, were similarly affected. Several outbreaks of this eye disease have been reported to me as occurring during the spring and summer months of 1892, in Alabama.

The disease announces its presence by an increased flow of tears; the eyelids are closed and slightly swollen. The conjunctiva becomes swollen, its blood vessels conjested and, in severe cases, a purulent discharge appears.

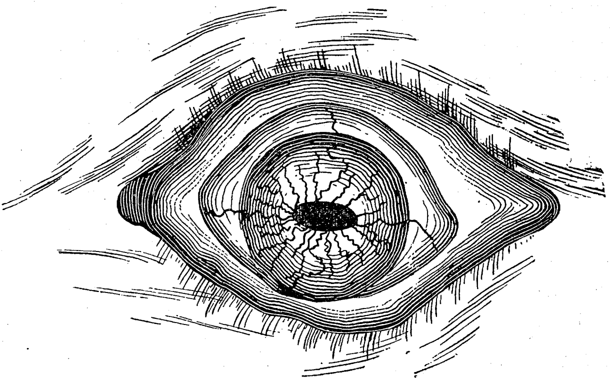

FIG. 7.

An illustration of an abscess and the attending vascularization of the cornea as observed in infectious keratitis and conjunctivitis in cattle. The black spot in the cut represents the yellow abscess and the radiating lines the blood vessels in the cornea.

Young animals seem to have a general fever, hanging of head, loss of appetite, and consequent emaciation; loss of appetite, etc., is most probably the result of pain instead of fever. These symptoms continue to increase for the first eight or ten days. About the third day from the first appearance of the disease, the cornea will exhibit a small delicately clouded spot, near its centre, which will gradually extend over the entire cornea, giving it a milk white appearance. The centre of the opaque cornea is at first pearly white in color, but in a short time a straw colored or yellow spot appears; this spot signals the formation of an abscess. The cornea at the yellow spot is rough and surrounded by a wall of thick, swollen, pearly white tissue. From this yellow centre (see Fig. 7) numerous blood vessels take their course toward the sclerotic border of the cornea. The yellow centre is generally longer from side to side, shorter from above to below, and is said to be occasionally mistaken for "an oat grain in the eye" by uninformed laymen. The abscess generally erupts or breaks open on the outer corneal surface leaving an ulcer to heal by granulations forming over its sides and bottom. In cattle, as a rule, the scar tissue is entirely removed and the cornea becomes clear and completely normal. However, in horses and occasionally in cattle a permanent pearly white opacity remains, causing partial or complete blindness. Some cases do not advance to the stage of abscess formation; in others the abscess may not erupt; while in still others the abscess may be so large that when it breaks open, the pressure of the aqueous humor against the remaining thin portion of the cornea will perforate it; this sudden removal of pressure on the lens may rupture the capsule of the lens and permit it to escape; the entire eye is thus involved, resulting in total loss of sight and of the eyeball.

The cause of this spreading eye disease is unknown, yet there are indications that point towards a germ or a microorganism as an exciting cause. Billings claims that it slowly extends over a herd from one animal to another; one eye may be at first affected, but in a short time the other eye is attacked. According to some of the German authorities the disease spreads quite rapidly—in a few days attacking 50 in a herd of 300; in 7 days attacking 20 in a herd of 40.

TREATMENT.—Separate the sick from the healthy; apply a solution of corrosive sublimate 1 part, water 2,000 parts; saturate a clean cotton cloth with the above solution and adjust the cloth over the eye; keep the cloth moist with the solution. During the purulent discharge from the conjunctival sack, the eye may be washed night and morning with warm water.

ULCER OF THE CORNEA.

Loss of substance or destruction of a limited portion of the cornea may result from the erupting of a corneal abscess, as in infectious keratitis; it may also appear in suppurative inflammation of the conjunctiva or cornea, and it is occasionally found associated with influenza in the horse; very often it is observed in the course of influenza (distemper) in the dog.

Ulceration of the cornea appears to be caused by an infectious or contagious microbe, since the disease is transmitted from one eye to the other, and occasionally appears as a disease that may extend to a number of animals in a locality.

An ulcer may appear near the center of the cornea or near its border; the cornea surrounding it is generally opaque; the bottom of the ulcer may be greenish yellow or gray white in color; the borders of the ulcer are, in the early stage, so abrupt that it appears as if it had been cut out with an iron punch. It may extend in depth to the internal layer of the cornea, then the reparative process may begin. Shortly after the formation of the ulcer, the cornea becomes vascular; the blood vessels give the opaque cornea around the ulcer a reddish tinge. As soon as the developing blood vessels reach the advancing borders of the ulcer the process of repair begins and continues slowly until the ulcer completely disappears, leaving behind a pearly white scar in the horse, but in the ox and the dog this opacity is, as a rule, removed.

If the ulcer is located near the border, the healing process progresses more rapidly than when it is in the centre of the cornea, because the developing blood vessels can reach the ulcer sooner and thus check its advancement. If the internal layer of the cornea is destroyed by the penetrating ulcer, the inflammation extends to all parts of the eye ball and generally results in loss of the entire organ.

TREATMENT.—Prof. Moeller very highly recommends aqua chlorata diluted with 2 or 3 parts of water. A solution of corrosive sublimate 1 part and water 1,000 parts may be employed; or a 2 to 4 per cent. solution of boracic acid. It is not advisable to use silver nitrate as it generally leaves a permanent opacity in the cornea. In examing the eye care should be exercised to prevent transmitting the purulent irritating discharge with its microbes, from the diseased eye to the healthy one. It is also best to separate the diseased animal from all others. If the cornea is perforated, a 1 per cent. solution of eserine or atropine may be used as advised in perforations of the cornea under the head of corneal wounds.

OPACITIES OF THE CORNEA.

Scar tissue, infiltrations and organized exudates that supervene or result from injuries, inflammation, ulcerations and abcesses are termed opacities. These opacities remain after the inflammation has subsided or after the wound or ulcer has healed, and are not to be confounded with the opacities attending active inflammation. Slightly foggy, weakly clouded, translucent, grayish blue or gray spots, not sharply limited, are mostly found in the outer layer of the cornea and are sometimes called *nebulœ.* If the opacity is semi-transparent, sharply limited, gray or milk white, it is designated *macula.* If the opacity is a dense, completely opaque, pearl white, gray or white, regularly distributed or in large spots or stripes, it is called a *leucoma.* There are also chalk-like, well defined opaque spots which are formed by using acetate of lead or silver nitrate with common salt, calomel or corrosive sublimate; insoluble precipitates are thus deposited in the corneal tissue. Black colored opacities may be spotted or cloudy and are due to bleeding from the vessels in the vascular cornea, or to adhesions of detachments of the pigmented iris; the latter may occur as a result of the attachment of the outer surface of the iris with the inner surface of the cornea.

The harm produced by opacities depend upon their location; an opaque spot in the center of the cornea cuts off more light than one located near the border. Total blindness is better (more safe) than partial blindness; hence, large and dense opacities are preferable to weak and diffuse opacities, unless the latter can be removed. Scar tissue, from ulcers, wounds or abscesses, can not be removed in the horse; it may in some instances disappear in the ox, but in the dog, it is, as a rule, entirely removed. Chalk spots, streaks or stripes, as a rule, are permanent—not amenable to treatment. Weak and superficial opacities may be improved and many times can be removed by judicious treatment.

The following ointment may be employed: Yellow oxide of mercury, 4 grains; atropine, 1 grain; vaseline 4 drachms. Put a small quantity under the eye lid; then with fingers on the outer surface of the lids work or move them around over the cornea in radial and circular directions. Finely pulverized calomel may be thrown into the eye by placing a small quantity in a quill and blowing it into the eye. This should not be repeated oftener than once per week. In case the horse will not permit the blowing of the calomel into the eye, it may be used in the form of a salve, by mixing it with vaseline. A salve of potassum iodide 10 grains and vaseline 1 ounce may be employed. Some authorities recommend massage treatment—placing two fingers upon the upper eye lid and with slight pressure moving it in a circular direction over the opacity. This massage treatment may be repeated daily unless signs of inflammation should appear.

STAPHYLOMA OF THE CORNEA.

The bulging forward and outward of the cornea is designated staphyloma. It may be partial or complete, depending upon whether a part or all of the cornea is involved. Thinning of the cornea by ulceration and eruption of large abscesses, so reduce the resisting power of the cornea that the intra ocular pressure (pressure of the aqueous humor, etc.) distends, projects or pushes the cornea outward. The scar tissue resulting from ulceration is also unable to withstand the intra ocular pressure and the cornea bulges forward, forming a partial staphyloma. A staphyloma from either of the foregoing causes is generally opaque, gray or white colored. In the healing of perforating wounds, the iris may adhere to the scar tissue, should the corneal scar then become distended it would carry with it the iris and the result would be called an Iris-staphyloma.

Occasionally intra ocular pressure pushes forward the entire transparent cornea.

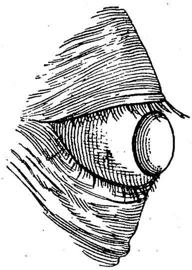

FIG. 8.
Total Corneal Stophyloma (after Armatage).

The treatment of staphyloma is mainly preventative. In impending perforations of the cornea from ulceration, wounds or abscesses, a compress bandage and a 1 per cent. solution of eserine may be employed. In cases of established perforation the eserine or atropine may be used as before directed for perforating wounds of the cornea. Proper treatment of abscesses, ulcerations and wounds of the cornea will also prevent the formation of a staphyloma.

NEW GROWTHS ON THE CORNEA.

PTERYGIUM (see fig. 9) is a peculiar fleshy growth consisting of an abnormal development from the conjunctiva. It has been observed in horses, dogs and cattle. Its usual situation is at the inner side of the eye ball; it is triangular, or fan-shaped, with the apex extending almost to the center of the cornea; generally it is loosely attached to the cornea and the conjunctiva. Sometimes it is present at birth and at times it results from the repairing of an ulcer near the border of the cornea. It is believed that animals exposed to smoke, dust, heat and slight injuries to the cornea are predisposed to its development. Treatment consists in removing the loose pterygium with the knife or shears; this should be done by a surgeon after the animal is cast or confined and a solution of cocaine is applied to the eye. The cornea usually remains opaque at the spot from which the tissue is removed. When a pterygium results from the contracting scar tissue pulling the conjunctiva over a part of the cornea, it should be left undisturbed.

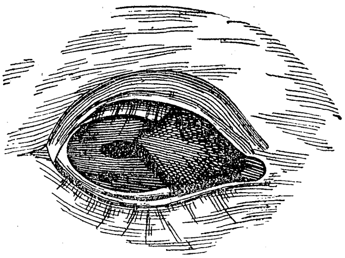

FIG. 9.

PTERYGIUM.—Fleshy growth on the conjunctiva and cornea (after DeSchweinitz).

A DERMOID is a small, skin-like growth, which usually appears on the nasal side of the eye ball, partly on the cornea and partly on the conjunctiva. The outer surface is generally covered with long hair that project outward between the lids. (See fig. 10).

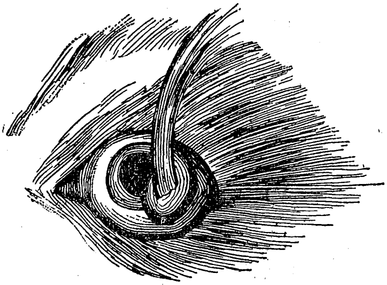

Fig. 10.

Dermoid.—Left eye of dog (after Gurlt).

It occurs in calves, pups, colts and lambs and is most frequently present at birth; but, according to some authors, it may be acquired after birth. The hairs interfere with the rays of light and the dermoid, as a whole, irritates the cornea and conjunctiva. Treatment consists in removing the dermoid by means of the knife or shears. The animal is cast and the eye is anesthized with cocaine; then the loosely attached skin-like growth is carefully dissected from the cornea and conjunctiva; a permanent opaque spot remains, but the constant irritating action is removed.

DISEASES OF THE IRIS.

Iritis or inflammation of the iris is generally associated with diseased conditions of the ciliary bodies, or the choroid coat; because, a close connection exists between these parts of the eye, in location, attachments and blood supply.

Iritis also appears in the course of inflammation of the entire eye ball, in periodic opthalmia (moon-blindness); it occurs also, in some instances, in connection with influenza, strangles (distemper), infectious inflammation of the lungs and pleura, in acute muscular rheumatism, in inflammation of the navel in young animals and occasionally in connection with catarrhal inflammation of the conjunctiva or ulceration of the cornea. Penetrating wounds or injuries near the margin of the cornea excite inflammation in the iris. Very rarely does iritis appear alone—without other parts being involved at the same time.

Owing to the fact that the iris is richly supplied with blood vessels, it is disposed to produce exudates, or to bleeding from its surfaces. The exudate may be flaky and gray, floating in the aqueous humor; or it may be pus-like and form a yellowish sediment at the bottom of the aqueous chamber.

These exudates may be tinged with blood or the entire aqueous humor may be colored by blood from the vessels of the iris. The exudates from the posterior surface of the iris falls between the iris and anterior or front surface of the lens; this pushes the iris forward; unless the iris is moved by the expansion of the pupil, the back or posterior surface of the iris becomes firmly attached to the capsule of the lens. The iris may, also, become attached to the posterior surface of the cornea; this frequently results from perforating wounds or ulcers of the cornea. The discoloration, swollen condition of the iris, and the flaky, purulent or bloody exudates can not be observed in many cases, because the cornea is so clouded or opaque. However, in the first or the last stage of such cases, one may be able to view the iris. During the "clearing up" period in moon-blindness one may observe the iris, faded somewhat in color, with its pupillary margin more or less ragged and irregular. Generally the tears flow in excess, dread of light and extreme sensitiveness are present during the active stage of iritis.

In the treatment of iritis the chief aim is to prevent the pupillary or free margin of the iris from forming attachments to the capsule of the lens or the posterior surface of the cornea. For perforations of the cornea directions for treatment have been given. To prevent adhesions to the capsule of the lens, the pupil may be kept expanded, during the active stage of the inflammation, by the use of atropine. The following has proven very beneficial in the hands of the writer: atropine 1 grain; potassium iodide 5 grains; pure water 1 ounce. A few drops may be put between the lids two times per day. The application of hot water will stimulate the absorbents and hasten the removal of the exudates and, at the same time, reduce the pain; while cold water fomentations will best reduce fever and inflammation.

CLOSURE OF THE PUPIL.

If the iris, *during the extreme contraction of the pupil*, becomes bound down to the capsule of the lens throughout its entire pupillary margin, it may leave a small, clear pupillary opening; this condition is denominated *exclusion of the pupil.* But if the pupil be completely obliterated during extreme contraction of the pupil when the iris is attached to the capsule of the lens, or the small pupil becomes filled in with an opaque, inflammatory deposit or exudate, the condition is termed *occlusion of the pupil.* The destruction of the pupillary attachment of the iris to the lens capsule is soon followed by the formation of a cataract—opacity of the lens. The anterior division of the aqueous chamber is completely separated from the posterior and the iris is bulged forward at all parts except at its marginal attachments to the lens capsule.

If the attachments of the iris to the capsule are not firm and solid, the iris may be torn loose by the use of atropine. In case that does not succeed, the iris may be mechanically separated or detached by a surgical operation; or a new pupillary opening may be made by the operation known as irodectomy. These operations can only be performed by a skilled surgeon and are, many times, done after the lens has become opaque or the operation is followed by opacity of the lens, destroying the vision. The writer observed a case of occlusion of the pupil in both eyes of a three year old horse that was brought to the free clinic at the experiment station in Auburn. The cornea and aqueous humor were transpaparent, and the occlusion was very probably a result of acute iritis. A strong solution of atropine was dropped into the eye but the iris was so firmly fixed it could not be detached.

Excessively developed or large "soot balls" "grape-like bodies," hanging from the inner aspect of the superior part of the free margin of the iris, interfere with, or obstruct, the passage of light into the eye. The large, brown, flake-like bodies are quite frequently the cause of shying and cases have been recorded where complete blindness appeared as a result of these "soot balls" entirely closing the pupil. By a surgical operation they could be removed; this should be attempted only by a skillful operator.

Some white horses possess such a high degree of sensitiveness of the eye to light that in clear sunshine the pupil is closed by complete conntraction and the animal cannot see until the sun sets.

CATARACT.

All opacities of the crystalline lens, regardless of size, origin or condition, are embraced by the general name cataract. A false or spurious cataract is produced by collections of pigment on the capsule of the lens, resulting from the tearing loose of the attachment of the iris to the capsule. It appears in dark, almost black, colored spots on the anterior surface of the capsule. True cataract means that there must be opacity in the substance of the lens or its capsule. If the opacity is in the substance of the capsule it is known as capsular cataract, and when in the substance of the lens, it is designated lenticular cataract. Lentiular cataract may be partial or complete; the former when a small portion of the lens substance is involved and the latter when the entire lens becomes opaque. The causes of cataract are various; and in some cases are not distinctly understood. Occasionally a cataract may be present in one or both eyes at birth. Heredity, no doubt, exercises a great influence in the production of cataracts during fœtal life and also predisposes an offspring to the disease in later life. Cataract frequently manifests itself in the course of diabetes mellitis (sugar in the urine) but there is no positive proof that the sugar in the system causes the cataract. Hemorrhages (bleeding) in the aqueous chamber lead to straining of the capsule; the coloring matter of the blood is deposited in the capsule and the dark colored opacity remains after the blood is absorbed or removed from the aqueous chamber. Disturbances in the nutrition of the lens in old age is said to be the cause of senile cataract. In old age the lens substance becomes more and more solid; this leads to irregularity in its density; also prevents changes in the curvature of the lens that are necessary in the adjustment, or its accommodation, to different distances. The constant straining of the eye to bring a hardened lens to the various positions or forms

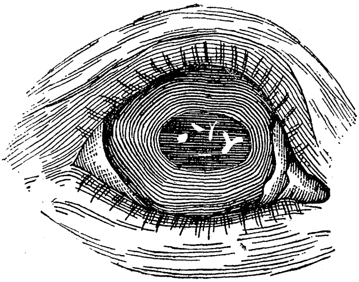

FIG. 11.

PARTIAL CATARACT (after Armatage).—The opaque spot or spots in the lens or its capsule may be seen through the pupillary opening. Spots in the cornea should not be mistaken for the deeply located opacities in the lens.

for different distances, would lead to perverted nutrition and possibly to inflammation, in the capsule, the lens, the ciliary ligament or ciliary bodies. The nutrition of the lens may also be perverted by inflammation primarily in the lens itself or from extension of inflammation in the iris, the ciliary bodies or the ciliary ligament, to the lens. Active inflammation in the lens or the surrounding parts, (from wounds, injuries or other diseases) generally leaves inflammatory products or deposits in the substance of the lens or its capsule, which form permanent opacities. Strokes on the head that produce sudden concussion are said to cause opacities in the lens. There are many cases of cataract, the cause of which cannot be determined; but the most prolific cause of cataract in the horse is periodic opthalmia (moon blindness). Straining the eyes to see objects in imperfectly lighted barns or stalls, no doubt, plays an important part in producing cataracts as well as other eye diseases.

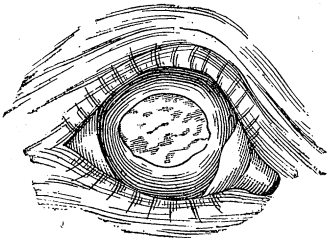

FIG. 12.
TOTAL CATARACT (after Armatage).—The opaque lens gives the entire pupil a grayish white color.

Occasionally small spurious cataracts of the capsule disappear, because of the great activity of the cells of the capsule. But opacity of the lens substance very rarely disappear; because changes in its structure take place very slowly for it contains no blood vessels or nerves.

Sometimes small gray specks may remain unchanged; but, as a rule, the little gray star like opacity gradually increases unil total lenticular or capsular opacity appears.

In examining the eye for a cataract one may readily see a gray, a bluish gray, a greenish yellow, a brown or a pearl white reflection in the pupillary opening; the form (star-shaped, cloudy, fog-like, feathery, streaked, or scattered dots, ball-shaped, etc.,) can be determined if the opacity be sufficiently developed. The exact location and form or the small, beginning white speck may not be visible to the observers unaided eye, especially out in the clear sunshine or when the ground is covered with snow. The animal should be placed so that the light falls upon the affected eye from a clear window or an open door in front of the animal. The observer then looks into the pupillary opening, standing in in front or to one side; it is well to observe the eye from various points of view. If the pupil is contracted or too small to admit of sufficient examination, a few drops of a solution of atropine (1 gr. atropine to 1 ounce of water) may be put into the eye to expand the pupil. The lens may, also, be examined by placing the animal in a dark room and illuminating the eye with a candle, or a candle and a double convex lens, or with a candle and a small concave mirror (see methods of examining the eye).

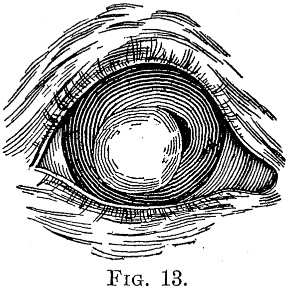

FIG. 13.

Luxuration (dislocation) of the opaque lens into aqueous chamber; the lens lies in front of the iris, almost completely obstructing the passage of the light through the pupil.

Treatment of cataracts in domestic animals consists chiefly in prevention. The reducing of all inflammations of the eye, the prevention of periodic opthalmia, keeping the surroundings of the animal in proper condition and maintaining sufficient light for the animal to see distinctly in all parts of the stall without straining the eyes. As a rule it is best to have the light enter the stall or barn from behind the animal, or from both sides. In man the opaque lens is removed by a surgical operation, and a double convex lens is adjusted in front of the eye thereafter. But this is impracticable among domestic animals, since the double convex lens can not be adjustad to the eye, and the eye would always be hypermetropic (farsighted), permitting the animal to see close objects indistinctly and therefore inducing it to shy or become frightened. However the opaque lens is occasionally removed in horses and dogs to eliminate the unsightliness of the cataract; but there is always more or less danger of losing the entire eye ball.

AMAUROSIS.

Paralysis (palsy) of the retina or optic nerve has been technically named amaurosis. This condition may depend upon tumors in the brain, injury to the optic nerve between the brain and the eye-ball, or inflammation of the retina. Parasitic cysts quite often appear in the brain of sheep and the amaurotic condition of the eye is a characteristic symptom.

Abscesses sometimes implicate the roots of the optic nerve and amaurosis supervenes. Temporary amaurosis is present during the intoxication period of lead poisoning; poisoning from *Kalmia latifolia* ("ivy"); during the comatose condition of the cow in parturient apoplexy (milk fever); and in congestion of the brain. Inflammation of the retina is nearly always present in moon blindness and occasionally it termiin paralysis of the retina—amourosis. Detachment of the retina from the choroid, hemorrhage from the retinal blood vessels, and emboli (plugging by clotted blood) of retinal blood vessels and excessive loss of blood, cause temporary or permanent amaurosis. If, in the course of inflamation, if the retina pigment is deposited in the retina, it produces night blindness—a condition that prevents the animal seeing at night. Extreme sensitiveness of the retina, as observed in Albinos and in some white horses, leads to day blindness. In such cases, the pupil is so nearly or completely closed that the animal can not see in clear sunshine, or when the ground is covered with snow; but during twilight, on cloudy days, and at night vision is normal. Amaurosis sometimes results from castration.

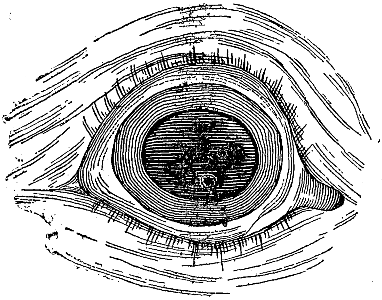

FIG. 14.

AMAUROSIS.—The pupil is greatly expanded, gray-blue in color and the eye appears bright, glassy, very clear (after Armatage .

In well established cases of amaurosis there is total blindness; yet there are no opacities in any of the tissues or humors of the eye. The eye is bright, clear, and perfectly transparent. The animal steps high, stumbles over, and runs against objects in its way. If, at a short distance, you noiselessly threaten to strike it, there is no winking or manifestations of fear. The ears are very sensitive to sound, and the outer ears are constantly on the alert to catch all noises. The pupil is expanded to its extreme limit; the iris is immovable and insensitive to light. Leading the animal from the dark into the light, or from the light into the dark, does not change the size of the pupil or move the iris; while in the normal eye the pupil expands in darkness and contracts on being brought to light. The pupillary reflex (the light reflected from the retina outward through the pupil) is, as a rule, grayish-blue; but may, at times, appear more gray than blue, or present a more or less distinctly green color.

TREATMENT.—When amaurosis is a result of another disease, it is evident that the disease of which it is a symptom should be treated. In cases of recent standing, good nutitive food, extra care and a nerve tonic (drachm doses of nux vomica two times per day) may be employed with advantage. But treatment of long standing cases always proves valueless.

GLAUCOMA.

This name is applied to several varieties of a disease whose chief symptom is increased ocular tension. The increased intro-ocular pressure is a direct result of the jelly-like vitrious humor becoming thin, more watery and greater in quantity. This condition may appear independent of any other disease, but it generally appears, accompanied by, or as a sequel of, inflammation in the choroid or the ciliary bodies. However, the exact cause in many instances is unknown. The extra amount of lymph or watery secretion within the eye has been explained in various ways. Some have claimed that it was due to obstructions in the intro-ocular lymph vessels, which carry off the extra amount of lymph; others have suggested that the extra supply of water was due to excessive secretion by the choroid, and especially the ciliary bodies. The development of glaucoma is slow, its course is nearly always chronic and of a more or less intermittent form. Old animals which have far-sighted (hypermetropic) eyes are predisposed to glaucoma.

SYMPTOMS.—Increased hardness of the eye-ball, or rise of intra-ocular tension, is the most prominent symptom. These conditions may be determined by placing the index finger of the right hand upon the upper lid of the left eye and the index finger of the left hand upon the upper lid of the right eye; then compare the tension or hardness of one eye with the other by palpating with the tips of the fingers; in increased hardness, firm pressure of the finger tip produces no impression; but the tension may be doubtful unless there is a marked difference in the impressions made upon the two eyes. The pupil is generally greatly expanded and the lens, as a rule, remains transparent, but may in rare instances be opaque. The depth of the anterior part of the aqueous chamber is diminished; the front surface of the iris is almost in contact with the internal surface of the cornea. The iris in some cases appears swollen and it is sluggish in movement or entirely inactive. The slight diffuse cloudiness of the cornea and the aqueous humor produces the sea green (glaucoma) color of the pupil. The episcleral and conjunctival vessels are more or less congested. But the excavation or sinking or depression of the optic nerve can not be seen without the aid of an opthalmoscope; this cupping of the optic disc is due to the intraocular pressure; the cup is called the glaucomatous cup and the yellow halo around it is known as the glaucomatous ring.

Treatment consists in preventing inflammatory adhesions between the iris and cornea by using eserine. Also, reduce inflammation of the iris, ciliary bodies and choroid, that may lead to glaucoma; this may be accomplished by using hot or cold water fomentations. A well developed case can only be relieved by irodectomy. If eserine is used constantly it must be in a weak solution (1-10 to 1-16th grain to one ounce of water.) Irodectomy consists in removing a portion of the iris; in glaucoma one-fifth to one-fourth of the iris should be removed; or what is known as the broad peripheral irodectomy can be done only by a skilled surgeon.

HYDROPTHALMUS.

This is an enlargement of the eye ball due mainly to an increased secretion of the aqueous humor, as in glaucoma. Sometimes the eye ball becomes twice its normal size; the cornea is generally so opaque that one cannot see the inner parts of the eye. In consequence of the enlarging of the eye ball the attachments of the lens are partially or entirely torn loose and the lens may float in the vitreous or the aqueous humor. The enlargement of the eye may appear suddenly, in twenty-four hours; or may advance slowly. Seldom is it relieved by treatment. Occasionally the cornea is ruptured and the eye ball lost. In the early stage, the cornea may be punctured, thus allowing the extra amount of aqueous secretion to escape; this has, in some cases, proven beneficial; however, it cannot be done by the novice or the inexperienced.

DISLOCATION OF EYE BALL—EXOTHALMUS.

The eye-ball may be pushed out of its socket by tumors that originate behind the ball; sometimes by bleeding, from deep penetrating injuries, congestion of blood vessels; by horns of cattle, by biting and scratching among dogs and cats, also by dislocation of the lower jaw in the smaller animals. Occasionally an animal has its eye dislocated by having it crowded out with a blunt stick or club in the hands of a cruel boy or attendant. If the eye is not lacerated, bruised or seriously injured and the optic nerve is not torn, the ball may be returned to its cavity and a compress bandage applied over it to keep it in place. This should be done as early as possible or the swelling of the parts around the eye will prevent returning it to its proper place. However, the outer angle of the eye may be divided if necessary to admit the eye ball to the socket. Should the eye ball be badly injured or in case it is impossible to return it to the socket the entire protruding parts may be cut away as deeply within the eye socket as possible; a pledget of cotton, saturated with a one per cent. solution of carbolic acid er corrosive sublimate may be pressed into the cavity; a compress bandage should then be placed over the eye.

When the eye is dislocated by growing tumors in its socket, or if there are malignant or fungoid tumors within the eye, or if the eye is very badly injured, it may be necessary to extirpate the eye ball, its muscles and the surrounding tissues. For this the animal must be cast, anæsthised with chloroform or some other anæsthetic; an assistant holds the eye lids apart; the operator grasps the cornea or the internal or external rectus muscle with the forceps in his left hand; the eye ball, the tumor, or the entire contents of the orbital cavity, if necessary, are then removed, with the shears or knife. The bleeding is checked by applying a pledget of cotton, and a compress bandage as before described.

ANIMAL PARASITES OF THE EYE.

Filaria papilosa is a small, round, white worm that is found most frequently in the vitreous humor; but is occasionally observed in the aqueous humor and commonly spoken of as the "snake in the eye." It is from one-half to two inches in length, and it is very probable that the young filaria reach the eye by way of the blood vessels, and develop in the humors of the eye. However it is scarcely probable that the humors of the eye are the natural habitat or home of this parasite, since the same worm has been found in other parts of the body. One man reports that he observed a worm in the aqueous humor during a period of six years. But a few months is usually the length of time this parasite lives in the eye. A number of cases are recorded where this parasite has produced inflammation of the cornea and iris, with an extra flow of tears and opacities of the cornea and aqueous humor; these conditions may subside in a short time and leave a slight cloudiness of the cornea and aqueous humor. In certain districts in India this parasite is very frequently in the eye of the horse and if not removed the eye goes blind. This worm has also been observed in the eyes of cattle. The worm may be removed from the aqueous chamber by cutting a small opening in the cornea at its upper border near the sclerotic margin; then remove the worm with small forceps. Before operating it is necessary to cast the horse or ox; anæsthise it with chloroform or æther and apply a ten per cent. solution of cocaine to the eye. After operating keep the eye moist and cool by frequent or constant cold water applications, and occasionally put into the eye a few drops of a one per cent. solution of carbolic acid or boracic acid, or a weak solution of corrosive sublimate.

Filaria lachrymalis is a small, white, round worm one-half to one inch long; it lives in the lachrymal ducts, under the haw or eye-washer and sometimes under the eyelids; it causes inflammation of the conjunctiva and lachrymal ducts and may close the tear ducts Remove the worms from the tear ducts and the conjunctival surfaces by using small forceps; then apply, two or three times per day, a few drops of a corosive sublimate solution (1 part c. s. to 1000 parts of pure water).

As elsewhere mentioned, Willach has discovered in the eye the young forms of various round and flat worms, and he claims that these animal parasites play an important part in producing periodic opthalmia.

Since nearly all parasites gain admission into the system by way of the alimentary canal, infection may be prevented by observing a few precautions. Impure drinking water is probably the most common carrier of the various animal parasites. Hence always give animals water from deep wells or pure springs, and never from ponds, rivers, or stagnant lakes. The digestive tract may become infected with these parasites by ingesting infected food. In all cases where parasites are found in the alimentary canal (manifested by the occasional passing of parasites with the feces), it is advisable to give one-half to one drachm doses of sulphate of iron or sulphate of copper in the ground food two times per day for one week; then give a purgative, consisting of one pint of raw linseed oil or one ounce of Barbadoes aloes.

STRABISMUS, SQUINTING OR CROSSEYE.

In this defect the visual axis or line of one or both eyes deviates from the normal. In other words, the eye ball is turned inward, outward, upward or downward by the excessive contraction of a muscle or as a result of the paralysis of one of the muscles of the eye. In converging (inward) strabismus, the external rectus muscle may be paralysed and thus be unable to counteract the contractions of the internal rectus, its antagonist. This weakness, partial or complete paralysis of one or more muscles of the eye may be due to the pressure of tumors on the nerve of the muscle, rheumatism, tumors at the base of the brain or injuries of the muscle. Squinting or crosseye may be treated by section of the antagonistic muscle, but this can be done only by a skilled veterinarian. However this defect is rare in domestic animals and may be detected by noting the squinting appearance and carefully comparing one eye with the other. When strabismus is present it causes considerable shying, which is especially annoying in nervous animals.

SOME OF THE CAUSES OF INDISTINCT VISION AND SHYING.

Hypermetropia or farsightedness is that defective condition of the eye which causes the principal focus to fall be-bind the retina, as illustrated in figure 15—H. In other words, the parallel rays which enter the eye come to a focus behind the retina. As a rule, the axis of the eye or the diameter from before to behind is too short and the cornea may appear less convex or flatter than normal. Removal of the crystalline lens (as is sometimes done in cataract) produces farsightedness. Convex glasses are used in hypermetropia in man, but are impractical with animals. Distant objects may be seen distinctly but the images of objects at a short distance are blurred and sometimes distorted into frightful forms. Hence farsighted horses are frequently frightened, or are caused to shy as a result of indistinct vision.

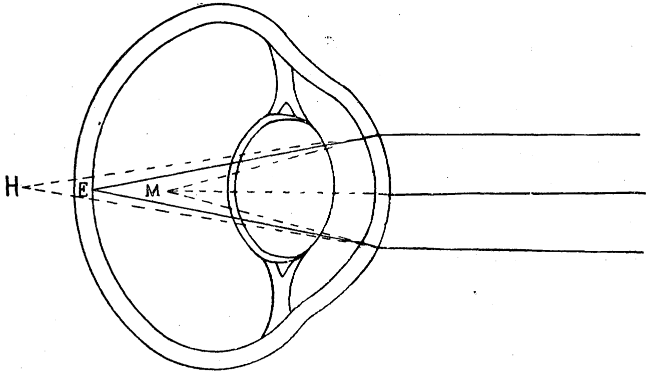

FIG. 15.

Diagramatic section of an eye (after Mœller) to show:

That the parallel rays of light, which enter the normal eye, converge or focus on the retina, making a distinct image.

That, in the farsighted eye, the parallel rays focus at H behind the retina, forming a blurred image on the retina.

That, in the shortsighted eye, the parallel rays converge at M in front of the retina, forming a very indistinct image on the retina.

Myopia or shortsightedness is a condition in which the refractive index of the eye is too great or the axis of the eye is too long; the parallel rays come to a focus in front of the retina (as in fig. 15—M.); or the principal focus falls in front of the retina. In shortsightedness the cornea may appear very convex or conical as it frequently appears in cattle.

Close or near objects can be seen distinctly but distant objects may be distorted or become very indistinct. Concave glasses are used by farsighted persons; but since the use of glasses is impractical for animals, shortsightedness, therefore, becomes a permanent cause of shying and fright.

In the Normal or Emmetropic eye, the principal focus falls on the retina, and distinct images of all objects, at near or far distances, form on the retina (fig. 15—E). The cornea, the aqueous humor, the lens and the vitreous humor take part in the formation of the image—the refraction and collection of the rays of light. The cornea is the principal refracting medium when the eye is at rest; but the changes in the convexity of the lens (caused by the contractions of the ciliary muscle) are the means by which the eye is adjusted, or accommodates itself, to different distances.

In the far-sighted, short-sigted and normal eye the curvature of the cornea and of the lens is regular; but sometimes the curvature of the cornea may be so irregular that one part or meridian may produce short sightedness, another part produce far-sightedness while still another meridian may be normal. This condition produces a very much distorted image and is a fruitful source of shying or the cause of fear and fright. Irregularities in the meridians of the cornea produce the condition known as astigmatism. This defective vision may also be caused by an oblique position of the lens. There are several kinds and degrees of astigmatism, all of which are very difficult to distinguish and can only be relieved by the use of proper glasses which are inapplicable to animals.

Slight cloudiness or opaque spots in the cornea, weak cloudiness of the aqueous humor, beginning cataract, beginning amaurosis or beginning glaucoma are accompanied by indistinct vision, and consequently produce frequent shying. In fact, partial blindness from any cause is always attended by indistinct vision and shying, fear or fright.

PERIODIC OPTHALMIA—MOONBLINDNESS.

This is an eye disease peculiar to horses and mules. Before the development of veterinary science the belief was prevalent that the moon exerted a direct or indirect influence upon the eyes; because the inflammatory attacks recurred at monthly or somewhat regular periods. Thus the names "moon blindness" and "mooneyed horses" originated. But as veterinary science progressed, extensive clinical and anatomical investigations made known the fact that moonblindness was a periodic or recurring inflammatory disease of the entire eye, involving primarily the iris, the choroid coat and the ciliary bodies.

SYMPTOMS.—This disease makes its appearance very suddenly—generally beginning in the night; in the morning the eye is found closed, extremely sensitive to light with a very great flow of tears down over the cheek. In some instances there is systemic fever, while in other milder cases, it is not manifest; but, as a rule, the horse or mule is dull, wanting in vigor, and energy, indicating constitutional disturbance. The eye ball is drawn backward into the orbital cavity, by the retractor muscle; this makes it appear smaller than the healthy eye; after several attacks the eye ball is said to shrink in size—decrease in actual volume. The conjunctiva exhibits slight swelling and diffuse reddening; the surface

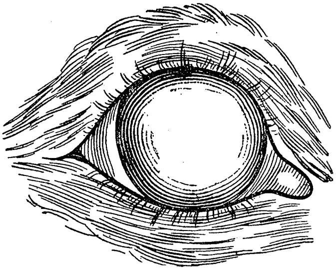

FIG. 16.

Diffuse cloudiness of the cornea as observed in moon blindness and in inflammation of the cornea. The internal structures of the eye are cut off from view by the total opacity of the cornea (after Armatage).

blood vessels of the sclerotic are congested; this produces a light red ring, or seam around the cornea (pericorneal injection.) The cornea near its outer border exhibits a weak, diffuse cloudiness, which soon extends over the entire cornea; in the beginning this cloudiness is weakly marked and the cornea appears as if it were glass with a thin layer of fat spread over it. In the advancement of the disease the middle or principal layer of the cornea becomes affected, which leads to intense, diffuse cloudiness and occasionally to vascularization of the cornea; the latter is distinctly visible at its border in a few days after the beginning of the attack. Sometimes a pearl white opacity may appear at some spot on the outer surface of the cornea. In the beginning the slight cloudiness of the cornea does not prevent one from viewing the iris, the lens and sometimes the vitreous humor and the retina. The purulent or flakey exudate in the aqueous humor and the excessive contraction (almost entire obliteration) of the pupil hide from view all the internal parts of the eye. The iris appears rough on its outer surface, slightly glazed, lighter colored than normal; at times it is covered with a grey exudate. The ciliary portion of the iris is bulged forward and outward; the movements of the iris are slow and weak; it is quite insensible to variations in light, and the pupil does not expand in the dark. The

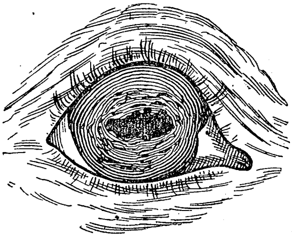

FIG. 17.

This cut represents the free border of the iris attached at points to the capsule of the lens, producing an irregular, ragged outline of the pupil and wrinkling of the iris. This may be observed after several attacks in periodic opthalmia (modified from Armatage).

color of the pupil when visible during its contraction is greyish green. Atropine causes the iris to expand slowly, weakly and irregularly; at points the pupillary border of the iris adheres to the capsule of the lens; the remaining parts are free; expansion of the pupil under such conditions produce irregularities in the iris and in the outline of the pupil (see fig. 17). At the lower part of the aqueous humor, in the anterior chamber, there is a gray-yellow, partly sedimentary, partly flocculent exudate, which sometimes is colored with blood. The quantity of the exudate varies; in the early stage of the attack—especially in the later attacks—it is visible by focal illumination as a slight cloudiness; at the height, or severest stage, of the attack the aqueous chamber is almost entirely filled; the exudate settles to the lower part of the aqueous humor, and is gradually absorbed and entirely disappears in the course of ten to fifteen days.

No prominent changes are exhibited in the conjunctiva; however, the pigmentation of the conjunctiva of the eye ball makes it difficult to observe variations in its blood vessels. Occasionally the conjunctiva becomes swollen and produces a slimy, serous secretion. In cases where the vitreous humor can be observed in the early stage of the attack it is found to be clouded. In the active, inflammatory stage, the eye ball is found, by palpation, to be sensitive and hard. Opacity of the lens appears during the later attacks, and, as a rule, when the lens become entirely opaque (total cataract) the periodic attacks cease in that eye. In six to eight days after the beginning of the attack the inflammatory appearances begin to subside, the sensitiveness to light and extra flow of tears abate; the exudate in the anterior eye-chamber begins to disappear; the pupil begins to expand and the iris may react with regularity. After about fourteen days from the beginning of one of the early attacks the inflammatory changes will have so completely disappeared that casual observation fails to discover anything abnormal in the recently diseased eye. However, a careful and critical examination discovers that the iris is still attached to the capsule of the lens; or one may find on the capsule pigment masses which were left there in the breaking away of the iris from the capsule; the iris is lighter in color—lighter brown, very like the color of dead leaves. Occasionally the iris is so pressed forward that it comes in contact with the cornea and the anterior division of the aqueous chamber appears obliterated. The pale green appearance of the pupil indicates more or less cloudiness of the lens or vitreous humor. In most cases, especially after the later attacks, there remains a bluish ring around the margin of the cornea—a diffuse cloudiness—the upper eyelid, instead of presenting a continuous arch, exhibits an abrupt bend a short distance from the inner angle; the upper lid and the eyebrow are also more wrinkled than usual; after a few attacks the eye ball shrinks in volume, is smaller than normal, and in the interval between attacks the eye ball, by palpation, exhibits uncommon softness. In most instances cloudiness of the vitreous humor and detachment of the retina can only be discovered by first expanding the pupil with atropine and then examining the eye with the opthalmoscope. After the disappearance of the acute inflammatory symptoms, or after the inflammation has subsided and all damages are partially repaired, or the eye has "cleared up," it may remain free from another attack for a month, for two or three months or even for a year. However, as a rule, the attacks occur somewhat regularly every four or six weeks until the eye becomes entirely blind. This disease generally results in the formation of a total cataract and occasionally in paralysis of the retina or optic nerve—amaurosis. The attacks may vary in severity in the different cases, but the successive attacks in each case grow more severe and leave behind more distinct and prominent signs of approaching total blindness. Five to seven attacks, as a rule, completely destroys the sight; thereafter that eye remains free from periodic inflammatory attacks; the other eye is then liable to become similarly affected until it goes blind. Rarely are both eyes thus diseased at the same time, but they may be attacked alternately until each one becomes blind.

The diagnosis of periodic opthalmia is not difficult. The previously mentioned symptoms and course of the disease are generally quite distinct. There are exceptional conditions and times when the owner or observer will be in doubt. During the first attack, when the cornea and the aqueous humor are so badly clouded that the pupil, the iris and all internal parts of the eye are invisible, one can not determine beyond question whether it is a case of simple iritis or iritis associated with some form of influenza. In some attacks the cornea may be so opaque for a time that one is unable to discover whether the aqueous humor is clouded or not; in such a case the owner may believe that the cornea is injured in some way. Time alone will bring forth or make clear the other symptoms. Again, during the interval between the first and second or between the second and third attacks, the before mentioned symptoms may be indistinctly marked; it will then be necessary to wait for the appearance of another attack. But in all the doubtful, indistinct cases, the characteristic fact of its recurrence in the same eye will remove all doubts in the mind of the owner if not in the mind of the buyer.

Causes.—A number of different microbes have been found in the tissues and humors of eyes affected with moon blindness. Vigezzi has found a micrococcus which he believes to be the direct cause of the disease; Trinchera discovered an immovable, curved bacillus; R. Koch found a short bacillus, rounded at its ends; Richter found a diplococcus and a triplococcus. However, no positive proofs have as yet been discovered, by experimentation or otherwise, that would justify a positive declaration in favor of any microbe. In fact the investigators have found a germ associated with the disease; but, if the microbe has been cultivated on artificial media, the eye disease has never been artificially transmitted or produced by means of the germ.

Willach examined 37 eyes from 24 horses and has discovered a variety of forms and kinds of round and flat worms; most of them were found in the humors and represented the young stage in their development. Similar parasites were also discovered in the alimentary canal, the liver and the lungs. Wallach believes that these worm-like parasites migrate from the alimentary canal during their early life—chiefly by way of the blood vessels—and thus reach the eye; these migrations take place periodically or at such times as the egg or young forms of the parasites reach the alimentary canal in the food or water. This theory would, of course, explain the periodic nature of the disease and many other phenomena connected with it. But the worm-like forms were found only in the examination of dead eyes, whereas the limited number of cases and want of transmission or actual production of the disease by experiment will not justify, beyond question, the 'far-fetched' conclusions.

On river bottoms, on moist clay soils, on marshy grounds, on moist coast lands of seas and lakes, in malarial districts, this disease is said to be most prevalent. In 1875, a regiment was moved from Frankfurt on the Main to Hofgeismar; at the former place moon blindness never appeared; during the first year, at the latter place, 5 cases appeared among the horses of the regiment; the second year 12; the third year 11; the fourth year 14, and the fifth year 42. The regiment that was stationed at Hofgeismar was moved to Frankfurt; during the last five years of this regiment at Hofgeismar there were 130 cases of periodic opthalmia, and during the first five years at Frankfurt not a single case appeared. Hofgeismar, Saarburg, St. Avold and other places in Germany seem to be peculiarly adapted, by their moist clay soils, to the development of the microbe, the parasite, the gas or miasmatic factor that causes this disease. Records also show that on certain low lands of Belgium, France, Spain, Italy. Austria and England, this eye disease prevails extensively. Likewise in our own country certain localities have more cases of moonblindness than others.

The writer has observed that this disease is more prevalent in the southern states, than in the central or northwestern states. Compare the number of cases in the dry, cool climate of South Dakota with the moist, warm climate of Alabama and the result shows the extremes—the almost complete absence in the former State and the unpleasant prevalence in the latter. It is said to occur less frequenly on lime soils. Clay soils will retain moisture longer and as a rule are richer in organic materials than sandy soils; consequenly germs, malarial parasites, etc., will grow abundantly on the moist clay soil.

The disease appears on sandy soil if there is sufficient moisture; it will also appear on moderately high rolling land irrespective of the kind of soil if there be sufficient moisture—as a rainy season followed by a warm season with occasional heavy rains. A number of cases have been observed at Auburn, 800 feet above the sea level, with a gray sandy soil; however, there are red clay districts not far from Auburn. I, also, have reports of its appearance on sandy soils in other parts of this state.

In the period from 1879 to 1890, appeared 2183 cases of periodic opthalmia among the horses of the Prussian army. Of this number 585 were in the 15th army corps; 358 in the first; 339 in the 11th; 145 in the 10th; 135 in the 5th; about 80 in the 2nd, the third and the 8th; about 70 in the 7th; about 60 in the 4th, the 6th, the 9th and the 14th; 49 in the guard corps. It will be observed from the above records that the disease prevailed quite extensively in the respective localities of the first five of the army corps above mentioned; while in the districts of those last mentioned the disease was comparatively rare.

Cloudy weather, or moist air, so common and constant on wet lands, is said to be a factor in causing this disease. Rank, succulent fodders, grown on wet lands, associated with a damp, sultry atmosphere, is conducive to the production of a lymphatic temperament or constitution—a horse with a coarse open texture of bones and muscles, with an excess of connective tissue, with thick skin, legs covered with an abundance of long hair and with labored, sluggish movements. No doubt, such animals are predisposed to moonblindness. Fodder, hay or grass, from low, swampy or wet soils may also contain the germs or malarial parasites which are believed by some to cause this disease. In some localities of Europe the hay and fodders, grown upon certain soils, are said to be the cause, or the carriers of the cause from the soil to the animal.

A constant stimulating diet of corn, rye or barley grain—especially in summer or when given to the growing colt—contain too much of the fat and heat producing food and not sufficient proportion of the muscle and bone forming food; the horse so fed may be very fat but less able to resist the germs of disease, more liable not only to moonblindness but also to "big head" and other constitutional diseases. Constant feeding of corn will certainly make the periodic attacks occur more frequently and also augment their intensity. This has been proven by a number of trials. A reliable farmer living near Auburn had a fine young mare that had been attacked two or three times; he believed the corn was making the disease worse; hence he withheld the corn and thereafter fed her upon oats; the eyes were not again attacked, and they recovered so completely that her owner could never observe anything wrong with them. Certainly the feeding of corn alone did not produce the disease, but after the real exciting cause had established it, the corn either maintained a supply of food for the microbe or diminished the general vigor of the animal or the resisting power of the leucocytes—germ destroying cells of the body. High feeding associated with irregular exercise, feeding irregularly and using unwholesome, decayed or partially rotten hay, fodder or grain; also the surface water of runs, ditches, ponds and shallow wells receiving the impurities from barns, barn yards or outhouses—all these are contributing causes and many times the impure water may convey the microbe, the originating cause, into the system.

Overworking an animal, no doubt, depresses the vigor and resisting power of the animal; thus attacks are more liable to begin or recur during the severe, exhausting spring plowing and summer work. During the time of breaking the colt and of the eruption of permanent teeth the attacks are excited to greater severity and are called forth more frequently. The eruption of nearly all the permanent teeth occur during the last half of the third, fourth and fifth years of age. The small teeth that usually appear just in front of the first molar on either side of the upper jaw, very rarely in lower jaw, are commonly called wolf teeth or "blind teeth." Many people believe that this little tooth in some mysterious way affects the eye, causes it to go blind "by pressing on the nerve of the eye." This is, to say the least, very unreasonable if not nonsensical. Those little teeth never affect the eye. No doubt they are broken off many times when a horse has an attack of periodic opthalmia and the eye "clears up" in ten to fifteen days—not because the little tooth was pulled or broken off with a punch—but because that eye disease appears and disappears periodically. Heredity is certainly a strong predisposing cause of the disease. It does not originate the disease but the offspring inherits the tendency or weakness of the eyes, that permits the originating excitant to call forth the disease with little resistance. This transmission, from sire or dam to the offspring, of defective tendencies is, no doubt, responsible for the appearances of periodic opthalmia in certain families when the original blood was so contaminated. In France the government discourages, and prohibits when possible, the use of blind stallions or mares for breeding purposes. The farmers and stockmen of the country have observed and noted the influence of heredity in the production of moonblindness. From the replies to a circular letter which I sent to farmers and stockmen in all the counties of Alabama, twenty-one stated that heredity was a primary or secondary factor in the cause of periodic opthalmia.

Poor or badly ventilated and improperly lighted stalls or barns are also causal factors. Prof. Williams of Edinburgh says: "Fifty years ago thousands of horses became annually blind from opthalmia; now-a-days one seldom sees a case of blindness from this cause. This happy result is due to the enlightened writings of Coleman on ventilation and the advance of veterinary science—facts which the public seem to ignore." In improperly lighted stalls or barns the light is so weak, or small in quantity, that the eyes are continually strained in order to see distinctly; or the light enters from a small window directly in front of the horse, placing the horse on the shady side of the objects in front of him, and this in combination, or contrast, with the constant glare of the window, is certainly as trying on the eyes as insufficient light. The light should come from behind or from either side of the animal in quantity sufficient to make all objects in the stall distinctly visible. It has been suggested that exposure to cold, or to any of the atmospheric influences which ordinarily produce acute catarrh or cold in the head, will cause an attack of moonblindness. The records of the disease in the German army show that more cases occur in winter than during any other season. But in this State the majority of cases appear in the spring and summer.

A rheumatic condition of the system is said to play an important part among the long list of causes of moonblindness. It, however, like many other depressing diseases and influences, is only a preparing or predisposing cause or condition which can not originate the disease but may excite frequent attacks and increase its severity. Smoke, pungent vapors, hayseeds, dust or any local irritants or injuries may awake the latent tendency or augment the intensity of an attack. In short, whatever depresses the vigor or debilitates the system will aid in originating the disease and will also increase the intensity and frequency of the attscks; anything that strengthens the constitution or improves the animal vigor will be a protective or assist in preventing periodic opthalmia.

The essential and originating cause is very probably a microbe, a miasmatic germ, an animal, worm-like parasite or the poisonous product of a germ. The natural habitat or its native place of propagation and development seems to be on moist lands that are, during one season, extremely wet and at other times dry enough to bring forth crops. The surface water of such districts, and the fodders, grasses and hays grown on such lands, transmit or carry the germs into the system of the animal.

During January, 1893, the veterinary department issued about two hundred circular letters containing questions relative to eye diseases among domestic animals; these were mailed to farmers and stockmen in all the counties of Alabama, and they were also published in many of the daily and weekly papers of the State. The principal question in the circular letter read as follows:

"Are horses and mules in your beat or county affected with what is commonly called moonblindness? If you have such an eye disease please state how frequently it occurs, and what is your view of the cause of it."

I received in all nearly 125 replies. From these replies I have obtained the following records on periodic opthalmia or moonblindness:

Eighty (80) cases were reported in such a manner as to leave in doubt just when they occurred; 33 cases were reported as being in existence at the time (January and February) of replying; 7 parties report that the disease was prevalent in their respective beats ten to twenty years ago, but not of late years. During the first three months of 1892 and during the same time in 1893, 21 cases have come under my observation at the free Saturday clinic; these cases were from the country and towns surrounding Auburn, and represent fully ten per cent. of all the diseased cases that appeared at the free clinic during the same time. The above records certainly indicate that periodic opthalmia is a common disease among horses and mules of Alabama; and according to the reports on other eye diseases it is the most prevalent and frequent cause of blindness.

The reports do not give data sufficient for one to state in just what beats it occurs, but they do show that moonblindness has been, or is at present, in nearly every county in the State; that annually a great many valuable horses go blind as a result of it. Generally speaking, the reports seem to indicate that the disease is most prevalent in the low lands or malarial districts of the State; yet the knowledge given of the local geography of the places from which the reports come, is not sufficient for one to make an accurate comparison.

From the replies I find that a variety of opinions were expressed as to the cause, and a great many failed to express their views, while others said they did not know. Let me now give a concensus of the opinions expressed. Six parties believed that improper and irregular feeding are important factors in the cause of moonblindness; 3 say "not enough variety in diet;" 4 believe "too much fodder and grain and not enough hay" is the cause; 1 says "feeding corn to colts;" 9 claim "feeding corn as an exclusive grain diet" is the direct cause; 3 give "exposure to cold" the credit; 1 says the "eruption of permanent teeth and the shedding of colt teeth;" 1 says "blind teeth;" 1 makes "high feeding and irregular exercise" responsible; 11 claim that "overwork" in various ways is a potent causal factor; and 21 say heredity, especially in blind or "weak-eyed" breeds, is the chief cause; six (6) parties traced the history directly to a blind sire or dam. Surely the above ideas, relative to the cause of periodic opthalmia, show that the stock owners of Alabama have been searching for the cause; and if they have not discovered the actual originating cause, they have found factors that intensify or conditions that make the disease worse. Some have suggested that home-bred horses are more disposed to this disease than horses or mules brought here from other states; yet others claim that the opposite is true. I am of the opinion that the animals freighted here from Kentucky, Missouri, Illinois, etc., are far more liable to contract periodic opthalmia than home-bred horses; because the diet of the northern horse is very greatly changed and he must also become acclimated —his system must be adjusted to new climatic conditions.

The susceptibility of an animal is determined to some extent by age. From the reports of cases where age was mentioned, and also from the records of European authorities, the period of greatest frequency is from 3 to 9 years of age. Some have placed this danger period from 2 to 7. Yet it should be remembered that periodic opthalmia does occur outside of the above age limits, for I have reports of cases 12, 13 and 15 years old.

TREATMENT.—Taking into consideration our indefinite knowledge of the originating cause and the numerous attending, exciting and predisposing causes, and the fact that the disease generally results in total blindness in one or both eyes, it is evident that preventative treatment is the most profitable and reasonable. The drainage, ventilation and light in most barns are sadly neglected and generally very defective. The barn is usually resting on the ground and the stalls are filled with clay which becomes saturated with urine. The clay allows very little moisture to pass through it; the urine, which falls upon it and with which it becomes saturated, passes off mainly by evaporation. With little ventilation or drainage below it, the clay rarely becomes dry and the atmosphere of the stall is constantly saturated with unhealthy gases (ammonia, etc.,) from the fermenting urine and decomposing organic matter of the feces. Such unhealthy conditions can be greatly improved by following the methods usually adopted in building houses in this climate. The floor of the barn should be from two to three feet above the ground; this may be accomplished by making the brick or stone pillars for underpinning the required height and using strong plank two inches thick for flooring.

Lattice work between the outside pillars will permit free circulation of air under the barn and prevent the use of the basement for a dog house, pig pen or as a place for fowls. This will give good, cheap drainage below with excellent under ventilation. The ventilation of the box stall (the best and healthiest kind of stall) should be so arranged that the hot and light air may escape through an opening or series of openings in the upper part of the outer wall, permitting it to pass directly out of the barn. Similar openings should be located in the outer wall near the floor to allow the heavy gases (carbonic acid gas exhaled by the lungs, etc.) to escape. Besides these openings lattice box stall doors and lattice outer hall doors and windows should always be in use for summer ventilation. There may be objections (its hardness and the drying out of the feet) to standing a horse on a plank floor; but these may be overcome by bedding or littering the box stall; by occasionally soaking the feet in water, and, when nearly dry, oiling them with an ointment made of one part of pine tar to eight or ten parts of lard or cotton seed oil. The light should, as before mentioned, enter from behind or from both sides of the animal; in the box stall the light should thus enter when the horse is standing at the manger. Furthermore, the light should be so arranged and of sufficient quantity to enable the horse to see distinctly in all parts of the stall.

The water supply and time of giving water to horses should be carefully considered. All surface water, from ponds, brooks, rivers and shallow wells should be avoided. Spring water, taken directly from the spring, filtered rain water or other kinds of filtered water, or water from deep wells are best, and less liable to contain disease-producing germs. The horse and the mule should always be given warter before feeding grain—never after, unless it be given two hours after feeding.

A constant corn diet is to be avoided, especially as a food for colts. It is extremely doubtful if corn for colts is ever advisable. Furthermore, it is injudicious to feed horses or mules upon corn as the only grain food at any other time except in the cold period of winter. In fact, there is no time in this climate when corn alone is really needed or demanded by the system. Far better results will be obtained by using oats as the staple or chief grain food; and, at times, equal parts of ground corn and cow peas, or equal parts of ground corn, cow peas and oats, or equal parts of ground corn and wheat bran, may be substituted for oats alone. Corn should never be fed to horses with weak eyes or with diseased eyes. Corn and fodder (leaves) form the staple articles of food, for horses and mules, in some parts of this State with a climate that will produce green rye for soiling during the entire winter and green sorghum and green millet for summer. Corn is too stimulating and contains too much heat-producing material; the corn fodder is a dry, rough food, which in combination with corn is liable to lead to attacks of constipation, producing passive congestion of the blood vessels of the brain and the eyes. To be sure this does not always occur, but many times an attack of periodic opthalmia may thus be called forth. Variety in rations should always be considered, and extended according to local food supply; watch the effects of the quality and the quantity of the various foods, and many times you will be able to regulate the diet of the animal according to your experience in feeding it. No fixed or absolute laws can be made to fit all cases; horses have their individual peculiarities as well as persons.

High feeding, with irregular exercise; excessive and exhausting work; exposure to cold (rheumatic influences) are to be avoided as far as possible, especially with animals affected with periodic opthalmia or predisposed to it.

The indiscriminate use of blind animals for breeding purposes can not be too strongly condemned. Heridity is certainly the most potent predisposing cause of periodic opthalmia. Mares with weak eyes and with a lymphatic temperment and structure should not be bred to stallions of similar temperment and form.

Proper *curative treatment* will sometimes check the progress of the disease, and may, in rare instances, result in permanent relief. During the active inflammatory stage bathe the eye in cold or hot water for 1 to 2 hours morning and evening; after each bathing put into the eye a few drops of the following solution: Potassium Iodide, 10 grains; Atropia Sulphate, 1 grain; Boracic Acid, 10 grains; Pure Water, 2 ounces. This medicine may be used for 6 or 8 days until the eye begins to clear up; then use the same prescription, omitting the Atropia Sulphate. When possible adjust over the eye a cotton cloth or small bag of cotton, kept constantly wet with cold or hot water. It is well to keep the horse, during the inflammatory stage, in a dark box stall if the ventilation, cleanliness and drainage of the stall is healthful and good. If the horse is constipated a mild purgative (one-half pound of Glauber's salts or one-half pint of raw linseed oil) may be given. Constipation may be thereafter avoided by giving a bran mash once or twice per week. Moderate and regular exercise or easy work is beneficial, but keeping the affected horse or mule at hard work is decidedly injurious. In every instance it is wise to remove, when possible, all predisposing or attending causes.

As indicated in several reports from different parts of the State, periodic opthalma seems to be disappearing in certain localities. It will certainly decrease in frequency, or entirely disappear, in nearly every beat in Alabama when the stock raisers comply with the hygienic laws, governing the health of horses and mules. The principles of feeding, ventilation, drainage, breeding and sanitation in general must be studied and practiced, from a scientific stand point. Besides Alabama can and should raise her own mules and horses. Healthier, better and cheaper animals can be bred and raised in this State than the majority of those that are annually shipped here from other States.

METHODS OF EXAMINING THE EYES.

Remove the blind bridle or any harness obstructions to free vision. Tie a cloth over one eye and then lead the animal over obstructions that will cause stumbling or high stepping. Repeat this test with the other eye blindfolded. If the animal with one eye blindfolded stumbles over low objects the vision of the other eye is defective. Note the attentive and erect position of the ears indicating that they are attempting to compensate for the defective sight. Carefully compare the fullness or prominence of one orbital region with the other; note that in fat or young animals the orbital cavity is full and that in poor or old animals the eye socket is not completely filled and the orbital rim or bony border is prominent. Excessive fullness of one orbital region would indicate that the eye lids or the tissues, surrounding the eye ball, are swollen, or it would indicate the presence of a tumor in the orbital cavity. Closely observe the form, position and condition of the eye-lids; the presence and position of the eye lashes; also, compare the curve of the free border of one upper lid with the same lid of the other eye. Examine carefully the secretion at the miner angle of the eye. The tears are like water; mucus appears gray and flocculent; pus mixes with the tears and appears yellow and cloudy; in the dog pus sometimes is colored green. If the mucus and pus are mixed the mucus flakes are colored yellow. An excessive quantity of tears, mucus or pus is manifest by the flowing of the secretions down over the cheek. The presence of the mucus, pus or an extra quantity of tears flowing over the cheek should induce the observer to look closely for foreign particles in the eye, inflammation of the conjunctiva, abscess or ulceration of the cornea and closure of the lachrymal ducts. For further examination the animal should be taken to a barn or stall. It is best to use a stall with one window or one door; the animals head should be turned to the open door or to the window, allowing the light to fall on the eye from directly in front or from an angle to the right or left of the front. The eye may be opened by gently and firmly pressing the lids apart with the thumb and index finger, using the right hand with the left eye, and the left hand with the right eye. To see the conjunctiva of the upper lid, it may be everted by grasping the eye lashes with one hand and everting the lid over the fore finger of the other hand. Examine closely the haw or "eyewasher" and all parts of the conjunctiva for signs of injury, inflammation and irritating particles. Examine also the opening of the tear ducts.

The observers attention is next directed to the size, form and position of the eye ball. It is always advisable to compare one eye with the other that the abnormal may be judged by its deviation from the normal. If the eye ball projects outward and forward excessively, dislocation of the eye ball, hydropthalmus (excess of water in the aqueous humor) or a tumor in or behind the eye may be suspected. If the eye ball is drawn backward into the eye socket, severe inflammation is present, attended by extreme sensitiveness to light, as in the beginning of an attack of moon blindness. A decrease in volume or size of the eye ball, (after repeated attacks of periodic opthalmia and in tuberculosis of the eye ball) is manifest by apparent drawing of the eye into the socket and the more or less infolding of the upper lid near the inner angle of the eye. The tension and hardness of the eye ball may be tested by palpation upon the upper eye lid, with the index finger; both eyes should be tested at the same time that one may be compared with the other. Note the presence or absence of the congestion of the pericorneal bloodvessels; its presence indicates inflammation of the ciliary bodies, the iris and sometimes the choroid coat.

The cornea may be next viewed from various positions, noting carefully its curvature, its opacities, the presence or absence of ulcers, abscesses, vascularization, swellings or new growths. The location, color and limitations of the opacities should first be determined. The weaker the opacity or cloudiness the more blue the color; intense opacities are white. Black opacities of the cornea signify pigmentation from iris adhesions or from blood stains. Striped and pearl like opacities, with sharp limitations, point to scars or chronic changes in the cornea; chalk spots result from the employment of silver and lead salts in wounds and ulcers of the cornea. Viewing the cornea in profile, or from one side, will enable one to locate the opacity, revealing in a degree what layers of the cornea are involved; and to a certain extent enables one to determine the curvature of the cornea, especially in partial or total staphyloma and extremely flat or very conical forms of the cornea. If the transparency of the cornea will permit, investigate the aqueous humor, searching for the gray, floculent exudate or the yellow, sedimentary pus exudate, or the red colored exudate in blood effusions; these may be present in penetrating wounds of the cornea, iritis and moonblindness.

The color, condition of the outer surface, movements and attachments of the iris should next be examined. The iris may become grayish brown by the deposition of inflammatory products in its substance, or become gray from the deposit of an exudate on its surface. The bluish-green color of the iris, manifest after one or two attacks of periodic opthalmia, is due to an atrophied (shrinking) condition of the iris. Occasionally in cattle a tubercular growth develops from the iris and completely fills the aqueous chamber of the eye. The iris may be attached by inflammatory adhesions to the capsule of the lens (as in iritis or moonblindness); or it may thus adhere to the posterior surface of the cornea (a result of penetrating wounds and ulcers). By the use of atropine, if the pupil is small or contracted, or eserine if the pupil is large or expanded, these adhesions may be destroyed or their permanent presence made known by the immovable iris and unchangeable form of the pupil. The iris, when attached to the capsule of the lens or to the cornea, may appear rough on its outer surface and its pupillary border is more or less irregular. The ragged, irregular border of the pupil should not be mistaken for the large brown "soot balls" that appear so frequently along the upper and lower parts of the pupillary border of the iris. The movements of the iris should also be watched when the animal is taken from the sunlight into the barn, or from the dark stall into the sunshine. If the pupil contracts regularly in bright light and expands regularly in partial darkness, the action of the iris is normal. But should the pupil remain greatly expanded under all conditions of light and darkness, one would suspect partial or total amaurosis. If the pupil remains partially or greatly contracted under all conditions of light and darkness, one should suspect adhesion of the iris to the capsule of the lens.

The pupillary reflex or color of the pupil is the reflection of light from the retina and the choroid. The normal color of the pupil varies with the variations in its size or in its degrees of expansion or contraction; its color also changes with the variations in the light. By great expansion of the pupil it appears blue-green; by medium expansion it appears blue-black; by great contraction it appears black. The color of the pupil in amaurosis is generally lighter, more clear and glassy than in the normal eye. When the pupil is small atropine should be used to produce maximum expansion. Or, the animal may be taken into a moderately dark stall where the color of the light reflected from the upper part of the retina and choroid will be green, and that reflected from the optic papilla (spot where the optic nerve enters the eye ball) will appear light red. This light red color is very distinct in carnivorous animals.

Cloudiness of the lens or the vitreous humor changes the color of the pupil according to the intensity of the cloudiness. Total cataract gives the pupil a gray, a white or a whitish-yellow color; while by a partial cataract the normal color of the pupil is cut off at the points or places of local opacities of the lens or its capsule. In cloudiness of the vitreous humor the pupil becomes more or less distinctly green. A liquid condition of the vitreous humor combined with cloudiness of the same also produces a distinct green pupil. Sudden or great movement of the cloudy vitreous humor, is a certain proof of its fluidity. The observer should view the pupil from various positions; by the use of the hand or a black hat the superfluous rays of light, or those coming from certain directions, may be cut off. The observer should not mistake the images of white objects (white shirt fronts, windows, holes in the building), for white or gray opacities in the lens or other parts of the eye.

Dislocation of the lens, falling of the opaque lens into the anterior or aqueous chamber of the eye has its appearance suggested by figure 13. But if the opaque lens should fall into the vitreous humor, the upper part of the pupil may remain transparent, and the small appearing optic papilla might be visible; yet a portion of the white or gray opaque lens could be seen through the lower part of the pupil; as a rule, the iris remains passively inactive and its pupillary border floats in the aqueous humor. Sometimes the lens may be partially dislocated or may have some shred-like, or hanging thread-like, attachments to its old location; these conditions would present different views in the pupil.

In order to be more accurate in locating and discovering opacities, the animal should be placed in a dark room where the eye may be illuminated by the use of a lamp or candle. The lamp may be placed in different locations, in front of, and outward from, the eye to be inspected; opacities will then be made more distinct. Three images of the flame may be seen as illustrated in figure 18. In the normal eye the first image is the largest, upright, the most distinct and reflected from the front surface of the cornea; the second image is smaller, upright and reflected from the anterior surface of the lens; the third one is the smallest, inverted

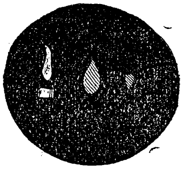

FIG. 18.

This cut (after Schlampp) shows the images of the candle's flame. The animal should be placed in a dark room or stall, or the test may be made at night in an ordinary stall; the candle is held a short distance in front of the eye to be examined and the following images, as above illustrated, will be seen. The first upright image is reflected from the cornea; the second upright image of the flame is reflected from the capsule on the anterior surface of the lens; the third or inverted and small image of the flame is reflected from the capsule on the posterior surface of the lens. The dark back-ground of the cut represents the pupil.

and reflected from the posterior surface of the lens. In the normal eye it will be noticed that these images are more or less distinct and that, as the lamp or candle is moved, the first two images of the flame will move in the same direction that the candle moves, but the third or inverted image moves in an opposite direction to that of the candle. As the candle is moved about in front of the eye, it may reach a place where the first two upright images remain clear and distinct, but the smallest and inverted image becomes cloudy and indistinct; this would indicate that the substance of the lens or the posterior part of the capsule is opaque at the point or spot where the candle's rays attempt to pass through. If the second image becomes indistinct the opacity lies in the anterior part of the capsule; if the first image becomes hazy and diffuse the cloudiness is in the cornea. Total cloudiness of the cornea would obliterate all three images, and the diffuse cloudiness of the aqueous humor obliterates the second and the third image.

A small double convex lens may be used, as illustrated in figure 19, to focus or collect the rays from a candle or lamp in a dark room or stall. Or, a concave mirror (with a small, round opening in its center for the observer to look through) can be used to collect and reflect the rays from a candle or from an open door or window; in using the mirror the candle

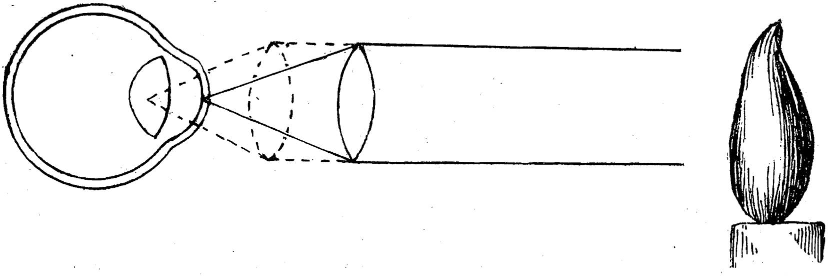

FIG. 19.
This cut (after Schlampp) illustrates how the double convex lens is employed in illuminating the eye or parts of the eye for the purpose of examination. The examination is made in a dark room or at night; the glass lens is moved forward and backward until the candle's rays are focussed upon the desired part or various parts, as it is upon the cornea and lens in the above cut.

or window should be backward from the head and outward from the shoulder or body. By employing the double convex lens or concave mirror, the transparent or opaque condition of the cornea and the aqueous humor may be distinctly observed and many opacities can thus be seen that are invisible in ordinary daylight. By employing atropine to expand the pupil, slight opacities of the lens may be made distinct and cloudiness of the vitreous humor may be observed. These methods of illuminating the eye also enables one to carefully examine the condition of the iris.

The opthalmoscope is an instrument that is used by occulists to look at the retina, its bloodvessels, the papilla optica, and to determine the degrees of farsightedness, shortsightedness, astigmatism, etc. Its use, however, requires great skill and much practice; hence, directions for using it will be omitted, since they would be of little value to the average man.

In preparing this bulletin, the writer has made frequent and extended references to the following books, pamphlets, and medical journals:

Mœller's—"Augenheilkunde."
Schlampp's—"Augenuntersuchungen."
Ellenberger-Shütz—"Jahresbericht über Veterinär Medicin. Jahr 1891."

Bayer's—"Bildliche Darstellung des Gesunden und Kranken Auges Unserer Hausthiere."
Williams—"Principles and Practice of Veterinary Surgery."
Reports of Bureau of Animal Industry on "Diseases of the Horse" and "Diseases of Cattle."
De Schweinitz's—"Diseases of the Eye."
Chauveau's—"Comparative Anatomy of Domestic Animals."
"Berliner Threrärztliche Wockenschrift."
Billings—"Bulletin of the Nebraska Experiment Station, June, 1889."

APPENDIX.

The following are some of the diseases that have been reported to this department as occurring in different parts of this State:

"Pink-Eye" has been reported as occurring among horses, mules and cattle. A large number of the cases of so-called "Pink-Eye," among horses and mules, was due to inflammation of the conjunctiva and sometimes of the cornea, associated with influenza, cold in the head, or strangles (distemper). An inflammation of the mucous membrane of the nasal passages may extend to the mucous membrane (the conjunctiva) of the eye by way of the tear canal and the tear ducts; or, some of the mucous discharge from the nostril may accidentally get into the eye. A few cases of "Pink-Eye" among cattle were associated with malignant catarrh; while nearly all "Pink Eye" cases among cattle have been outbreaks of infectious conjunctivitis and keratitis.

"Hooks" have been reported, in a number of instances, as a prolific cause of blindness. One man spoke of "bone hooks" and "fat hooks," but failed to explain the technical meaning of these terms. However, the indiscriminate practice of cutting out the haw or "eye washer" when the eye is affected with conjunctivitis, moon blindness, or tetanus (lockjaw) is certainly useless, if not barbarous.

One case of night blindness; and as previously mentioned, 134 cases of periodic opthalmia have also been reported.

Reports of four outbreaks of head scab among sheep have been received. This is a disease of the skin, and is caused by a mite (sarcoptes scabiei, var. ovis) which attacks the skin of the short wool regions of the head and legs. In attacking the skin of the eyelids, it produces entropium which leads to inflammation of the conjunctiva and cornea. Scrape the crusts from the affected places and apply any good sheep dip, once every eight days for one month.

The writer has also observed a few cases of diphtheritic conjunctivitis among turkeys and chickens. Separate the sick ones from the healthy and wash the eyes and the diseased surfaces of the mouth and throat with a weak solution of corrosive sublimate (1 to 500).

CEREBRITIS (Blind Staggers) has occurred in several counties of Alabama during the past winter and early spring. It has occurred, in nearly every instance, as a result of feeding rotten or mouldy corn. Curative treatment is usually ineffectual; it is best to prevent it by ceasing to feed damaged, mouldy corn.

The writer has received a great many reports, and has also observed cases, of "Big Head," (*osteo porosis*)—a disease of the bones, manifest by enlargement of the facial bones, of the lower jaw bone and the bones of the limbs, and nearly always leading to the "breaking down" of the horse after a long period of more or less severe rheumatic lameness. This disease is generally fatal. Excellent care with the variety in diet, as suggested to prevent moonblindness, will be good preventative, as well as palliative, treatment in this disease.

A few cases of malignant catarrh ("hollow horn?") have been reported and also a few cases of Parturient Apoplexy ("milk fever") among cattle.

Hog cholera raged in several counties last year, and has appeared in some counties this year. The disease has done the most damage in beats and counties where hogs have been allowed to run at large. To be sure it occurs in stock-law districts, but it does not there spread so rapidly; and in some instances the spreading of the disease has been checked or stopped at the border line between stock-law and non-stock-law districts. Since the germs of this disease are propagated mainly by filth and bad sanitary conditions, it pays best to work along the line of prevention. Keep hogs and pigs confined to a certain pasture, or lot; see that these places are kept free from stagnant pools or filthy holes and that the water supply is pure. Also remember that the omniverous hog can not live under any condition or eat all things with impunity. It is well to keep a mixture of equal parts of charcoal, wood ashes, sulphur and common salt (pulverized and thoroughly mixed) constantly in reach of the hogs; also, keep a small box of nut coal in the hog lot continually.

This department is desirous of receiving reports of all diseases among domestic animals, especially all outbreaks of infectious, contagious, or spreading diseases that appear in Alabama. Questions relating to animal diseases will be gladly received and promptly answered. Address all such communications to the Veterinarian of the A. & M. College and Experiment Station.

AGRICULTURAL * EXPERIMENT * STATION
OF THE
AGRICULTURAL AND MECHANICAL COLLEGE,
AUBURN, ALABAMA.

BULLETIN NO. 44, - - MAY, 1893.

TOBACCO PLANT,

ALEX. J. BONDURANT

CONTENTS.

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TOBACCO.

The scientific facts pertaining to agriculture, so far as they have been discovered, are scattered through many books and agricultural publications; few of these publications are accessible to the ordinary farmer.

Some service may be done to the farmers generally and especially in the cotton States by collecting some important facts that are accurately and certainly known and the experience of intelligent farmers and scientific men on the subject of "Tobacco Culture" and presenting these to the public in compact form. The investigation of this subject was commenced last year and methods of cultivation and management of this crop was given in Bulletin No 37, March, 92.

I. Object of Experiment.

Experiments to a limited extent were undertaken the past year in tobacco, with seed fromseveral varieties that are raised in Virginia, North Carolina, Florida, Connecticut and Cuba to ascertain, if possible, the kinds that are best adapted to this climate, and tofind out if the culture of tobacco, as a staple crop, could be made profitable in Alabama.

Experimentation was conducted only in a general way, more with reference to the growth of the different varieties planted and their qualities, than to the particulars of fertilizers suitable to the crop and methods of curing.

Raising Plants.—These experiments were commenced the middle of February; at that time preparation was made for raising the plants in the open air beds burnt in the woods. The first seeding was made 13th of February; from this bed very few of the plants came up. The 7th day of March two open air beds were made which were left without any covering. At the same time a hot bed was made, the seed sown and the bed covered with cheese cloth. From these beds the seed soon germinated, and in ten days from the time of sowing some of the plants could be seen. The cold spell of weather, which commenced March 19th, when ice to the thickness of a quarter of an inch was formed, destroyed most of the plants in the open air beds during germination, those which were protected under the covering of cheese cloth in the hot bed fared much better, and while large numbers were killed by the freeze, the proportion .was much less than in the open beds, and it was from the hot beds that plants were raised for planting the experimental grounds.

April 7th, other seed were sown for late plants for replanting; these were principally of the Cuban varieties obtained from the Florida station; no plants of any consequence were raised from these seed. It was demonstrated from the experiments made in the raising of tobacco plants, that the young plants were easily affected by cold and quickly killed by freezing weather in this climate, in fact, seemed to be affected sooner in this respect than in many localities in the old tobacco raising States. To avoid this difficulty, it is advisable, when practicable, to raise the plants under covered beds, in preference to open air beds.

Another important discovery was made in raising plants on the Station, viz: That the flea beetle, commonly called tobacco fly in the old tobacco States, seems to be abundant in this section, attacking the plants soon after they come up, and in uncovered beds, destroying the plants unless insecticides were promptly applied. It was further ascertained that the plants under canvass made a more rapid growth and presented a healthier appearance, and were ready for transplanting much earlier than those in the open air or uncovered beds.

Transplanting the Plants.—The transplanting of the plants from the plant-bed to the experimental grounds was commenced May 18th, and continued as the season was favorable for transplanting up to the middle of June. A few of the first plants which escaped being killed by the March freeze were left to grow in the open air bed, these made a rapid growth and were topped the 6th of June, and were cut and ready for curing the 1st of August.

Of the different varieties planted the Cuban varieties were the first to get their growth and were ripe and ready for cutting early in August. These were much blistered and made leaf of poor quality, owing to their rapid growth and early maturing during the month of July. which was a wet month, making unfavorable conditions for the growth of tobacco of good quality. Another important fact was observed in connection with Cuban varieties, that is, that the leaves were coarse and thick, not so well adapted for either wrappers or fillers for cigars, too strong for any smoking purposes.

The varieties from Virginia, North Carolina and Connecticut did not make as rapid growth as the Cuban varieties, and did not ripen until September, and continued to ripen until October. Some plants of good size and quality were obtained from these varieties which would make a good quality of chewing tobacco and cigars. The curing was imperfectly done, as it had to be cured by the air process in the gin house; and while a small quantity of bright leaf was secured by this method, the proportion of bright tobacco was thereby greatly reduced.

Making Cigars.—With the view of testing the quality of the tobacco raised on the Station for cigar purposes, and as instruction to the agricultural students, an experienced cigar maker was employed to make up a small quantity of the tobacco into cigars.

This experiment of cigar making demonstrated that some of the tobacco was suitable for this purpose. During the process of making, when the cigars were in a damp condition, they were weighed. It took from 120 to 125 of the smaller size to weigh a pound, and from sixty to eighty of the larger size to weigh a pound.

From the above the conclusion can readily be drawn as to the profits arising from tobacco when manufactured into cigars, and this experiment should encourage the growers of tobacco in this State to strive to raise a good grade of cigar leaf.

Tobacco growing is one of the most profitable branches of tropical and semi-tropical agriculture; the subject has been much neglected by writers of agricultural literature. The importance of the subject to the farmer may be estimated when it is considered that next to the cereals used as staple articles of food there is probably no plant so widely and generally grown as tobacco, and certainly none that is used by a greater number of the human race. It is proposed in this bulletin to give a brief history of the plant; to notice some of the leading varieties, some instructions for its successful cultivation and management with a view to encourage the cultivation of a plant that can be generally grown in this State, the climate and soil of which, it is believed, suits it admirably, in sufficient quantity not alone to satisfy all local demands, but to open up a large and profitable export trade.

II. Botanical Characteristics of Tobacco.

The tobacco plant is known to botanists by the generic name of Nicotiana. The genus Nicotiana belong to the Nightshade family to which order belong the Potato, Tomato, Capsicum, Henbane and deadly Nightshade

Of some fifty known varieties of the genus Nicotiana, it is claimed that all are natives of America, except two, namely: Nicotiana Suaveolens, which is a native of Australia, and is known as "Native Tobacco," and Nicotiana Fragrans, a native of New Caledonia.

The best known species are as follows:

(1.) Nicotiana Tabacum, of which there are two varieties, viz: Macrophylla (Maryland tobacco) and Angustifolia (Virginia tobacco). Each of these two varieties is divided into several sub-varieties.

The Macrophylla is the variety which affords the famous Cuban and Manilla tobaccos; it has a fine leaf which is soft and thin, and is much valued in the trade for the fine qualities of the leaf for binders and wrappers in making cigars.

Angustifolia is the most commonly cultivated variety in the United States.

(2.) Nicotiana Rustica, best known as Hungarian tobacco, is largely grown in Europe and Asia. There are also two varieties, a large leaved and a small leaved kind, both of which yield tobacco of good quality.

(3.) Nicotiana Persica, a type produced by climatic influences, but long thought to be a distinct type.

(4.) Nicotiana Crispa. This species is much grown in Syria and on the Mediterranean coast.

(5.) Nicotiana Repanda, a Mexican variety. It has small leaves, used for imparting the peculiar aroma to Mexican cigars and cigarettes.

The remaining species, notably Nicotiana, glauca, glutinosa, longiflora, nana and sanguinea, are of no commercial importance, being of interest only to the botanist and horticulturist.

III. Climatic Conditions.

Of the many conditions which affect the quality of tobacco, the most important is climate; other conditions may be, in a measure, modified, but very little can be done with regard to climate. The most rational mode of overcoming this difficulty would be in the selection of seed of the varieties which have been grown with success under similar climatic conditions as prevailin the district proposed to be cultivated.

In this State, with its range of climate from semi-tropical to temperate, a wide margin is permitted to the grower, and seed can be procured suitable to all parts of the State. In tobacco, as in all other crops, the aim of the grower should be to produce the kind which will command the highest price. The most valuable tobaccos are the Cuban and Manilla, and they owe their fame mostly to the favorable conditions under which they are grown. These places possess a tropical heat, but at the same time are tempered with the sea breeze, and there are, no doubt, parts of the coastal districts of this State which may produce an article that could favorably compare with these tobaccos.

Tobacco thrives best in a good rich soil, rich in vegetable mould, but light soil containing a good amount of organic matter and well drained will produce an excellent smoking tobacco, and on such soil the finest leaves are grown. The more clay in the soil the thicker the leaves become, and the aroma becomes less, and is consequently less suited for the finer qualities of smoking tobacco, although the weight of yield may be heavier.

Black prairie land will probably yield more to the acre than any other kind of land in this State, but the tobacco will not possess so fine a quality—on such soil it grows larger, has coarser stems and a heavier leaf, and is not so good for wrappers, or fine cut or cigarettes and cigars as the upland tobacco on sandy soils. Though tobacco is a hardy plant and will grow under varied conditions, yet to become a profitable crop, it must not be grown in a situation very different from that to which it is suited by nature. It must be remembered that the plant is a native of a warm climate, and thrives best in a moist atmosphere; therefore, in such a climate, by employing ordinary means, tobacco may be made to yield a profit not attainable in less favored situations. A warm, moist climate will permit of the selection of the varieties that sell at the highest price in the market, and in a suitable soil the profit will be such as is not often or easily realized from any other crop.

From a table at hand, which gives the essential features of the crops of cotton for the year 1888, in the United States, it appears that the yield per acre for cotton was one hundred and eighty pounds—price per pound, eight and a half cents. Value per acre, fifteen dollars and thirty cents.

With tobacco, the average annual production during the past decade has been about one-sixth that of cotton. The average yield per acre has been about seven hundred and twenty-five pounds, with an average of eight and one-half cents per pound, making the value of tobacco per acre sixty-one dollars and sixty-two and a half cents.

As the Havana tobaccos command the highest price, growers everywhere attempt to introduce and cultivate them. The difficulty in growing these varieties is, they speedily degenerate if the conditions are not favorable. Virginia tobacco is the most favored in temperate climates, as it does not require such a high temperature, but on account of its botanical characteristics it is not much liked by cigar or cut tobacco manufacturers. A high price is generally commanded, no matter of what variety, which possesses either a light mahogany, cinnamon, or golden color, and fine aroma, with thin ribs far apart and even. The wider the leaf and the less they are worm eaten, or torn, the greater the number of wrappers which can be cut from a pound for making cigars, consequently manufacturers will pay more for grades possessing these qualities than for others. There are among growers as many varieties of tobacco as there are varieties of cabbage, each section favoring a particular kind.

It may, however, be said of the varieties most generally grown in America, that the Kentucky, Virginia and Maryland are employed for chewing, pipe and cigarette smoking, while the Connecticut seed leaf and Havana are most in use for fillers and wrappers in the manufacture of cigars.

Tobacco is now cultivated through a wider range of temperature than any other tropical plant, and whether grown amid the plains of South America, or in the rich valleys of South side Virginia, or as far north as Connecticut, develop its finest form and perfection of leaf.

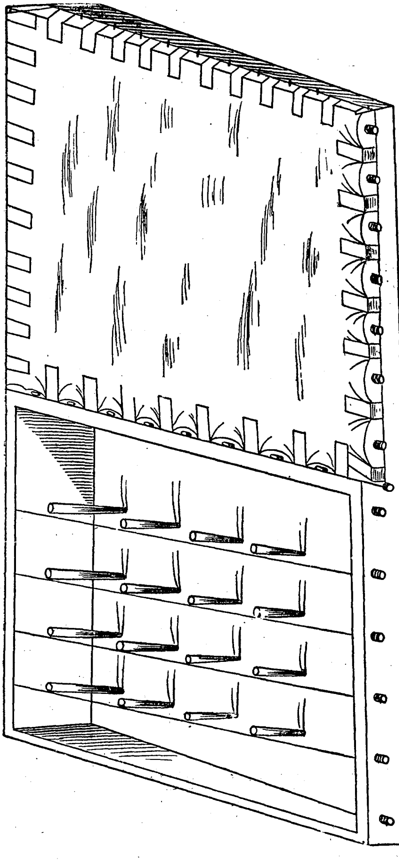
During the last half century the plant has been developed to a greater extent than during the three hundred years succeeding its discovery. Its cultivation and management have been reduced to an approach to an exact science, and the quality of the leaf is, in a great measure, within the control of the growers of the plant; until quite recently it was supposed that the varieties that grew in the tropics could not be cultivated with success in the temperate regions, but recent experiments have demonstrated the fact that the tobacco of Cuba can be grown with success in many parts of the United States. The tobacco raised in the tropics is the finest in flavor, while the more temperate regions produce the finest and best colored leaf.

The tobacco of the tropics, as to the uses to which it is put, is limited, while the tobacco of the more temperate regions can be used for all the purposes for which the plant is needed.

Formerly but little attention was paid to the color and texture of the leaf, the principal object being the production of a leaf of large size, rather than one of good color and of silky texture. Now, these are most important conditions, and give value to the tobacco in proportion to the perfection of these qualities.

IV. Raising the Plants.

The first operation necessary in starting tobacco growing is the making of a seed-bed for raising the plants. A warm sheltered position should be selected for this. It is a common plan to burn a pile of brush-wood on the land selected for raising the plants to supply potash, and at the same time destroying the seeds of weeds, or the eggs of insects.



A more recent plan of raising the plants is under a covering of cheese cloth in a hot bed. Plate No. 1 is an illustration of the modern method of covering the plants during their growth both in the open air and hot beds. The area of the seed bed will of course depend upon the extent of the proposed cultivation and as usually about one square inch in space is allowed to each young plant in the seed-bed, it will require a seed-bed of thirty-six square feet, say nine by four feet, to supply plants for an acre planted at equal distances of three feet apart. An ounce contains enough seed to plant from six to seven acres, but as it has not a high percentage of vitality it is usual to sow at the rate of half an ounce for an acre. The bed ought to be covered with a covering of cheese cloth, or fine brush, or short leaf pine straw. This not only protects the plants from the cold, sudden freezes, which are common in the early spring in this latitude about the time germination commences, but checks too rapid evaporation from the earth, keeping the surface moist. When the young plants first appear above the surface they are very tender; they require frequent watering of weak liquid manure and top dressing with fertilizers. All weeds must be carefully removed and the flea beetles which often destroy all the young plants in a few days must be watched for and insect remedies applied. In from five to six weeks the plants will be ready for transplanting.

V. FIELD CULTURE.

Land on which it is intended to grow tobacco should be well ploughed; on compact soils the ploughing should be deep. An intelligent rotation of crops carried out with an intelligent knowledge of the needs of the tobacco crop will be the aim of the practical farmer. Before transplanting the young plants from the seed-bed the land should be ridged, the distance between the ridges depending on the kind of tobacco to be planted—the larger kinds requiring more room than the smaller-leaved and tall sorts; but they should be far enough apart to allow a free passage between the rows of plants without injuring the plants. Generally from three to three and a half feet apart between the rows, and the same between the plants will be sufficient. Where the surface is level the plough may be run lightly over the field at right angles, thus forming small hills on which the plants are planted.

Choice of Soil.—The growers of the plant in Virginia are very particular in the selection of soil for the plant. The lands which they find best adapted are the light red or chocolate colored lands and the richest low grounds. The selection of soil will depend upon the color of leaf in demand, as the soil as well as the fertilizers determine to some extent the color and texture of the leaf.

The effect produced by planting tobacco too near the sea is injury to the leaf, which is apt to be thick and unfit for a cigar wrapper. In some countries, however, notably Cuba, the leaf grown near salt water is equal in color and texture to any grown in the interior.

Generally the plant obtains its finest form and quality of leaf on lands bordering the largest rivers. This is true of the tobacco lands of Connecticut, Kentucky, Virginia and North Carolina, as well as of those in the islands of Cuba and San Domingo; but some of the finest tobacco grown in the United States is grown in countries some distance from large rivers.

When possible, select the kind of soil for tobacco that will produce the color and texture desired. For Connecticut seed leaf a light moist loam is the best soil. For the bright tobaccos, such as are raised in Virginia, North Carolina and Maryland, the soil should be light and friable, or what is commonly called a sandy loam, not too flat, but of a rolling, undulating surface not liable to overflow in excessive rains. New cleared in these last named States is considered better than long cultivated soils. In Cuba the planters select the red soil as the best for fine tobacco. Some planters, however, prefer a soil mixed of one-fourth sand and one-half to three-fourths of decayed vegetable matter.

Both the Cuban and American planters concur in asserting that a large quantity of silicious matter in soils is essential for the growth of good cigar tobacco. The rich clay loams on the banks of the James River in Virginia do not grow the highest price tobacco, while the less fertile silicious soils of other sections will produce tobacco of superior quality for chewing and smoking. Tobacco of high grade will not grow in the calcareous regions. A better soil is one that rests upon the primary foundation.

VI. TRANSPLANTING.

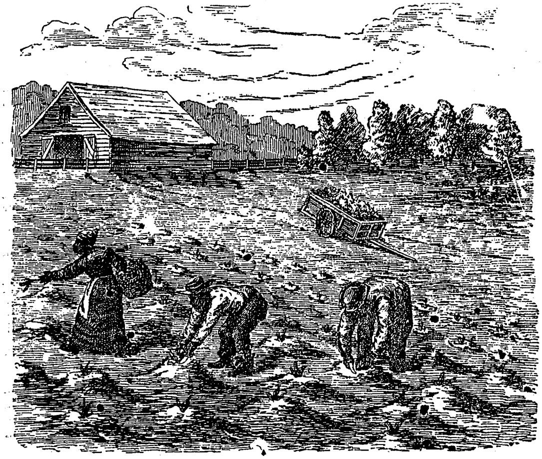


FIGURE 2.

—Figure 2 shows the plan of placing and setting the plants.

Transplanting should be done in the evening or on a cloudy day. Before transplanting, the seed-bed should receive a good watering so that the plants can be drawn without injury to the roots.

The planting is similar to the planting of cabbage and is no more difficult. A good plan is, for a boy to walk between the ridges, placing the plants alternately to right and left, being followed by the planters, who place the plants in the hills or ridges, taking the precaution to leave the bud well above the surface.

In a few days any missing hills which occur should be replanted, and during the early growth a close watch must be kept for the cut worm, bore worm, and other injurious insects. When the plants have taken root they grow very quickly and subsequent cultivation is simple, though requiring care.

When the plants are from six to nine inches high they require to be hilled, by mounding the earth around the plants, to protect them from falling when the soil is wet or from being blown down by heavy winds. One or two hoeings are necessary during the growing period to keep down the weeds, as everything that detracts from the growth of the plant is detrimental to the quality of the leaf.

VII. Chemical Properties.

An analysis of the ashes of tobacco by Professor Johnson shows the following constituents in their several proportions (per cent.):

Potash	12.14
Soda	0.07
Lime	45.90
Magnesia	13.09
Chloride of Sodium	3.49
Chloride of Potassium	3.98
Phosphate of Iron	5.48
Phosphate of Lime	1.49
Sulphate of Lime	6.35
Silica	8.01
	100.00

From this analysis it will be observed that of the mineral matters contained in tobacco, the following predominate: silica, potash, lime and magnesia, with a large proportion of the phosphate of iron and sulphate of lime.

There is in tobacco a volatile akali which may be known by its smoke changing the color of flowers—turning red to purple and purple to green. Different kinds of tobacco are distinguished by the peculiar odor emitted. This variation is in part due to the different modes of curing the leaf.

Recent Investigations.—Many new investigations have been made as regards the tobacco crop, referred to under the following heads.*

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*Dr. J. Nessler, of Karlsruhe (Landw. vers. Stat. 40, pp. 395-438) Experiment Station Record, October, 1892.

(1) Demands of the trade especially with reference to burning qualities.

(2) What amount of chlorine is allowable and what amount of potash essential to the desired burning quality.

(3) Effect of soil on the burning quality.

(4) Amounts of chlorine and potash removed from the soil by different crops and effect of previous cropping on the burning quality of tobacco.

(5) Amounts of potash and chlorine furnished the soil in different manures.

(6) Effect of manuring on burning quality.

(7) Effect of previous cropping and manuring on the properties of tobacco other than that of burning.

(8) Injurious and beneficial methods of cropping and manuring tobacco.

The various properties of the tobacco leaf, burning qualities, size, weight, color and fermentive properties, are all more or less affected by the variety of tobacco, the soil, time, and manner of manuring, climate and the time of ripening.

The properties of tobacco may also be affected by the manner of curing and the weather during the curing. The fact that so many factors play an important part in determining the quality of tobacco makes this part of the subject a difficult and tedious one to study and understand. To secure the desired burning quality, the amount of chlorine must not rise above a maximum, nor the amount of potash sink below a minimum. From studies made of forty-six samples of tobacco, grown in Baden, Germany, on different soils and with different manures, the conclusion was, that tobacco continued to glow longer, *i. e.*, burned better, the more potash and less chlorine (sodium chlorine) it contained.

In general, tobacco will be of inferior burning quality, which contains more than 0.4 per cent. of chlorine, and less than 3.5 per cent. potash.

Effect of Soil on Burning Quality of Tobacco.—As a result of the studies referred to above, it was found that while tobacco from sandy soils contained on an average only 0.29 per cent. of chlorine, that from heavy soils contained 0.92 per cent. of chlorine, and that tobacco from light soils averaged 2.8 per cent. potash, while that from heavy soils averaged 2.4 per cent. From these indications, to secure the best burning quality, tobacco should be grown on light soils, and not on heavy clay soils.

Effect of Fertilizers on Burning Qualities of Tobacco.—As previously stated, that to be of good burning quality, tobacco should not contain more than 0.4 per cent. chlorine to 2.5 per cent. potash (that is, six times as much potash as chlorine), consequently, fertilizers for tobacco should contain at least six parts of potash for every part of chlorine that is at the disposal of the plant. The closer the relation between potash and chlorine in a fertilizer the less it is adapted for tobacco. A number of experiments have been made, with potassium nitrate, potassium sulphate, potassium muriate, gypsum and common salt as fertilizers for tobacco.

The chlorine compounds always injured the burning qualities, and the potassium sulphate and potassium nitrate often improved this quality, though not always—the failure being due, it is believed, to the potash not being sufficiently distributed through the soil, or where heavy applications were made to the formation of too concentrated solutions.

The tobacco plant gets its growth and maturity rapidly, and requires a constant supply of plant food from the soil, but on the other hand it is exceedingly sensitive to concentrated solutions. It is important that the fertilizer, especially the potash, be thoroughly mixed with the soil to a depth to which the roots extend. This may be accomplished in a measure by applying the fertilizer sometime in advance of planting.

Previous Culture of Land for Tobacco.—The quality of the soil and the manuring are largely responsible for the early and late ripening and the regular and irregular ripening of tobacco.

Tobacco plants ripen later on soils rich in organic matter, except in the case of sandy soils, where the organic matter decomposes rapidly. Heavy applications of nitrogenous manures retard ripening. Tobacco richly manured with liquid manure, night soil, barnyard manure, or nitrate of soda, ripens late.

If the plants are set late on fields so manured, or those rich in organic matter, the leaves may not have time to ripen, and a greenish leaf will result, which, in burning, gives an unpleasant odor and bitter taste, and bitter taste in chewing also.

Formulas for Fertilizers for Tobacco.—The following fomulas for fertilizing tobacco have been recommended:

Formula No. 1.—From 900 to 1250 pounds of wood ashes, or 350 pounds of potassium sulphate per acre, the applications being made to deep soils late in the fall, or to shallow soils before the first plowing. In the spring before setting the plants 135 to 180 pounds of nitrate of soda may be applied when the land is not heavily manured. In rainy seasons, when the plants lose their dark green color, and fail to grow well, 90 to 135 of nitrate of soda per acre may be applied while the plants are small.

Formula No. 2.—Two hundred and seventy-five (275) pounds of low grade sulphate of potash, 250 pounds of acid phosphate (12 per cent.) and 100 pounds of sulphate of ammonia (a by-product of gas liquor) or 280 pounds of cotton seed meal. Sulphate of ammonia, it is stated, is one of the most concentrated forms in which ammonia can be applied to the soil, and is, at the same time, one of the most active and readily available forms, being decidedly quicker in its action than any form of organo-nitrogenous matter.

Magnesium carbonate, a new product of the Stassfurt industry, of Prussia, Germany, containing 18.5 per cent. of potash, is said to possess good properties in improving the quality of tobacco. In the Connecticut valley, where fine cigar leaf is raised, nearly all kinds of domestic, commercial, and special fertilizers are used. Of domestic fertilizers, horse manure is considered the best, as it produces the finest and lightest colored leaf of any known fertilizer. Cotton seed meal, when used with domestic manure, is an excellent and strong manure.

Mapes formula is a favorite with many growers of fine cigar leaf in Connecticut.

VIII. The Stalk.

Figure 3.

Figure 3 represents a full grown tobacco stalk, with the leaves taken off.

The tobacco stalk varies with the varieties of the plant.

All of the species cultivated in the United States have stalks of a large size, much larger than many varieties grown in the tropics.

The American varieties have erect, round, hairy, viscid stalks and large fibrous roots, while the foreign varieties are harder and much smaller. The size of the stalk corresponds with that of the leaves; the two larger stalks in the figure show the American, and the smaller stalk the foreign. The size of the stalk corresponds with that of the leaves, and with such varieties as are planted in Virginia, North Carolina, Kentucky, and other old tobacco States, will be found to be larger than the Spanish and Syrian tobacco, which have a much smaller, but harder stalk. The stalk must be hard and strong to support the long, palm-like leaf, which, in some varieties, grows to a length of two and half to three feet.

The Leaves.—The plant bears from eight to twenty leaves, according to the species of the plant.

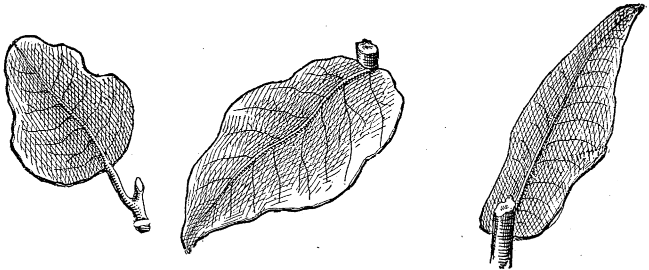

FIGURE 4.

They have, as represented in figure 4, various forms; ovate, lanceolate, and pointed. Leaves of a lanceolate form are the largest, and the shape found on most varieties of the American plant.

The color of the leaves when growing, as well as after curing and sweating, varies, and is frequently caused by the condition of the soil. The color, while growing, may be either a light or dark green, which usually changes to a yellowish cast as the plant ripens. The ground leaves generally ripen first, turning yellow and during wet weather will rot and drop from the stalk if not gathered. The color of the leaf, after curing, may be determined by the color of the leaf while growing; if dark green while maturing in the field, the color will be dark after curing and sweating, and the reverse if of a lighter shade of green. If the soil be dark, the color of the leaf will be darker than if grown upon light soil. The kind of fertilizers applied to the soil, as well as the soil itself, has much to do with the texture of the leaf, and should be duly considered by all growers of the plant.

The Flower.—The flowers of the tobacco plant grow, as is shown in figure 5, in a bunch on the summit of the plant, and are of a pink, yellow, purple or white color, according to the variety of the plant.

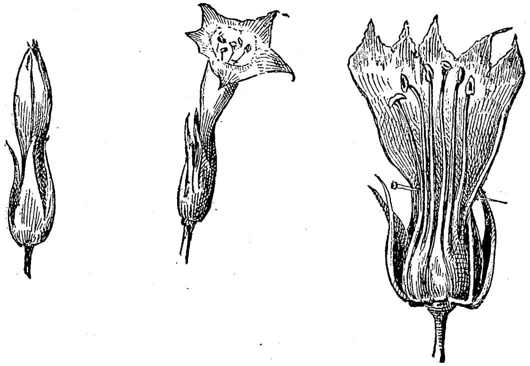

FIGURE 5.

After the buds appear they blossom in a few days and remain in full bloom two or three weeks, when they perish.

The Capsule.—When the flowers drop from the fruit bud, the capsules grow very rapidly and soon attain full size, as shown in figure 6.

FIGURE 6.

This occurs only in those plants which have been left for seed and remain untopped. In form, the fruit bud resembles an acorn, though more pointed at the top; in some species, of a dark brown, in others of a light brown color, containing two cells filled with seed, similar in shape to the fruit bud. Some writers state that each cell contains about one thousand seed. The fruit buds of Virginia tobacco, as well as of most varieties grown within the limits of the United States, are much larger than those of Havana, Syrian and numerous other species of the plant, while the color of these last named varieties is a lighter shade of brown.

The color of the seed also varies according to the varieties of the plant. The seeds of some species are of a dark brown, while others are of a lighter shade.

The seed are so small that the variety to which they belong can not be determined except by planting or sowing them. The plants selected for seed should be left growing late in the season. Strong, healthy plants generally produce large, well-filled capsules, and these should be selected by the grower for seed. The largest and finest capsules on the plant mature first, while the smaller ones grow much slower and are frequently several weeks changing from their green to brown color. Many of the capsules contain imperfect seed and some do not contain any seed at all.

The Sucker.—The sucker makes its appearance at the junction of the leaves and stalk, as indicated in figure 7.

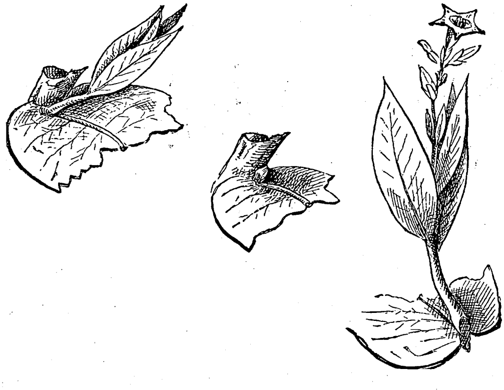

FIGURE 7.

Usually these are not seen until after the plant has been topped, when they come forward rapidly and if not plucked off in a short time develop into strong, vigorous shoots.

The growth of the suckers is injurious to the leaf, retarding their size and maturity, and affect the quality as well as the maturity of the plant. When the plants are fully ripe and ready to harvest, the suckers will be found to be growing around the root of the plant.

This is one of the most reliable evidences of its maturity, as it denotes the ripening of the entire plant.

Breaking off the suckers hastens the ripening of the leaves and gives a lighter shade of color, no matter on what soil the plants are grown.

Topping.—Topping is simply breaking off the bud at the top of the stalk, as represented by figure 8,—

FIGURE 8.

to prevent the plant running up to flower and seed.

By this means the best growth of the leaves is secured, and they at once develop to the largest possible size; will ripen sooner, while the quality is much better.

There are various methods of topping, as well as different periods. Some planters top as soon as the capsules appear, while others wait until the plants are in full blossom. If topped before the plants have come into blossom, it should be done as soon as possible, as a longer time will be required for the leaves to grow and ripen than when topping is delayed until the plants are in bloom. Top the plants at a regular height, leaving from nine to twelve leaves, so that the field will look even and also make the number of leaves to a plant uniform. The above method of topping refers more especially to cigar rather than cutting leaf. Those varieties of tobacco suited for cutting leaf should be topped as soon as the flower bud appears; top low, thereby throwing the strength of the stalk into a few leaves, making them large and heavy. Let it grow from five to six weeks after it is topped, so as to have it thoroughly ripe, thereby giving it the bright, rich, golden color, entirely different from cigar leaf, but desirable for chewing leaf. The custom in the old tobacco States is to top for English shipping from eight to ten leaves; for coal curing, from ten to twelve. In some sections of the United States the plants are not topped at all; the leaves are left upon the stalk until they are fully ripe, when they are taken off.

IX. Insect Pests.

The two most destructive pests that prey upon the tobacco plant after being transplanted to the field are the "cut worm" and the "horn worm", as shown by figure 9.

FIGURE 9

The cut worm commences its work of destruction in a few hours after transplanting in the field.

During the night this worm begins by eating off the small or central leaves, and often so effectually as to destroy the plant. The best time to find and destroy these pests is early in the morning, when they can be found nearer the surface; with the heat of the sun they burrow deeper in the soil.

Soon after they disappear, the fight with the horn worm commences.

Figure 10 shows the Sphinx, or moth, the parent of the horn worm, the larvae and the horn worm.

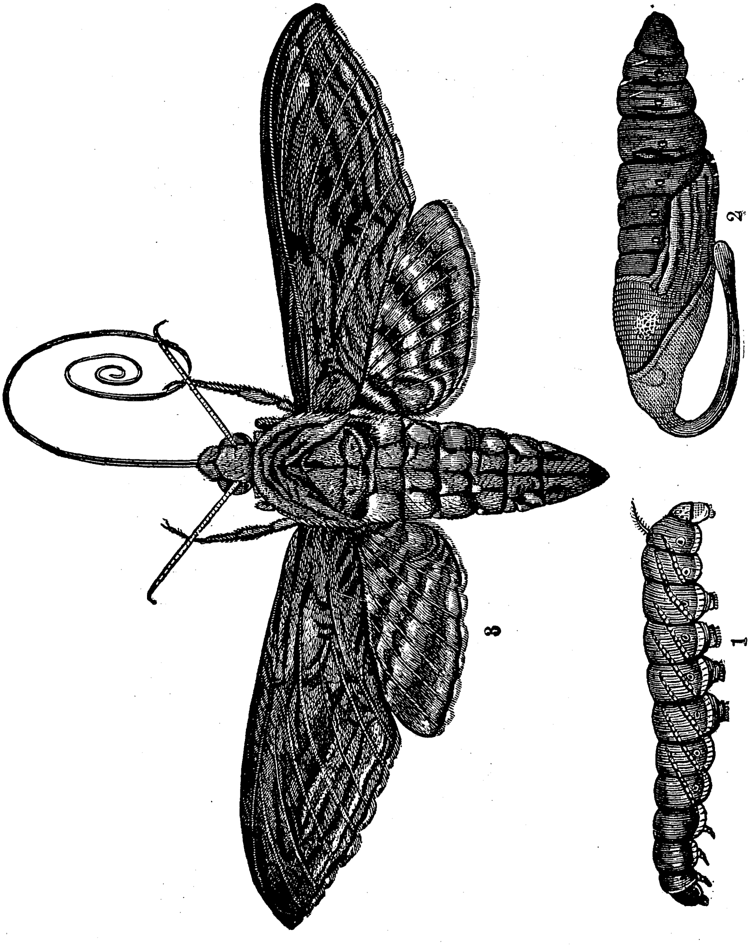

Figure 10.

The horn worm feeds upon the finest and largest leaves; eats the leaves in the finest parts of them. They leave large holes which render the leaf worthless for a cigar or chewing wrapper, leaving it fit only for fillers. As the Sphinx, that lays the eggs usually deposits two crops of eggs on the tobacco plant during its growth, it will require much time and labor to destroy the eggs and worms. If this is neglected, the crop will be much injured and will not be sought after by good judges of tobacco.

X. VARIETIES OF TOBACCO AND HARVESTING.

Figure 11 represents the Connecticut seed leaf as it appears ready for harvesting.

FIGURE 11.

Tradition indicates that this variety was introduced originally into the New England States by B. P. Barber, and it is thought to belong to the Cuban variety. The varieties cultivated in the United States and known as "seed leaf" tobaccos, are grown in Connecticut, Massachusetts, Vermont, and eastern and western States.

All of the seed-leaf of the United States is used exclusively in the manufacture of cigars, and is celebrated for cigar wrappers from the superiority of its color and texture, and the good burning quality of the leaf.

The plant grows to the height of about five feet, with leaves from two and one-half to three feet in length, and from fifteen to twenty inches broad. The color of this tobacco after curing is either dark or light cinnamon.

There are two principal varieties of Connecticut seed-leaf, broad and narrow leaf—of these two, the broad leaf is considered the finest, cutting up to better advantage in cigar making, and ripening and curing fully as well.

This tobacco has not that fine flavor of Cuban tobacco, but in texture is considered equal to it. It burns freely, leaving a white or pearl colored ash, which is one of the best evidences of a good cigar tobacco.

The leaf is firm and strong, and sufficiently elastic to bear considerable manipulating in manufacture. Thorough cultivation by the growers has made this quality of tobacco one of the most profitable of any cigar tobacco grown in the United States.

FIGURE 12.

This figure represents a plant of Virginia tobacco maturing seed. Virginia tobacco has acquired a reputation which has gradually increased for more than two hundred and fifty years.

The plant grows to the height of from three to five feet; the leaves are long and broad, and when cured are of various colors, from a rich brown mahogany, cinnamon, to a fine golden yellow. The finest quality of Virginia tobacco comes from the southside counties, but the amount is small compared to the quantities of dark raised on the lowlands of the Dan and James rivers and their tributaries. The tobacco grown in the southside and southwestern counties of Virginia is much lighter in color, and of much softer and finer texture than the ordinary Virginia tobacco.

Havana Tobacco.—This famous variety of tobacco, as is shown in figure 13, is considered the finest flavored for cigars that is now cultivated.

FIGURE 13.

This variety, it is stated, grows to a height of from six to nine feet, with oblong, spear-shaped leaves. The leaves when young are of a dark green color, and have rather a smooth appearance, changing at maturity into yellowish green. This variety grows quickly, and by careful pruning a fine colored leaf is obtained, varying from a straw color to a dark brown or black.

The finest is grown in Vuelta de Abajo, which for nearly a century has been celebrated as a fine tobacco producing district. The Havana tobacco ripens in from eight to ten weeks after being transplanted.

The stalk and leaves are not as large as the Connecticut seed-leaf, but it is better in flavor.

Cutting the Plant.—Figure 14 represents harvesting the plant.

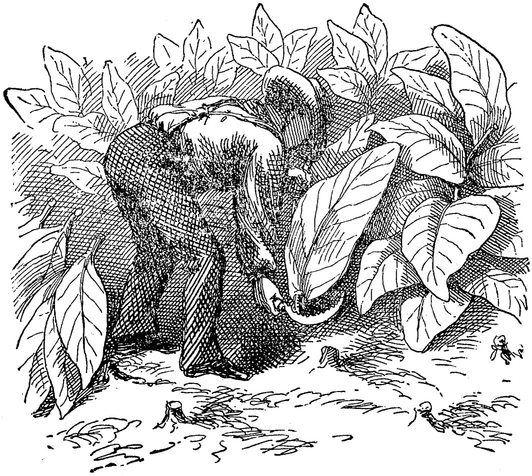

FIGURE 14.

There are two methods of harvesting, cutting down the whole plant or gathering the leaves singly. The former is the one that has been practiced for a long time by tobacco planters; the latter, which is of recent origin, is regarded by many as the most scientific method.

Both these plans of gathering have their advantages. The first is the easiest and permits of quicker handling, but the leaves have to be assorted afterwards, while the latter permits the sorting of the leaves in the first operation, and the development of a greater number of mature leaves.

For cutting, a heavy knife is used, and the method is similar to cutting sugar cane, the plant being held with the left hand and cut close to the ground.

The plants should be removed to a shady place to prevent their becoming sunburnt.

Putting on the Stick.—This is shown by figure 15.

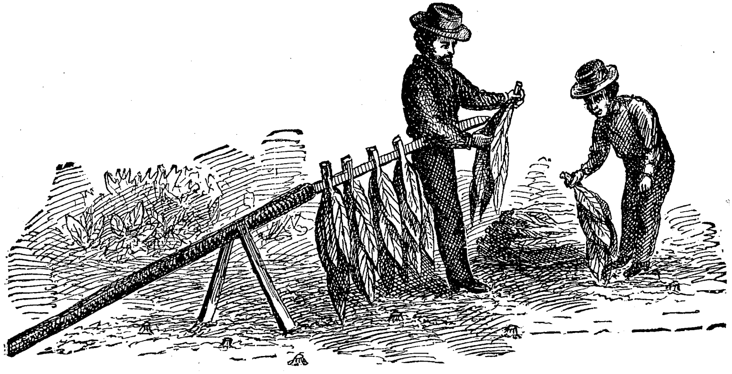

FIGURE 15.

After the plant is wilted and becomes pliant and in good condition to handle without breaking, it should be placed on the stick.

Some tobacco growers hold the opinion that the plants should be harvested without wilting at all, stringing on the stick as soon as cut, and carrying them immediately to the tobacco barn. The reason for this is, that often at the time of cutting the plant the ground is hot, and the plant becomes very warm and quickly sunburned. When hung on the stick, which is four and a half feet in length, six to eight large plants are the usual number.

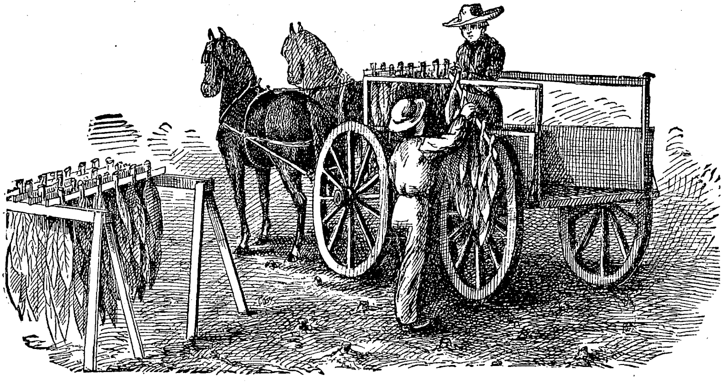

FIGURE 16.

Carrying to the Barn.—This figure shows how the sticks are placed on a frame in the field and loaded on the wagon for taking to the tobacco barn.

XI. MODERN VIRGINIA TOBACCO BARN.

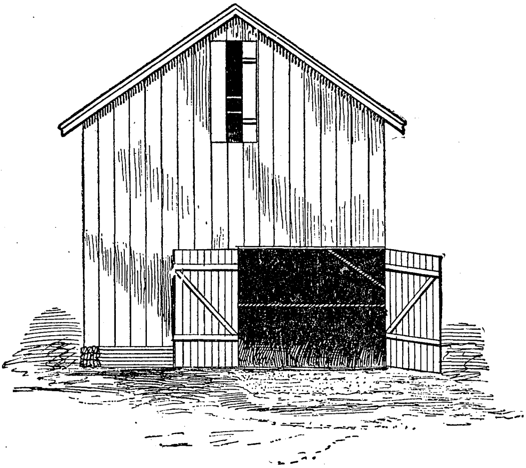

FIGURE 17.

The process of curing now commences, and on the success of this operation depends in a great measure the ultimate value of the crop. No matter how fine the plants may be, or how large the production, an error in curing is sufficient to destroy, in a great degree, the work of the season. The tobacco barn should be built with windows and doors sufficient to insure a free current of air. The barn should be high enough to permit three rows of plants being hung one above the other, say 16 to 18 feet from floor to roof.

There are several methods of curing, viz: Air curing, sun curng, firing with open fires, and curing by flues.

Air curing is the process of curing the plant in shade or barn, as seen in figure 18.

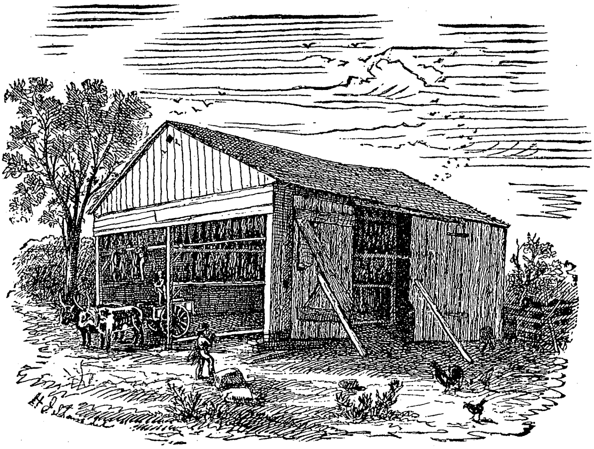

FIGURE 18.

Sun curing is the method of curing in the open air, while firing is the process of curing as above stated, either by open fires or flues in the tobacco barn. The latter method is the one generally practiced in the tobacco sections in Virginia, North Carolina, and to some extent in the west, and is considered the best way of curing cutting leaf.

Method of Curing.—There are two common methods practiced of handling tobacco for curing,—the older and long favored method of cutting and hanging the whole stalk with the leaves attached, and the method of detaching the leaves from the stalk before hanging,—a method which is comparatively new in this country, but is employed to considerable extent in Germany and France.

These methods are too long to be discussed fully in this bulletin for the purpose of passing on the merits of either.

A recent experiment conducted at the North Carolina Experiment Station, with a view to settling the matter, indicates that a comparison between the weight of one-half a crop of tobacco cured on the stalk and the other half cured separate from the stalk shows a difference of weight of 128 pounds per half acre in favor of the latter. Major R. L. Ragland, a large and successful grower of tobacco in Virginia, states that he has for years employed both methods with success, and there is no doubt that in parts of Virginia and North Carolina the method of stripping the leaves has recently come into decided favor.

A contrary view is held by Prof. Wagner, of Darmstadt, Germany, a most reliable authority, and one in whom the Germans have great faith. He says: If the leaf is picked before it is ripe, it needs a process of subsequent ripening to give it a good quality. This is impossible if the leaf is separated from the stalk. With this view another German writer, W. Tscherbatscheff, also agrees.‡ An experiment conducted by Nessler shows that the dried constituents of tobacco cured on the stalk, and separate from it, show no appreciable difference in weight.*

These opinions are conflicting and irreconcilable at present, and further investigation will have to be made to settle the question.

XII. Snow's Modern Tobacco Barn.

This new process of harvesting and curing tobacco was introduced by W. H. Snow, of Highpoint, North Carolina. Figure 19 shows the view ot this modern barn.

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‡ *Tscherbatscheff W. Der Tabak und Seine Kultur in den Nordamerikanischen Staaten, Laudwirth Schaftliche Jahrbucher*, 1875, *p.* 102.

*Wagner, I. C., p. 38.

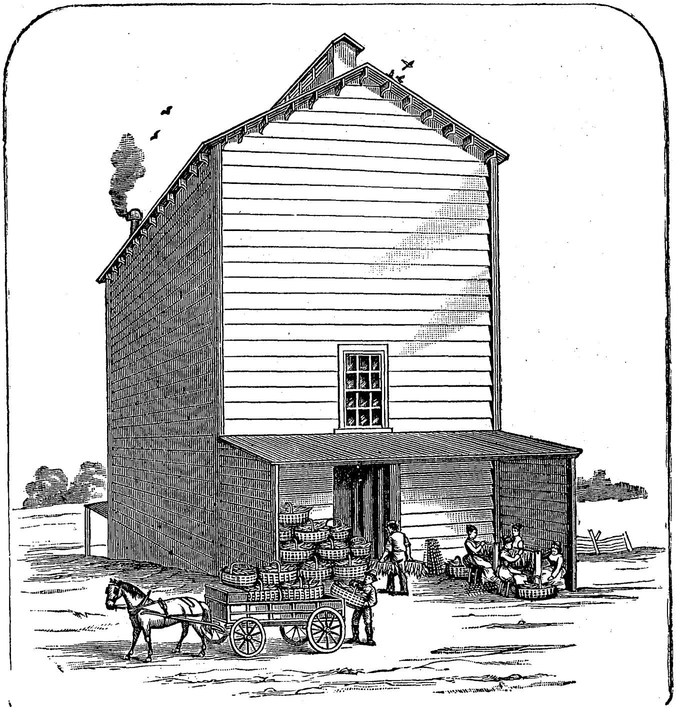

FIGURE 19.

It is not necessary at present to give details for the construction of this barn and apparatus. It is claimed that this system of curing tobacco in the Snow Modern Barn has important advantages. The leaves are stripped from the stalks in the field and brought to the barn in baskets, and strung about the width of a finger apart on pointed wires which project at right angles from a wooden stick. As the sticks are filled they are placed in movable racks in the barn, and as fast as a rack is filled it is raised by a simple device to the top of the building. This is continued until the barn is filled, leaving only as much space between racks as is required for the hanging leaves.

Plan of Housing.—The plan of housing in this barn is illustrated by Figure 20.

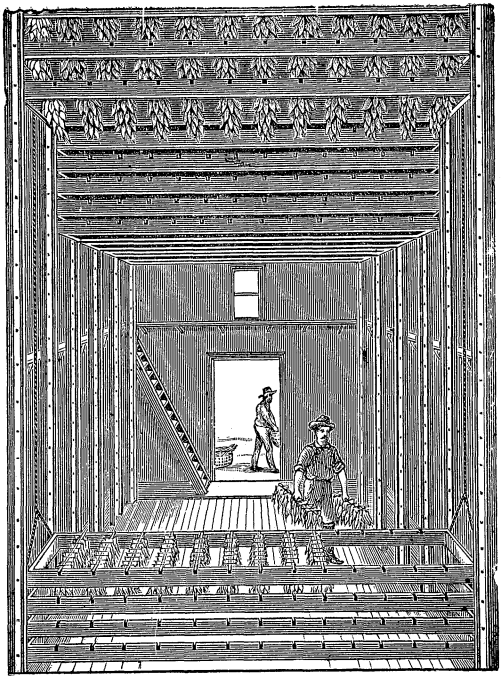

FIGURE 20.

Advantages of the Method.—The following are some of the important advantages claimed for the Snow process over the old:—

I. The planter can begin to house his crop from two to four weeks earlier, as the bottom leaves which ripen first can be taken off and cured as soon as they are ripe.

II. As the lower leaves are pulled off those left on the stalk ripen up more rapidly, which enables the planter to get in his crop earlier in the season.

III. The tobacco can be stored in a much smaller space and with no risk of losing color or molding when bulked down.

IV. Tobacco can be cured with a more uniform color.

V. Less fuel will be required, and the risk of setting fire to the barn will be greatly lessened.

Many other advantages are claimed for this new system over the old, which I will not now enumerate.

Flues and Flue Curing.—The cut 21 represents the furnace and pipe which is extensively used in flue curing.

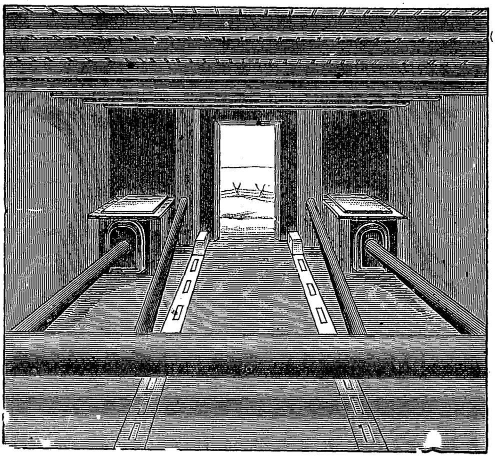

FIGURE 21.

Flues have almost entirely superseded open fires for curing yellow tobacco as being cheaper and better every way. The heat is more readily controlled by the use of flues, and the tobacco cured by this process is cleaner, brighter and sweeter. The flue is regarded as the best mode for applying heat in the curing process for any type of tobacco requiring the application of artificial heat, and is fast superseding the open wood fire.

The Stove.—The stove as represented in figure 22 is the kind usually used. This is placed in the basement of the barn. The doors of the stoves open from the outside. The stoves are covered with brick or stone arches extending two feet beyond the rear ends of the stoves.

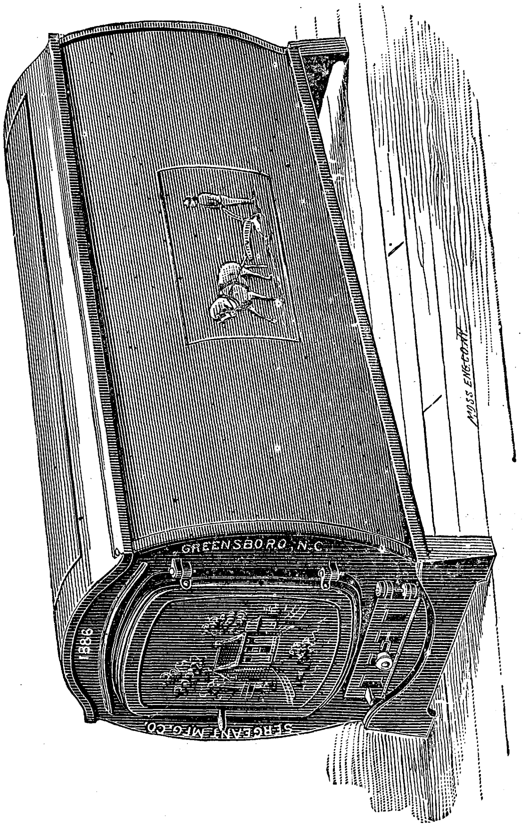

FIGURE 22.

XIII. STRIPPING.

This process is represented by Figure 23.

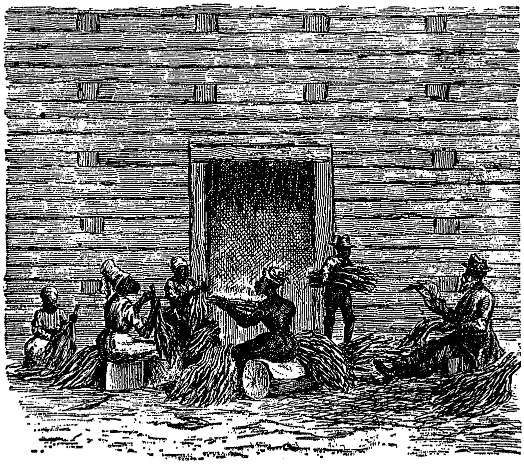

FIGURE 23.

After the tobacco is thoroughly cured it has to be stripped. The leaves become soft and pliant in damp weather and can be readily taken down out of the barn for stripping. After taking down, the plants should be packed, in order to be kept moist until stripping.

This operation consists in taking the leaves from the stalk and tying them in bundles after assorting the various qualities and keeping them separate. Each hand or bundle of the best grades should contain at least twelve leaves. In the old tobacco States the plant is usually made into three grades—long, short, and lugs, or worm eaten leaves.

In Cuba the leaves are divided into four classes; first, the leaves at the top of the plant, which constitute the best quality, from the fact that they get more equally the benefit of the sun's rays by day and the dew at night; second, the leaves which are next to the above; third, the inferior or small leaves; fourth, the lug leaves, or those nearest the ground.

The assorting of the plant previous to putting in hands or bundles is an operation that requires judgment and a practiced eye. This mode of assorting colors in stripping is similar to that of shading cigars, in which the utmost care is taken to keep the various colors and shades by themselves. Assorting the plant does not imply that it is carried to its fullest extent in point of color, as in shading cigars, but simply keeping those general colors by themselves, like light and dark brown leaves. Figure 24 shows the bundle after it has been stripped, assorted and tied.

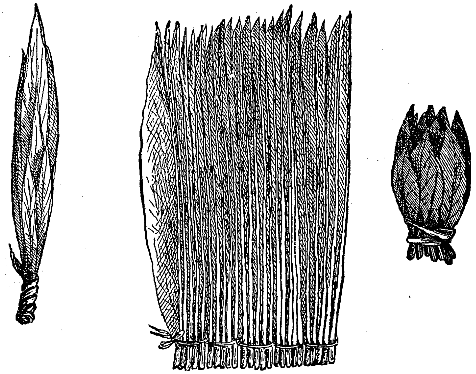

FIGURE 24.

Packing.—This is shown by figure 25.

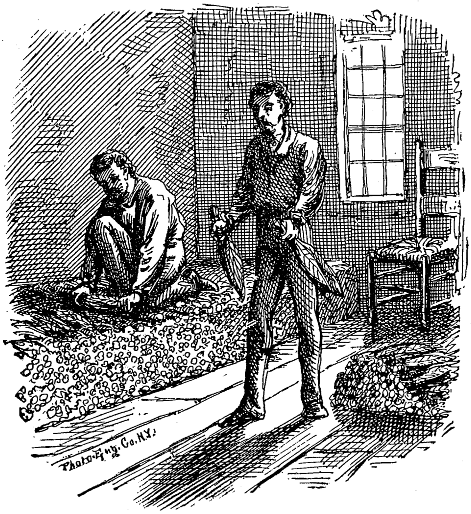

FIGURE 25.

After the process of stripping is completed the hands should be packed to keep them moist or as near possible in the same condition as when stripped. Select a cool, dry place in the center of the floor of the tobacco barn. It should be packed loosely or compact according as the hands are moist and dry.

Hand the tobacco to the packer, who presses the hands firmly with his knees and hands, laying the tobacco in two rows—keeping the pile about the same height, filling in occasionally with a middle row until all is packed. The different qualities should be packed separately. They can be packed any height or length desired, but usually from three to five feet high will be found convenient height, while the length may be proportioned to the height or not. After the tobacco is packed, it should be covered with boards and gently weighted with stone or pieces of timber. If the tobacco is packed down in a good case, or keeping condition, which requires experience to determine, it can remain packed until ready for prizing.

Prizing, Casing and Baling.—This is shown by figure 26.

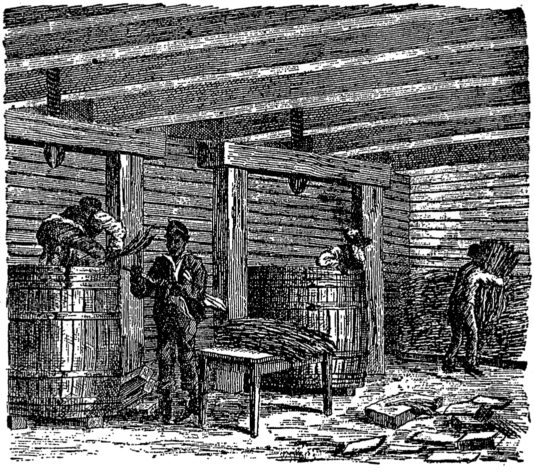

FIGURE 26.

The term prizing originated in Virginia. In the sense in which it is to be taken here is a local word, which the Virginians claim the credit of creating. It is the act of pressing or squeezing the article which is to be packed into any package by means of certain levers, screws, or other mechanical force,—this requires the combination of judgment and experience, otherwise the tobacco may become bruised.

All leaf used for cutting purposes and export in America is prized in hogsheads; cigar leaf is usually cased or baled. In some tobacco sections about 800 pounds net is packed in one parcel, while in others from 1000 to 1800 pounds. Tobacco in good condition to prize must be damp enough to bear the pressure without breaking and crumbling, while it must not be too moist or it will rot in the case.

The hands or bundles are packed in the hogshead, or the case in two tiers—when nearly filled, it is subjected to a strong pressure as is shown in figure 27.

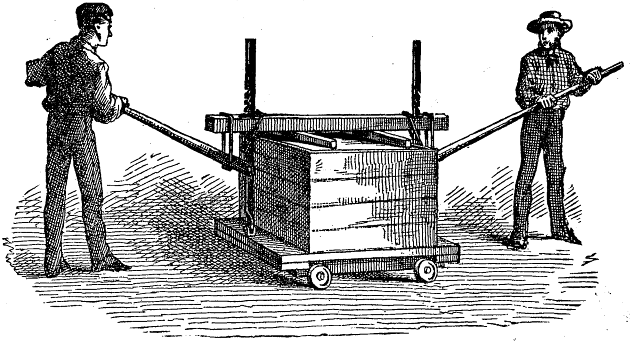

FIGURE 27.

The tobacco should be cased hard so that the mass will rise but little when the pressure is removed. When tobacco is prized or cased in the spring, it will commence to "warm up" as the summer comes, and will go through a sweat. After "going through a sweat" the leaves take on a darker color, and lose the rank flavor which they had before.

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* After much correspondence and delay, the plates for this Bulletin were procured from The American Publishing Company, Hartford, Connecticut, Historical Publishing Company, Philadelphia, Penn., and Orange Judd Company, New York—and the issuing of the Bulletin has been delayed from this cause.

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Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

INJURIOUS AND BENEFICIAL INSECTS.

Some Insect Pests of the Farm and Garden.

J. M. STEDMAN.

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☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

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INJURIOUS AND BENEFICIAL INSECTS.

SOME INSECT PESTS OF THE FARM AND GARDEN.

J. M. STEDMAN.

It is the intention of this bulletin not to discuss in a scientific way original or other observations on insects, but to put into popular language the facts already known to Entomologists, in regard to some of the insects effecting the farm and garden crops, and to do so in such a way as to be of service to the busy farmer, who has little or no time, and less inclination, to procure the necessary literature, and study out for himself the life histories and methods of attack of these insects, and of the means of destroying them or of preventing their ravages. Hence this bulletin has no claim to originality other than the form of expression. It is written expressly for the farmers of Alabama. The discussion of the life histories of the insect is given only in so far as it is important that the farmer should know it, while the methods of destroying the pests receive prominent attention.

It is our purpose to issue several small bulletins on injurious insects, taking them up in the order of their food plants, instead of grouping them together in one large bulletin that will take so much of the farmers time to read that it will be laid on the shelf, whereas a small one now and then would be read. Persons wishing these or any or all bulletins can get them free by simply sending a postal card requesting the same and giving their address to President W. L. Broun, Auburn, Ala., or simply Experiment Station, Auburn, Ala.

Bulletins on Fungus and other diseases of plants will also be issued.

GENERAL REMARKS.

In order to arrive at the best results in combatting insects, it is important that we should understand at least the general life history of the insects in question, that we may thus know at what stage in its development means can best be taken to destroy it. Some insects can best be fought in the egg stage, others in the larva or worm stage, a few in the pupa stage, and still others in the adult stage; while many can be controlled in two or more stages. To arrive at this in a scientific way forms one of the great problems of the economic entomologist.

The larger number of our insects have four well defined stages of growth. The first is known as the *egg* state and of course in itself can do no harm. In a few cases these eggs are deposited in clusters or groups and in such a way that we can gather and destroy them, or when this is not practicable, they can be killed by spraying them with kerosene emulsion or soda and caustic soap.

Many insects winter in this egg stage as well as in the pupa or in the adult state, and since they frequent sheltered places, as leaves, rubbish and brush along fences and ditches, etc., it becomes important that all such useless material be gathered and burned every Fall, thereby destroying many insects that otherwise would appear the following Spring. Hence clean farming is one sure road to success.

The second, or *larva* or worm state is the one in which most insects do their greatest amount of injury, since it is here that most of the growth and feeding takes place. Many insects are injurious only in this larva stage, as our cotton-worm, cabbage worm, cut-worm, etc , and all other moths and butterflies. Some exceptions to this rule are to be found, as in our grasshoppers and most beetles, that do as much damage in the adult as in the larva stage in many instances. While again, the Rose-chafer that does little or no damage in the larva stage, as an adult, does much injury to our vineyards. The larva or worm does not resemble in the least the adult insect in most cases, and hence unless one be familiar with the subject, he cannot tell the adult insect by the larva. The caterpillar or worm changes to a butterfly or moth, the maggot to a fly, and the grub to a beetle. It is in this second stage that most insects are to be controlled.

The third, or *pupa* state is usually a quiet, inactive and perfectly harmless stage. Since many insects winter in this condition we can take advantage of it, and resort in the Fall to a general cleaning up and burning of all rubbish, leaves, etc., and to the burning over of stubble and to late plowing.

The fourth, or *adult* or imago stage is the perfect insect, such as a butterfly, moth, beetle, fly, etc., and it is in this state only that the eggs are deposited from which a new brood developes. As stated under the second or larva state, most adult insects except grasshoppers and beetles are in themselves harmless to the farm and garden crops; they deposit the eggs, however, on the respective plants on which the larvæ feed, and in view of this we can take means to prevent such a deposit and hence protect the plant. This is especially true and important in those cases where the larva is a borer and hence cannot readily be gotten at in that stage. Hence the necessity of covering up the base of peach trees with straw, cotton seed, ash, etc., to keep the adult from getting at the proper place to deposit her eggs, or of spraying apple trees with Paris green or London purple to prevent the coddling moth from getting into the apple, or of covering the trunks of trees with a sticky or poisonous wash to prevent the borer from entering. All preventive applications must be made just before the adult insect appears, and must be kept up at frequent intervals as long as the adult is in a condition to lay eggs.

So far as the farmer is concerned vegetable feeding insects can be divided into three groups. I. Those insects that live, either in the young or adult stages or both, within the tissues of the plant. These are called borers. They feed upon the juices and tissues inside the plant. II. Those that suck the juices of plants, in which case one finds no parts of the plants eaten away, but the leaves shrivel up and dry or turn another color. These are called sucking insects. They pierce the plant with their mouth-parts and simply suck the juices. III. Those that eat the parts of plants, in which case we find places eaten away, or parts eaten or cut off, as we say. These are called biting insects. They feed upon at least the outer parts of plants and in most cases the inner tissues at the same time.

REMEDIES.—From the nature of the case, it is evident that each of the three groups of insects as above described will require a different mode of treatment.

In general (special and exceptional cases will be noted under their respective heads) the best if not the only way to get rid of the borers is either to dig them out or, as has lately been successfully done in the case of the peach tree borer, pour hot water on that part of the tree that is infected. The application of chemicals after the insect is once inside the plant is of little or no use, since the plant would be killed before the insect could be reached. The application of chemicals to prevent their entering has succeeded in some cases. Paris green or London purple mixed with water (see formula under insecticides) and thrown in the form of a spray (apparatus for spraying will be explained later) on to the plant or parts of the plant liable to be infected, has resulted in lessening the attack in a number of cases where the insect or its young eat their way in through the outer tissue, but where the adult deposits its eggs inside the tissue beneath the outer layer, this method is of little value. The application of certain substances like coal tar, tobacco, etc., is sometimes used as a repellant. Methods and contrivances to keep the insect away will be noted under the special insect.

The sucking insects cannot be destroyed by putting poison like Paris green on the plant, since these insects do not eat the outside of the plant and hence not the poison. They can insert their mouth-parts through the surface of a leaf covered with Paris green, for instance, and not eat it, but suck the pure juice from the part beneath. They must be killed by simple contact with some chemicals, and a substance like Paris green, which is very poisonous to insects if it be eaten, may not affect the insect in the least to have it covered with the poison. Perhaps the most effectual substance with which to kill sucking insects is what is known as Kerosene Emulsion. (See formula under Insecticides.) This must be thrown on the plant in the form of a spray by means of some kind of a force pump. (See spraying apparatus.) Pyrethrum is an active substance in killing by contact nearly all kinds of insects, but unfortunately it is of late years so adulterated that it is almost useless for the farmer. It comes in the form of a powder and can be dusted on the plants by means of a bellows or mixed with water and thrown on in the form of a spray. (See Insecticides.)

The biting insects can be destroyed by poisoning the parts of the plants effected. To accomplish this we can resort to a large number of chemicals, compounds and patent insecticides. Some of the most useful being Paris green, London purple, White Hellebore, etc. A number of the patent insecticides (so called) that are advertised to kill *all kinds* of insect enemies are of no value to the practical farmer.

The mode of applying the different poisons to kill biting insects varies with the kind of plant infested and also with the insect. Some are simply dusted on to the plant as a powder, others sprayed on with a force pump. The methods of applying each substance will be given under their respective heads. (See Insecticides.)

INSECTICIDES.

The various substances, compounds and mixtures used to destroy or drive away insects can be divided into three groups. First, internal poison, that kill by being eaten with the natural food of the insect. Second, external remedies, that kill the insect by contact, either by irritating the skin, or by stopping up the breathing pores. Third, repellants, including substances that keep the insects away by offensive odors or by mechanical barriers.

INTERNAL POISONS.

Paris green is the most important insecticide of its class. It kills by virtue of the arsenic that is here in chemical combination with copper. It comes in the form of a fine powder and can be purchased at about thirty cents per pound. It can be used either as a powder to be dusted, or as a liquid to be sprayed on the plants. As a powder it is to be well mixed with from twenty to forty, and even eighty, times its bulk of flour, Plaster of Paris or air slacked lime; and can then be evenly and thoroughly dusted on to all parts of the plant by means of some kind of bellows or other powder dusting machine. (See machines for applying Insecticides.) One pound of Paris green to the acre is usually sufficient provided the dusting be done evenly and thoroughly. Paris green is sometimes used undiluted, or very slightly so (one part of Paris green to three parts of flour) as is the usual case with cotton, when the poison is placed in two heavy sacks made of some strong cloth, as 8 oz. osnaburg, and fastened to each end of a five foot pole. It is the thoroughness with which this poison is applied and not the strength that secures success. As a liquid Paris green is to be mixed with water in the proportion of one pound poison to from 150 to 200 gallons water. Paris green does not dissolve in water, and since it is very heavy and tends to settle quickly, it is very essential that the liquid be often and thoroughly stirred. It is to be sprayed on the fruit trees and other plants by means of some kind of force-pump and hose with a spraying nozzle. (See machines for applying Insecticides.) One should be exceedingly careful in spraying peach trees not to get the mixture too strong, since the leaves of this plant are very tender and easily "burned" by Paris green or London purple. A mixture of one pound Paris green to 250 gallons of water should be used on peach trees, and that only when the leaves are young. Apple trees should be sprayed just after the flowers have fallen. Small fruits and vegetables are not easily injured, if at all, by Paris green.

London Purple is about as good as Paris green as an insecticide in many cases, and has this advantage, that it is much cheaper, costing about fifteen cents per pound, and is also a much finer powder and hence remains suspended in water much longer. It is to be used in the same way and in the same proportions as Paris green.

Hellebore (white) is a powder poison made from a plant. It kills both by being eaten and by contact. It can be used as a powder to be dusted on to the plant either full strength or diluted with flour, or as a liquid, one pound Hellebore to 40 gallons of water, to be sprayed on the plant. It costs about twenty-five cents per pound. It is used less extensively than Paris green or London purple, but is especially excellent in destroying the currant worm.

White Arsenic is not to be used when Paris green or London purple can be had, since it is dangerous to have about and is apt to burn the leaves.

EXTERNAL POISONS.

Pyrethrum is a powder made from the flowers of a plant and is very poisonous to insects, but is perfectly harmless to man and domestic animals. It kills insects by contact, and can be most successfully used as a powder to be dusted by means of a bellows or other powder dusting machine. Pyrethrum is hard to obtain pure or at least in a fresh condition. It loses its strength by standing, and should be kept well corked. It may be used as a spray in the proportion of one pound of Pyrethrum to 40 gallons of water. Pyrethrum is very useful for killing the cabbage worm, or insects destroying parts of plants that are ready to be eaten by man. It is also of great use in clearing rooms of flies, musquitoes, &c., and fleas and lice on domestic animals.

Kerosene Emulsion is perhaps the best substance to be used for sucking insects. It is made as follows: "Dissolve one half pound of hard soap in one gallon of boiling water, and while the liquid is still hot, but not near a fire, add two gallons of Kerosene. The whole is then violently churned until it forms a creamy mass, which will thicken into a uniform jelly-like mass on cooling, and the oil remains incorporated in the mass, and will not separate or rise to the top. The churning can best be done by means of a force pump with a small nozzle, pump the liquid back into the vessel containing the liquid. The emulsion thus obtained will keep indefinitely." When ready to use, thoroughly mix one part of the emulsion with nine parts cold water. This is to be thrown in the form of a spray on the plants by means of some kind of a force pump and spraying nozzle. (See machines.)

The kerosene emulsion will injure no foliage, and since it kills insects by contact, it is the most effectual remedy against the chinch bug, plant lice, bark lice, melon bug and other sucking insects, and also for the cabbage worm, and white grub, and will even kill eggs in some cases. It is of the greatest importance that the emulsion be forcibly, thoroughly, and evenly applied, as can be done only by the use of some force pump arrangement.

Carbolic Acid Emulsion is made by adding Carbolic Acid (the crude material, dry to get a good strength) one part to 5 or 7 parts of the soap solution similar to that used in making the Kerosine Emulsion. The liquid is to be churned in the same manner as the Kerosine Emulsion, to form an Emulsion.

This Carbolic Acid Emulsion is one of the best preparations to protect plants against lice and fruit trees against borers. It can be sprayed upon the trunks of fruit trees or rubbed on by means of a cloth. Every fruit tree should be treated in this way, especially the young trees, about two weeks after the trees blossom.

Tobacco Decoction is made by adding refuse tobacco, which can be obtained at small cost from tobacco factories, to boiling water, in the proportion of one pound of tobacco to two or three gallons of boiling water. As soon as the water has cooled, strain out the tobacco, and the decoction is then ready to use. It is to be sprayed upon the leaves, and is an effectual remedy against the striped flea beetle, and the cucumber, watermelon and squash flea beetles. It will also drive away some bugs from similar plants. It is also valuable as an insecticide against lice and ticks upon domestic animals, and has the advantage over Kerosene Emulsion in that it leaves the hair in a better condition.

Bisulphide of Carbon is a liquid that is of great use in destroying the Phylloxera of grape, ants, insects in stored grain, and other insects which can be reached by means of a vapor. For Phylloxera and ants it is to be poured upon the top of the ground above them.

For grain insects and insects affecting clothing, it is placed in shallow dishes and kept in the closed room. The vapor from this liquid is extremely explosive, and must not be used in a room or near the least trace of fire, even a lighted cigarette may cause a great explosion. Bisulphide of Carbon can be had from the manufacturer for from 10 to 12 cents per pound in 50 pound cans.

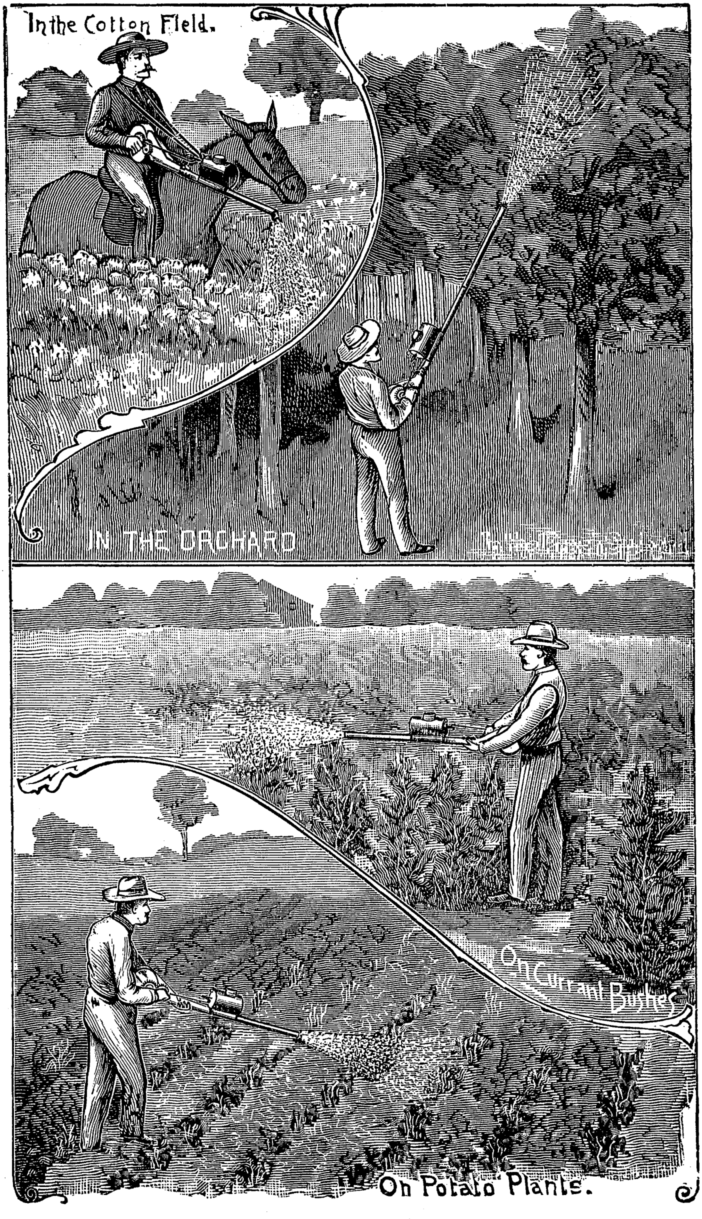
MECHANICAL ARRANGEMENTS.

These are intended to act as barriers to keep away insects, or as traps to capture them. They will be described under the special insect which can thus be best treated.

MACHINES FOR APPLYING POISONS.

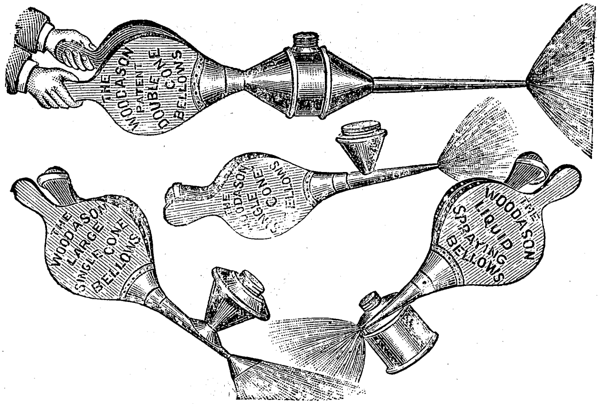
There are a great many kinds of machines and devices manufactured and sold by dealers for applying insecticides and fungicides, some of which are very good, and every farmer, fruit grower and gardener should have at least one. In order to save the purchaser time and trouble in making a selection, a few of the more important machines are here figured, together with the price and manufacturers address.

It is of course important, whenever possible, that one provide himself with two machines, one for using a powder, the other for spraying a liquid; but in case only one can be purchased, a force pump and spraying nozzle should be selected, since one can often mix the powder with the water and apply it in this way.



Leggett Bros. Powder-Gun.

One of the best machines for dusting a powder on plants is Leggett's Powder-gun. It works by turning a crank, and throws the powder in a fine dust constantly and evenly, and the supply can be easily regulated so that one or one half pound of Paris green or London purple can be evenly distributed over an acre. This instrument has been highly recommended by all who have tried it. The price of this gun delivered complete with four extra tubes, shoulder strap and oil can is six dollars. This machine can be purchased from the makers, Leggett & Bros., 301 Pearl St., New York.

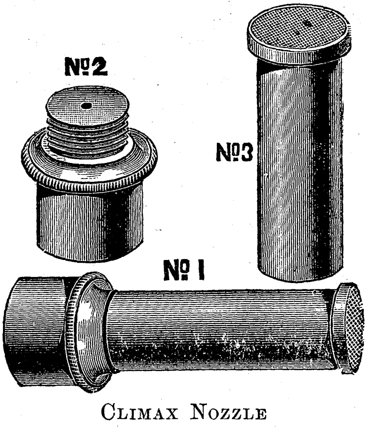


Another very simple and effective machine is Woodason's Liquid and Powder Spraying Bellows, of which four styles are made. The Double Cone Bellows for dusting Paris green, London purple or Pyrethrum, can be purchased for $3.00, and will be found a very simple and economic machine. The liquid spraying bellows can be had for two dollars.

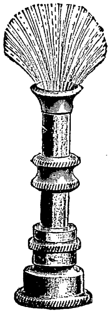
These machines will be found very useful, and are highly recommended. They are manufactured by Thomas Woodason, 2900 D. St., Philadelphia, Penn., or they can be purchased of H. A. Kuhus, Atlanta, Ga.

In the purchasing of machines for spraying liquids, three things should be taken into account. The pump should be made of such materials as will not be easily affected by the chemicals used, there should be some automatic device for keeping the liquid constantly stirred, and the spraying nozzle should be one that is not easily clogged and one that will throw a fine and uniform spray. There are many nozzles manufactured for this purpose, almost any of which can be purchased from a dealer in force pumps.

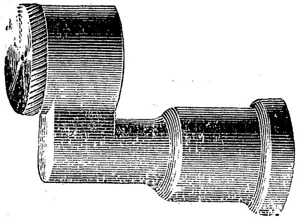
The names of some of the different spraying nozzles are "Masson," "Cyclone," "Vermorel," "Boss," "Graduating," and "Climax." Some of these nozzles, such as the "Boss" and the "Graduating," can be made to throw a fine or coarse spray, or a solid stream. They are all of value and range in price from a dollar to a dollar and a quarter.



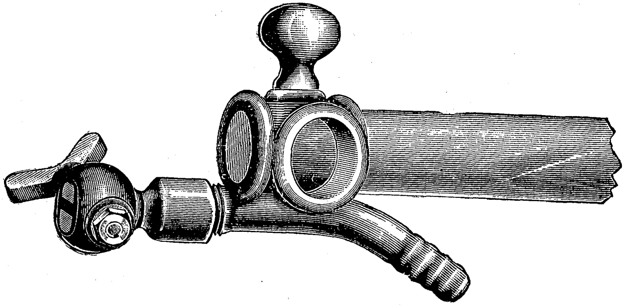
Climax Nozzle



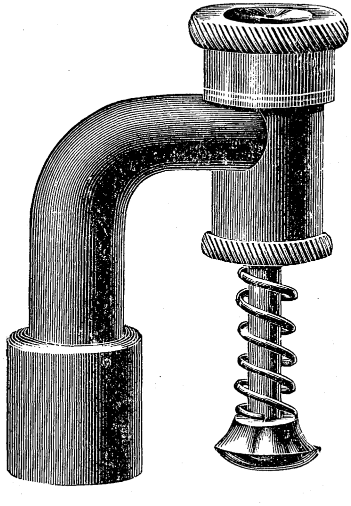
Graduating Nozzle.



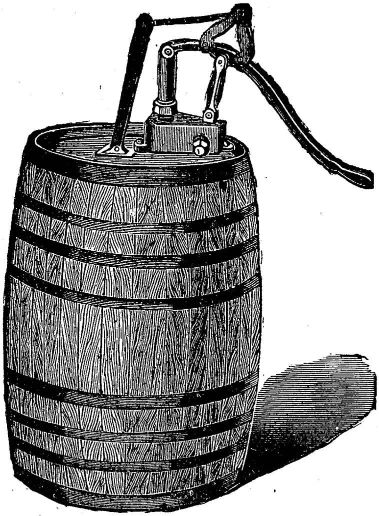
Cyclone Nozzle.



Mason Nozzle.

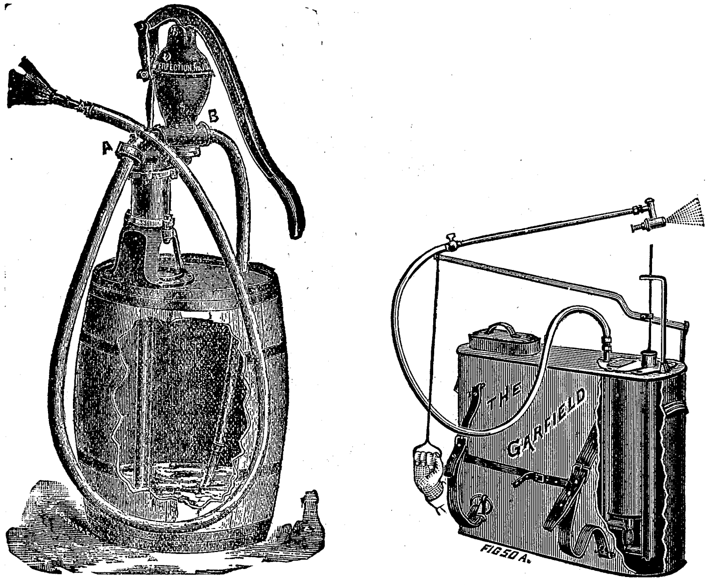


Vermorel Nozzle.



Climax Automatic Agitator Pump.

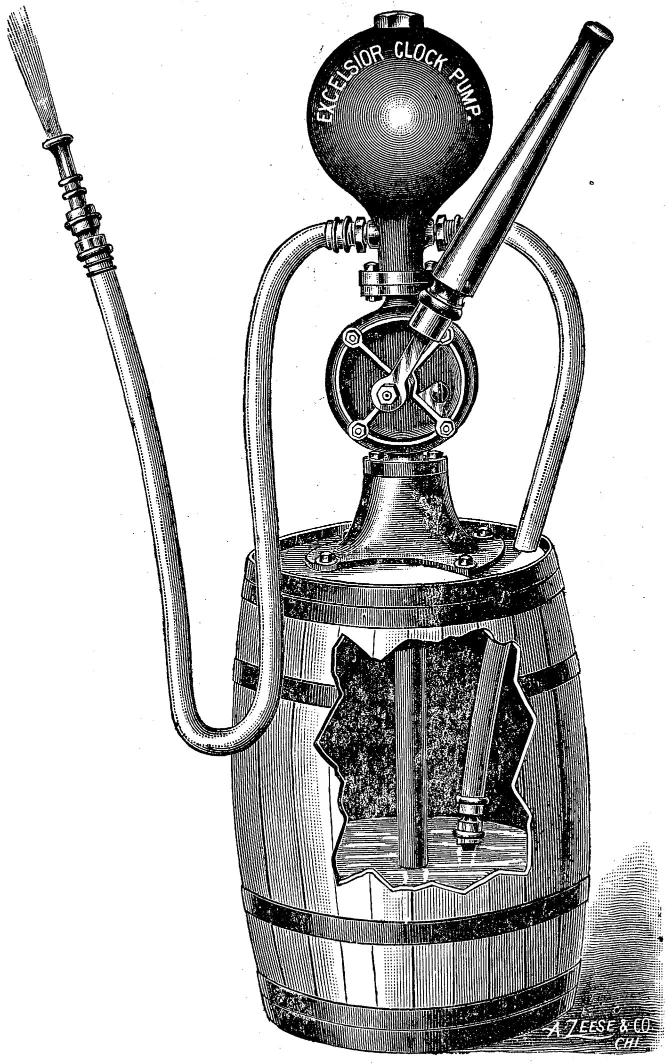
The "Climax Automatic Agitator Pump," manufactured by the Nixon Nozzle and Machine Co., Dayton, O., is an excellent machine for spraying Paris green or London purple in water, since it has an automatic device for keeping the liquid constantly stirred. The price of the pump, however, is a little high, being $15.00.

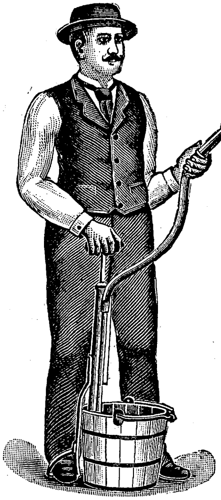


Field Force Pump Co.

The Field Force Pump Company, Lockport, New York, manufacture a pump that can be mounted on a barrel, and has a second hose reaching to the bottom of the barrel, which keeps the liquid constantly stirred by forcing part of it back into the barrel. These pumps are comparatively cheap, and can be had for $10.00.

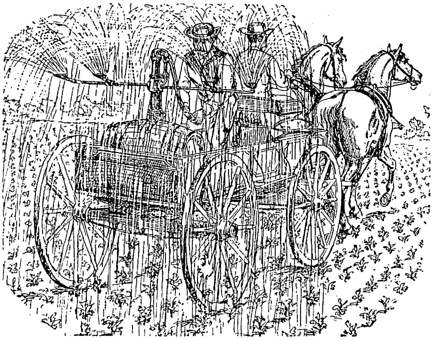
The same company also manufacture a knapsack sprayer, known as the Garfield. This machine is to be carried upon the back, while the person pumps with one hand and holds the nozzle with the other. This pump is very convenient, and costs but $12.00.

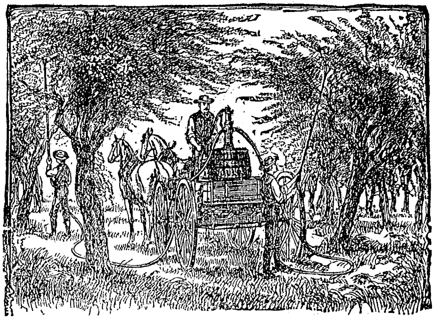

EXCELSIOR CLOCK PUMP.
A. ZEESE & CO. CHI.



Excelsior No. 8

William Stahl, Quincy, Ill., also manufactures a number of different styles of pumps, including a knapsack pump. The Excelsior Spraying Outfit No. 8, which costs but $2.50, consists of a pump and hose that can be used in a pail; they also manufacture more durable and more costly machines for use in a similar way. They manufacture an Excelsior Clock Pump that is extremely useful, since it can be mounted upon a barrel and has a second hose extending down to the bottom, which keeps the liquid well stirred, while the lever handle can be used at any angle. The price of this pump is $13.00.





The Goulds M'f'g., Co., Senaca Falls, New York, are the manufacturers of a large number of pumps similar to the above, including the Knapsack Sprayer. The method of using some of their pumps for orchard and field work is shown in the above cuts.

Adam Weaber & Son, Vineland, N. J., are also the makers of some excellent spraying machines. One of their nozzles that will be found convenient to use in connection with a number of machines of various makers, is shown in the above cut.

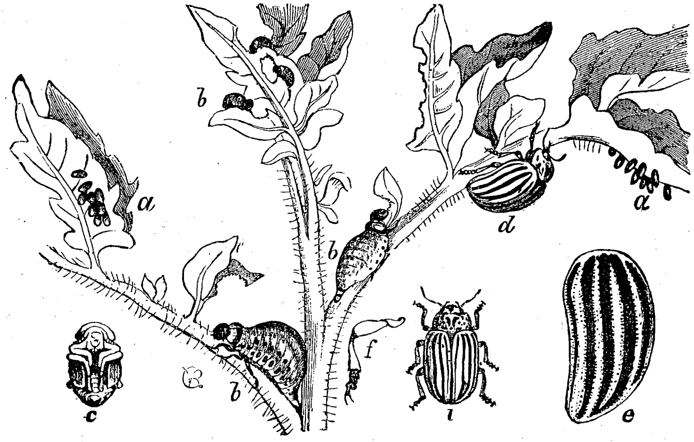
I wish to acknowledge the kindness of the various firms above mentioned, in loaning us the cuts here used to illustrate machines.

INSECTS.

THE POTATO PLANT.

COLORADO POTATO BEETLE.

The Colorado Potato-Beetle has appeared in Alabama this year for the first time. This insect has occurred in immense numbers throughout the northern and eastern parts of the United States, having originally come from the west. It has done immense damage to the potato crop, and when not kept in check it will strip the plants completely of their leaves.



COLORADO POTATO BEETLE.—*a*, eggs; *b*, larvæ; *c*, pupa: *d*, *d*, adult beetles; *e*, enlarged wing cover of beetle.

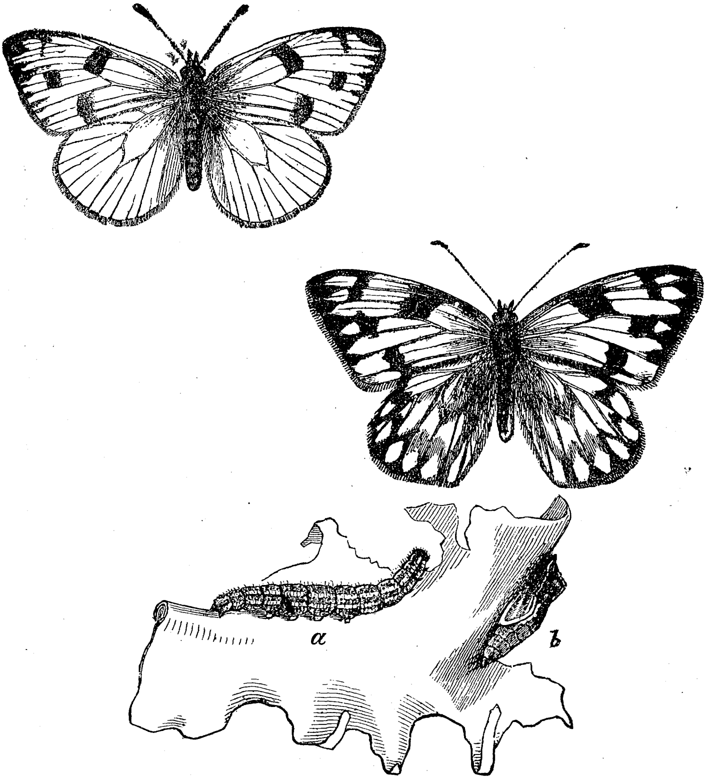
The adult insect is a beetle nearly one-half inch in length, of a yellow color, with dark longitudinal stripes and orange legs and belly. It deposits its eggs in clusters, usually on the underside of the leaf; these hatch in about a week into small grub like larvæ, at first of a light yellow color, but changing to orange or red with a few black spots along the side, as they grow larger. They eat almost continually and with great rapidity, and keep their bodies distended with food. In a few weeks they become full grown and descend just beneath the surface of the ground, where they transform to the pupa stage. They remain in the pupa stage about ten days, and then come forth as a perfect insect. These then pair and the female soon deposits her eggs, and another brood follows with the work of destruction. There are about four broods in a season, and unless they are held in check, it is easy to see that they increase in numbers with great rapidity. The adult beetle, only, lives through the winter, secluded under rubbish, leaves, etc., and comes out in the Spring to deposit eggs.

Remedies.—Fortunately this insect can be readily held in check by sprinkling or dusting the plants with Paris green or London Purple, used either as a powder or in a liquid state. In using these remedies as a powder, the poison can be diluted by mixing with four times its bulk of flour. This can then be applied by means of a dusting machine or powder gun, or it can be sifted on by means of a tin can with a few small holes in the bottom. It is better to dust the plants early in the morning when the dew is on them. In using the poisons as a liquid, 1 pound of the poison to 50 gallons of water, can be sprayed upon the plants by means of some spraying machine, or the liquid can be carried in a pail and sprinkled on the plants by means of a brush-broom. It is important that the liquid be frequently stirred, otherwise the poison will settle to the bottom, especially Paris green. Fortunately the larvæ as well as the adults are destroyed by these remedies. It is important that the application be made as soon as the insects appear, and should be kept up as often as they appear in damaging numbers. This is especially true with the young potato plants, since they will eat every leaf in a remarkably short time.

CABBAGE PLANT.

CABBAGE BUTTERFLY.

There are two species of the common cabbage butterfly in Alabama. One known as the southern cabbage worm is a native of this country. The other known as the imported cabbage worm was introduced from Europe about 1857, and has since spread nearly all over the United States and Canada, and has almost exterminated the native species. The life histories and habits of these two insects are so nearly alike that, for our present purposes, a description of those of the imported cabbage worm will answer for both.



Southern Cabbage Butterfly :—Adult male and female. *a*, larva ; *b*, pupa.

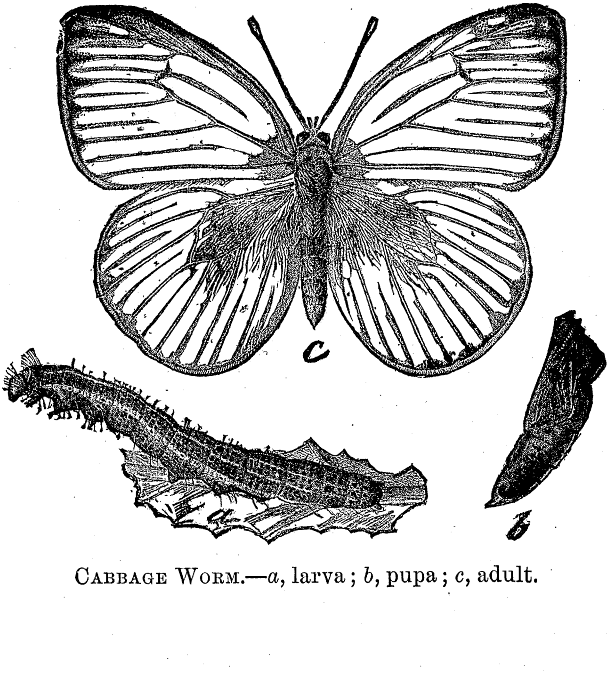
The adult butterfly is so common and well known to every gardener and farmer, that a description of it is unnecessary, suffice to say it is a small white butterfly, with a few black spots near the margin of the wings, which measure about two inches in expanse. The female butterfly deposits her small yellowish eggs upon the leaves of the cabbage plant. In a few days the little green larvæ hatch and immediately begin to feed upon the foliage. They eat with considerable rapidity, and become full grown in about two weeks. As a rule the larvæ then leave the cabbage plants and seek some sheltered place, and change to pupæ, which are naked and without a cocoon. Occasionally the pupæ will be found on the cabbage plants. They remain in the pupa state about ten days, and then the adult butterfly comes forth ready to deposit eggs, which soon hatch into another brood of worms. There are several generations each year, and it can be readily seen that if left to themselves, they will increase in number with great rapidity. This insect passes the winter in the pupa state.

Fortunately these insects have a number of natural enemies that tend to keep them in check. The adult butterflies fall a prey to birds, and a bug that catches them and sucks their juices. The larvæ and pupæ fall a prey to birds, and are greatly subject to the attack of certain insects both predaceous and parasitic. The larvæ are also sometimes killed in great numbers by a certain disease.

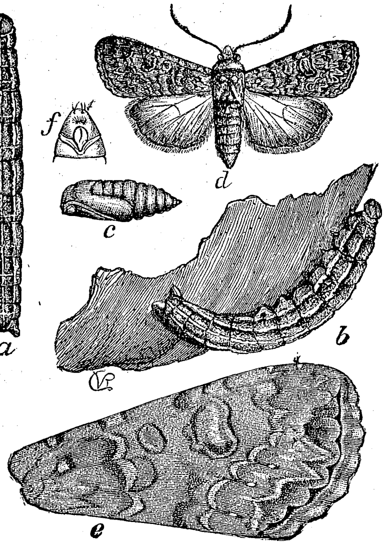
Remedies.—The cabbage worms are readily killed by a number of easily applied remedies. When the plants are very young Paris green or London purple can be applied without danger. It may be used either as a powder or mixed with water. When the plants are of any considerable size Pyrethrum either mixed with five times its bulk of flour and, dusted on the plants, or mixed with water and sprayed upon them, will prove an excellent remedy, provided the Pyrethium is good. Kerosene emulsion will kill them, but when the plants are nearly headed, it may taint the leaves.

Dr. C. V. Riley says that the cabbage worm can be killed by the use of hot water sprinkled upon the plant by means of an ordinary sprinkling pot. If the water be boiling in the pot, it will kill the worms and yet not be too hot to kill the leaves by the time it reaches them. It is essential whatever remedy you use, that it be applied at frequent intervals, as new broods come on every few days. There need be no fear about the use of Pyrethrum, since it is not poisonous to man. As regards the use of Paris green, there need be little or no fear if it be used properly, that is, reduced to the proper strength and put upon the plants evenly. The worms will be killed by a very small amount that would not affect man, and the first rain will wash the most of it off.

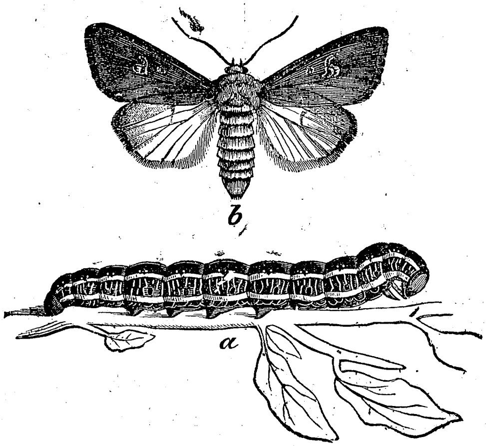
OTHER CABBAGE WORMS.



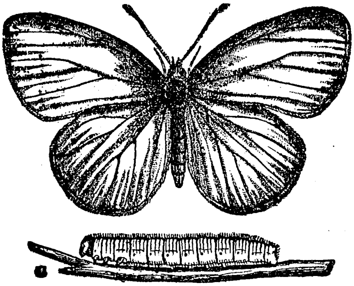
CABBAGE WORM.—*a*, larva; *b*, pupa; *c*, adult.



Cabbage Worm.—*a*, *b*, larva; *c*, pupa; *k*, adult.



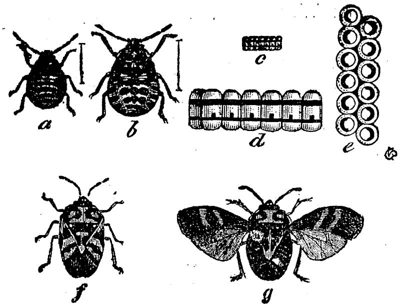
Zebra Cabbage Worm.—*a*, larva; *b*, adult.



CABBAGE WORM.—larva and adult.

HARLEQUIN CABBAGE BUG.

This is a small sucking insect of a dark color with orange yellow markings. It is not confined to the cabbage plant alone, but feeds upon a number of cruciferous plants. The adult lives through the winter, and deposits its eggs upon the young plants as soon as they are set out. The eggs hatch in about a week or less into a minute insect resembling very much the adult, except that it is smaller and has no wings. The insect pierces the plants by means of its mouth parts and sucks the juices. It develops in a little less than two weeks into an adult insect. This insect does not pass through the inactive pupa stage of most insects, but feeds continu-



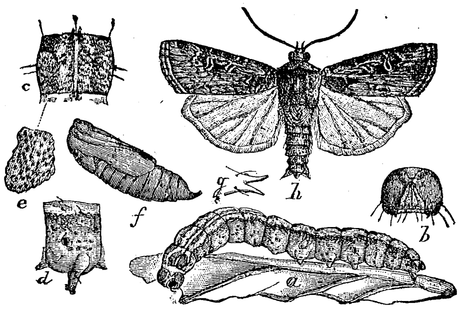
HARLEQUIN CABBAGE BUG.—*a*, *b*, young: *c*, *d*, *e*, eggs; *f*, *g*, adult natural size.

ally from the time it hatches, and is extremely destructive to the cabbage plant. A few of these insects will kill a plant in a single day. There are several broods each season.

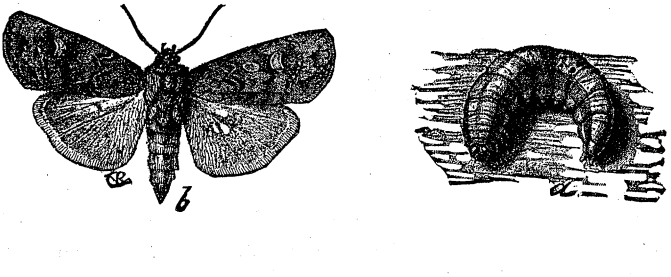
Remedies.—It is of the greatest importance that this insect be fought as soon as it appears in the Spring, otherwise they will increase beyond our control. The same substances which are used to combat the cabbage worm, with the exception of Paris green, viz : Kerosine Emulsion, Pyrethrum and hot water, are used to kill these insects.

CUT WORMS.

There are about ten different species of cut-worms that attack the cabbage. The habits and life histories are so nearly alike that for our purposes we can treat of them in general.



Cut Worm.—*a*, larva ; *f*, pupa ; *h*, adult.



Cut Worm.—*a*, larva ; *b*, adult.

The adult is a small nocturnal moth, with an expanse of wings of about 1½ inches. The female deposits her eggs usually upon the branches of bushes. As soon as the eggs hatch, the larvæ descend to the ground and feed while young upon various plants, usually grass. They are about half-grown when winter comes, and they then seek shelter by crawling under some object or burrowing in the ground. They pass the winter in this condition and come forth in the Spring in search of food. They now attack a large variety of plants. Nearly all garden vegetables are attacked by them. They soon become full grown, and in early Spring enter the ground, and just below the surface turn to the pupa stage. In three to four weeks they turn to the adult and emerge as a moth, the female then depositing eggs for another brood. Some species of cut worms have more than one brood in a year.

Remedies.—One of the best methods to kill the cut worms is to place clover, cabbage or other leaves upon the soil before the garden is planted; these leaves to be poisoned with Paris green or London purple, either by dusting with the powder or dipping them in a solution of the poison. The worms crawl about in search of food, eat the leaves, and are killed before the cabbage or other plants are up. The cut worms are easily trapped by placing boards on the ground between the rows of vegetables, and killing in the morning the worms that get beneath them during the night. Occasionally the worms can be successfully fought by digging them out of the ground.

COTTON PLANT.

COTTON WORM OR COTTON LEAF WORM.

This insect is too well known throughout the cotton growing States to need any description, either of the adult, its habits or its life history.

REMEDIES.—The cotton insect is easily destroyed and its ravages prevented by the use of Paris green or London purple. The larva or worm stage is the best one in which to fight this insect. We simply have to poison the leaves on which they feed, in order to kill them, and it is surprising what a small amount of either of the above poisons is necessary. The amount of poison used is of little value provided it is so distributed as to cover every leaf. The application of the poison should be made just as soon as the worms appear, and if well done there need be no damage resulting from these worms.

One pound of Paris green or London purple to the acre is sufficient. It is sometimes used undiluted, but more often it is mixed with from three to five times its bulk of flour. The cheapest method of application is as follows: Make two sacks of some heavy cloth, 8 oz. osnaburg if the undiluted poison is to be used, but thinner cloth if diluted; these sacks should be about one foot long and four or five inches in diameter; leave it open along the whole length of one side; sew up both ends firmly. Get a hard wood stick five feet long and about 1½ inches thick and 2 inches wide, and bore an inch hole near each end. Firmly tack a bag to each end of this stick in such a way that the stick will form the upper portion of the bag; the bag will have its length in the direction of the stick, and there will be but one opening into the bag, viz: the hole in the stick. The bags can now be filled, by means of a funnel, with pure Paris green or London purple, or that thoroughly mixed with about three times its bulk of flour.

The pole is to be carried by the man on horseback, who rides between the rows, holding the pole across the horse, and shakes or taps the pole with a stick, thus causing the powder to sift through the sacks on the plants. It is essential that the sacks do not touch the leaves or become wet in any way, otherwise the powder will not sift through. The workman should keep out of the dust as much as possible, and should dust his clothes and take a bath at the close of his work; it is well also to brush or wash the mule. The above apparatus can be made in a short time by any farmer, and the poison and flour will cost him no more than 50 cents per acre, and money can be made by having these ready for use at a moment's notice before the cotton is up.

It is of the greatest importance that the poison be applied just as soon as the worms first make their appearance, since every day that is neglected may cost a great many dollars. A single application of the poison, if not followed by a heavy rain, is usually all that is necessary to protect the crop. With the above precautions, and especially that of promptness and thoroughness in the application of the remedy, no farmer need fear trouble from the cotton worm.

The Paris green or London purple may also be applied by mixing it with water in the proportion of one pound of poison to a barrel of water, and spraying it upon the plants by means of a force pump and spraying nozzle. There are many machines for this purpose. (See machines for applying insecticides.) Where a farmer has a large crop of cotton every year, it will be to his advantage to purchase a spraying machine that can be used with a mule.

The adult moth of the cotton-leaf-worm can be trapped by placing a shallow basin of kerosine, molasses, or even water upon poles at intervals about the cotton-field, and putting a lantern just above or in the basin. The moths are attracted at night by the light and fall into the oil or molasses from which they cannot escape. This method has proved very successful in many localities.

BOLL WORM.

The boll-worm like the cotton-worm needs no description to a farmer living in the Southern States. (For figure of boll-worm see corn-worm under corn-plant.)

As is no doubt generally known, the boll-worm is the same thing as the corn-worm. It often migrates from the corn-field to the cotton field, as soon as the ears of corn begin to harden, and then eats its way into the cotton boll. In migrating it frequently also eats the leaves of the cotton to a slight extent.

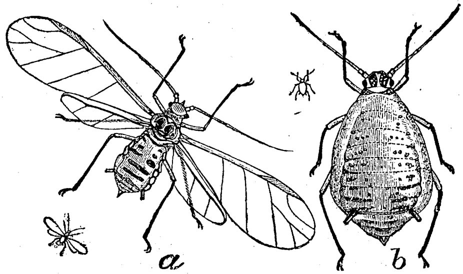
The adult moth deposits her eggs upon the leaves of the cotton plant, and the young crawl to the bolls into which they eat their way, but frequently in doing so, they eat of the leaves. It has often been said that the boll-worm feeding upon the inside of the boll, as it principally does, cannot be poisoned by ordinary means. However, from what has been said, one can easily see that if there be poison upon the leaves of the cotton-plant when the boll-worm migrates to it from the corn, or when the young are hatched from the eggs laid upon the cotton leaf, that those worms that do eat of the leaf, will be poisoned. Hence the poisoning of the leaves for the cotton-leaf-worm will also greatly lessen the number of boll worms; and an application of the poison at a time just before or as soon as the boll-worm begins to migrate from the corn, will save much money. The poisoning for the third brood of the cotton worm and of the boll worm may be done simultaneously. The application of the poison for the boll-worm is accomplished in the same way as given for the cotton-worm.

Perhaps the most widely used method of destroying the boll-worm is to trap the adult moth. The moth is not only attracted by light, but is also attracted by sweets. Hence the placing of lanters in basins of some liquid about the the field, or the placing of simply basins containing molasses and vinegar in the proportion of 4 parts of vinegar to 1 part of molasses, will catch large numbers of the moths. They are attracted by the odor of the mixture, and in trying to sip it, they fall into the liquid and cannot escape. Since the moths fly only at night, the basin should be visited every evening, the moths taken out and the liquid replenished.

From what has been said in regard to the cotton-worm and boll-worm, it will be seen that we can fight both worms by the same remedies and at the same time.

APHIDS ON COTTON.

Aphids, or plant lice, as they are commonly called, are small, usually wingless insects, frequently of a green color. They pierce the leaves of the cotton-plant and suck its juices. Since they are not biting insects and do not eat the tissues, they cannot be killed by the use of the poisons applied to destroy the cotton worm or boll worm.



Plant Lice or Aphids.—*a*, male; *b*, female.

The cotton-plant louse is not as common or destructive an insect except in extreme cases, as the boll worm and cotton-worm. Whenever the plant louse does occur to a threatening extent it is easily destroyed by the use of Kerosine Emulsion. (See Insecticides.)

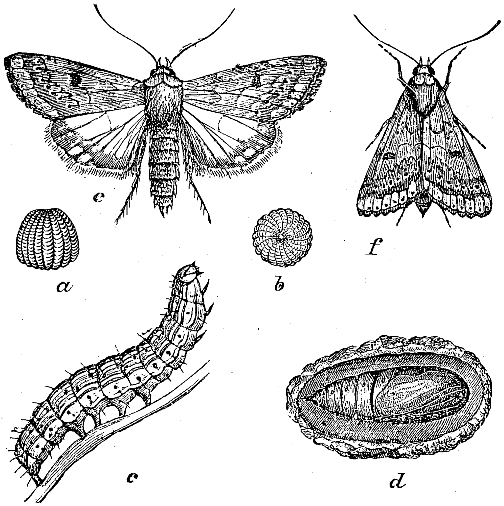
THE CORN PLANT.

CUT WORMS.

The cut-worm has been already described as affecting cabbage. They are also very destructive to corn, often necessitating re-planting. It is not necessary to describe them again. The remedies to be used in the case of their attacking corn are the same as those to be used in the case of cotton. (See cut worms under the cabbage plant.)

CORN-WORM OR BOLL-WORM.

This is perhaps the most destructive insect affecting corn, especially the roasting ears. The worm is the same that attacks the cotton bolls, but prefers the corn while it is soft to cotton, and only migrates to the latter when the corn becomes too hard.



Corn-Worm or Boll-Worm.--*a*, *b*, eggs greatly enlarged; *c*, larva; *d*, pupa; *e*, *f*, adulta.

The female moth deposits her eggs among the silks of the young ears. As soon as the larvæ hatch they eat their way into the ear, and feed upon the young kernels of the corn. They remain here eating the corn for several weeks, and sometimes eat the entire length of the ear, although they usually confine their depredations to the extremity. If the corn becomes too hard before the worms are full grown, they migrate to the cotton plant and enter the boll; otherwise they simply leave the corn, and burrow just beneath the ground, where they make a frail cocoon of silk and sand, within which they change to a pupa. In about two weeks they come forth as adult moths. There are four or five broods during the summer. The first broods attack the corn, as a rule, the latter broods attacking the cotton bolls, the corn at this season of the year being too hard for them to eat.

The cotton or boll worm winters in the pupa stage.

REMEDIES.—Owing to the peculiar habits of the corn worm, no successful means has yet been devised to control them on a large scale against attacking corn. The only remedy is hand picking. The ends of the ears can be opened and the worms picked out and destroyed. Their presence can usually be told by a premature ripening of the silk. Trapping the moths as suggested under the cotton plant can be used to a good advantage.

I wish to acknowledge the kindness of Dr. C. V. Riley, and also of the U. S. Department of Agriculture through Dr. Riley, for the cuts of the insects used to illustrate this Bulletin.

It is hoped that whenever a fungus or other disease, or an insect attacks a plant in sufficient quantities to attract attention, that the person will send a note and a sample or specimen of the same to J. M. Stedman, Biologist, A. & M. College, Auburn, Ala.

Bulletin No. 46, : : : June, 1893.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

RYE VS. ENSILAGE.

ALEX. J. BONDURANT, AGRICULTURIST.
A. F. CORY, ASSISTANT AGRICULTURIST.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

All communications should be addressed to

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THE EFFECT OF RYE AND ENSILAGE ON THE YIELD OF MILK.

The ensilage question is one of some interest to all of the farmers of Alabama, it is of especial interest to those few who are thinking of building silos. That ensilage is a good feed is beyond all question; whether or not it pays even in cold climates seems from the best evidence to depend on "Local circumstances and seasonal peculiarities."

In Bulletin number 5, second series, volume 3, of the Ohio Experiment Station, after reviewing the work of nine other stations, the following conclusions are drawn: "While the results of these experiments are somewhat contradictory, those which bear evidence of the greatest thoroughness agree in indicating that there is practically no difference between the feeding values of a given quantity of corn, cured as ensilage, and an equivalent quantity cured as dry fodder, provided equally good husbandry has been used in both cases.

Whether corn may be cured and preserved more economically by one process or the other depends largely upon local circumstances and seasonal peculiarities."

The above quotation gives the standing of the silo question in the northern States where ensilage is most used; what the standing may be in Alabama and other States of the same latitude where green feed can be had the whole year round without silos, remains to be settled by experiment.

GREEN RYE AS OPPOSED TO ENSILAGE.

Last winter some simple experiments on Rye and Ensilage were conducted on this station, the object being to compare the effect of these two feeds on the yield of milk.

Four thoroughbred Jersey cows were used in the experiment. Before beginning the test the milk from each cow was carefully weighed for four days. The cows were then divided into two lots of as nearly equal milk producing capacity as possible.

Kate Hazen 1st and Ransom's Pride were called for convenience lot 1, Hattie Signal 2d, and Miss Hattie Pogis were called lot 2.

Up to the beginning of the experiment all of these cows had received the same feed.

During the experiments both lots were given the same quantity of grain and fodder, the only difference in the feed being in the Rye and Ensilage. The regular grain feed per day was four quarts of corn and cob meal and two quarts of cotton seed meal, oat straw and shucks and during the latter part of the experiment pea hulls were used as dry fodder. The grain feed was made small in order to more clearly show the effect of rye and ensilage. The low yield of milk is due partly to the small grain feed and partly to the cold and rainy weather.

The experiment was begun on the morning of February 3d, and continued until the night of March 2d, making 28 days.

It is divided into two periods of fourteen days each. Duthe first period lot 1 was fed rye, and lot 2 ensilage. During the second period lot 1 was fed ensilage and lot 2 rye.

At the beginning of the test, the quantity of rye fed per day to each cow was 30 pounds. This was increased to 40 and on the fifth day of the test to 50 pounds. Kate Hazen 1st, failed to eat all of her rye and for the remainder of the experiment only 40 pounds of rye per day was fed to each cow. At the beginning of the 2d period the rye given to lot 2 was raised in the same way to 50 pounds. Both cows in this lot failed to eat all of the 50 pounds, and the quantity given per day for the remainder of this period was

40 pounds. The ensilage was measured, but several times it was weighed and the weight fed per day found to be about 25 pounds None of the cows ate all of the ensilage given.

The ensilage used was a fairly good quality of sour ensilage made of corn cut just after the grains had glazed.

The rye used was cut every evening. It was sown thickly in drills two feet apart on well manured land and was ready for the first cutting in November.

The following tables give the daily yield of milk from each cow :

FIRST PERIOD.

	Lot I, Rye.			Lot II, Ensilage.		
February.	Kate Hazen 1st weight of milk in pounds.	Ransom's Pride—weight of milk in pounds.	Yield of milk from both cows.	Hattie Signal 2nd weight of milk in pounds.	Miss Hattie Pogis weight of milk in pounds.	Yield of milk from both cows.
3	11¼	9¼	20½	8¾	13¼	22
4	12½	11¼	23¾	9	15	24
5	13¼	11½	24¾	9	13¾	22¾
6	14	12	26	9½	14¼	23¾
7	13¾	12¼	26	9½	13½	23
8	13½	13¼	26¾	9½	13¾	23¼
9	11¾	12½	24¼	9½	14½	24
10	12¼	13¼	25½	9½	14	23½
11	12¼	12½	24¾	9½	13¼	22¾
12	14¾	13¼	28	10¼	13½	23¾
13	14	12¾	26	9¼	13½	23¾
14	14¼	12½	26¾	9¾	13½	23¼
15	14¼	12¾	27	9¾	14¾	24½
16	14	12½	26½	10½	14¼	24¾
	185¾	171½	357¼	133¼	194¾	328

Total yield of Lot I ... . 357¼ pounds.
Total yield of Lot II ....328 "
Balance in favor of Rye ... 29¼ "

SECOND PERIOD.

Lot I, Ensilage.				Lot II, Rye.		
February.	Kate Hazen 1st weight of milk in pounds.	Ransom's Pride—weight of milk in pounds.	Yield of milk from both cows.	Hattie Signal 2nd weight of milk in pounds.	Miss Hattie Pogis weight of milk in pounds.	Yield of milk from both cows.
17	13½	12¾	26¼	10¼	14¾	25
18	12	11½	23½	10	15½	25½
19	12	10¼	22¼	10½	16	26½
20	12	9½	21½	11	16¾	27¾
21	11¾	9¾	21½	10¾	16¼	27
22	12¾	10¾	23½	11¾	17¼	29
23	12¾	11½	24¼	12	17½	29½
24	13¼	11½	24¾	11¾	18¼	30
25	12¾	11	23¾	12¼	18	30¼
26	12½	11½	24	12	18½	30½
27	12¼	11	24¼	12	17¾	29¾
28	11¾	11¼	23	11¾	17½	29¼
Mch.						
1	12½	11¾	24¼	12½	19	31½
2	13½	10¾	24¼	12	18¾	30¾
	175¼	154¾	330	160½	241¾	402¼

Total yield of Lot I .... 330 pounds.
Total yield of Lot II .... 402¼ "
Balance in favor of Rye . 72¼ "

The following is a summary of the important points in the above tables:

DURING THE FIRST PERIOD.

Lot 1, fed on rye yielded 357¼ lbs. milk.
Lot 2, fed on ensilage yielded 328 lbs. milk.
Balance in favor of rye 29¼ lbs. milk.

DURING THE SECOND PERIOD.

Lot 1, fed on ensilage yielded 330 lbs. milk.
Lot 2, fed on rye yielded 402¼ " "
Balance in favor of rye 72¼ " "

Lot 1, fed on rye, first period yielded 357¼ lbs. milk.
Lot 1, fed on ensilage 2d period yielded 330 " "
Balance in favor of rye 27¼ lbs. milk.

Lot 2, fed on ensilage, first period yielded 328 lbs. milk.
Lot 2, fed on rye second period yielded 402¼ "
Balance in favor of rye 74¼.

The above experiments simply show the effect of rye and ensilage on the flow of milk. The effect of these feeds on the yield and quality of butter remain to be determined by future experiments.

Those farmers who are thinking of building silos had best bear in mind the following points:

1st. Corn cured as ensilage has no more feeding value, than an equivalent quantity cured as dry fodder.

2d. In order to make good ensilage it is necessary to have a good silo, a good ensilage cutter, and steam power.

3d. Green rye can be raised at the rate of ten tons per acre. In the winter of 1889–'90 rye sown in drills two feet apart on this station was cut four times between October 30th and February 27th, and yielded 21,392.50 per acre. The yield will of course vary some with the severity of the winters.

In order to make good ensilage some capital is necessary.

Rye for winter use requires only time, a liberal use of manure, and some labor.

Very few farmers can even think of making ensilage; but every man can afford to have a rye patch.

It is expected to continue the experiment on rye and ensilage next winter.

Bulletin No. 47, : : : July, 1893.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

FRUITS.

ALEX. J. BONDURANT, AGRICULTURIST.
JAMES CLAYTON, ASSISTANT HORTICULTURIST.

CONTENTS.

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All communications should be addressed to

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* To be filled.

† In charge of Soil Tests.

A RECORD

—OF—

Experiments in Fruit Culture.

BY JAMES CLAYTON, Assistant in Horticulture.

After eight years experiments in comparing the different varieties of fruits on the Experiment Station, detailed accounts of which have been published in our Bulletins from time to time, it is deemed advisable to give a final summary of the results. This is done in as plain and simple form as possible, in order that persons who contemplate planting fruit, may select that which has proved successful, and avoid the failures.

The soils of this Station are of gray sandy, and light clay nature, and therefore the conclusions drawn are sufficiently accurate and definite to render them valuable to all those who live on similar formations.

GRAPES.

In 1886 a vineyard with northern exposure was planted in 48 varieties of grapes, six of each kind, excepting a few varieties of which more than six were planted, as shown in Bulletin No. 29, pages 11 and 12. In the Spring of 1892 *all* of the varieties were found *dead* except the Concord, Delaware, Ives and Perkins, the original of which was as follows:

Concord	110	vines,
Delaware	106	"
Ives	109	"
Perkins	107	"

In removing the posts and the debris of the *dead* vines six each of the above four were taken up, though living and vigorous—which reduces the original number, not counting a few that had previously died, to:

Concord	104	vines.
Delaware	100	“
Ives	103	“
Perkins	101	“

On careful investigation July 1, 1893, we find we have

Concord,	dead,	60,	living	44.
Delaware,	“	7,	“	93.
Ives,	“	11,	“	92.
Perkins,	“	29,	“	72.

It will be seen from these figures that the Delaware and Ives are the most hardy, while the Concord and Perkins are reasonably so. These four make an admirable succession of fruit, the Perkins ripening early in July—then the Delaware and Concord, and last of all, the Ives, holding on until the Memory comes in.

In the New Vineyard, with Southern exposure, planted in 1889 (See Bulletin No. 29, page 15), the results are almost identical. Out of 78 varieties planted only 17 are alive July 1, 1893, and of these, the four which stood the test in the Old Vineyard, with the addition of the Martha, Norton's Virginia, Empire State, Warren and Cynthiana, are the only ones of any value. However, it would be unjust to place the Green Mountain, Northern Muscat and Moore's Diamond, in the list of failures, as at present they are vigorous and promising, but further trial is necessary to show what they will do.

Not one of the Concord, Delaware, Ives, or Perkins planted in the New Vineyard, has died.

These facts are conclusive testimony to the value of these four which we call standards, and we advise our people not to spend money for fancy varieties, when they can so easily propagate these which furnish all the requisites for market, table and wine, and should satisfy the most exacting taste.

THE SCUPPERNONG.

Of the eight varieties of the Rotundifolia or Muscadine type, planted in 1886, (see Bulletin No. 29, page 18,) all are giving perfect satisfaction, and we call attention to some of the different varieties of this most excellent grape. By planting the ordinary Scuppernong, the Memory, the Mish, and Flowers, one can have a constant supply of this fruit until frost. The Memory and Mish are especially desirable, combining superior quality with vigorous growth and great productiveness. The Flowers has not the fine quality of the Memory and Mish, but being the latest to ripen is very valuable, and is unsurpassed by any grape for wine making. The James has been highly recommended by some who claim that it will bear fruit longer than any other variety, but our experiment has not verified this claim. While we have nothing but praise for it as a grape, the season is no longer than that of the scuppernong, and by the average taste would be classed as a "very good Muscadine."

APPLES.

Of the 45 varieties planted in the Spring of 1886, only the following 17 have given satisfaction, and are considered worthy of being recommended for general planting. A brief description of these varieties may not be out of place.

SUMMER VARIETIES.

RED JUNE.—Dark red, conical, flesh white and crisp, very good in quality. Tree a vigorous grower and profuse bearer, entirely free from blight. Ripe June 15.

ASTRAKAN RED.—Light red with stripes, flesh white and crisp, good in quality. Tree vigorous and prolific, slightly attacked by blight. Ripe June 15th.

Early Harvest.—Bright yellow, fine flavor. Tree medium as to growth, prolific, slightly attacked by blight. Ripe June 25th.

Carolina Watson.—Red with stripes, flesh white and crisp, delightful perfume, a large, beautiful apple. Tree vigorous and prolific, slightly attacked by blight. Ripe July 1.

Horse.—An old standard, of good quality. Tree vigorous and prolific. Ripe July 25.

FALL VARIETIES.

Elgin Pippin.—Bright yellow, conical, flesh white and crisp, medium to large. Tree large and vigorous, almost free from blight. Ripe August 10.

Simmons Red.—Yellow skin, nearly covered with red, flesh yellow, quality very good, medium to large. Tree vigorous, profuse bearer, almost free from blight. Ripe August 20, and continues into September.

Carter's Blue.—Dull, greenish red, crisp and sugary—large, flat. Tree vigorous, not prolific, almost free from blight. Ripe September 10.

Kittageskee.—Yellow, flesh yellow and firm, small to medium. Tree vigorous and very prolific—almost free from blight. Ripe Sept. 25.

Tuscaloosa Seedling.—Yellow skin, nearly covered with dark red, flesh yellow, a good keeper, and very good quality, medium to large. Very little blight. Ripe Sept. 25.

Romanite.—Green, with red cheek, flesh firm and crisp, subject to bitter rot. Tree vigorous and very prolific, slightly attacked by blight. Ripe October 1.

Horn.—Green, with dark, red cheek, firm and crisp, a good keeper, small to medium. Tree small but vigorous, very little blight. Ripe October 1.

WINTER VARIETIES.

Hewes' Virginia.—Dark red, small, profuse bearer, tree small but vigorous, very little blight. Ripens in October.

Limber Twig.—Dull, rusty red, medium size, flesh firm and crisp, a good keeper, tree vigorous and prolific, almost free from blight. Ripe in October.

Stevenson's Winter.—Green with dark red, flesh firm, a good keeper, vigorous and prolific, very little blight. Ripe in October.

Ben Davis, or N. Y. Pippin.—Greenish yellow, covered with red, flesh firm, a good keeper, medium to large. Tree vigorous but not very prolific, very little blight. Ripens in October.

Wine Sap.—Dark red, small to medium, very good, vinous, good keeper, tree vigorous and a profuse bearer, very little blight. Ripe in October.

The following varieties have a good growth of tree, but do not fruit well:

Hames,
Habersham Late,
American Golden Russet,
Rawl's Jennet,
May,
Cannon Pearmain,
Yopp's Favorite,
Hiley's Eureka.

The following have been badly attacked by blight, and are not satisfactory.

Summer Queen,
Yellow English.
Cook's Seedling,
Shockley,
Shannon Pippin,
Thornton Seedling,
Terry's Winter,
Southern Golden Pippin.

The following varieties are proved to be entire failures here:

Family,
Rhodes' Orange,
Chattahoochee Greening,
Equinettilee,
Buncombe,
Laurens Greening,
Oconee Greening,
Palmer,
Pryor's Red,
Bradford's Best,
Taunton,
Junaluskee.

PEARS.

In 1885 forty varieties of pears were planted, a description of which can be found in Bulletin No. 30, page 9—all of which have succumbed to the blight, excepting the Keiffer, Garber's Hybrid, Duchesse d' Angouleme, Mount Vernon, and Winter Nelis. While the Large Duchesse and Smith's Hybrid, and LeConte are not entirely dead, they are so badly affected that very little hopes are entertained of their recovery. When the blight first attacked these trees, the most vigorous efforts were made to eradicate it, by pruning and burning the diseased portions, but with no avail. So many enquiries are made about this blight, that the following quotation is made from Bulletin No. 8, 1889. U. S. Dept. Agriculture by Dr. Geo. Vasey, and Prof. B. T. Galloway, in reply to a letter from C. H. Franklin, Union Springs, Ala. "This malady is caused by one of the most minute of living organisms, a species of bacteria. They are frequently spoken of, as disease producing germs, and the malady they occasion belongs to the same category of germ diseases now definitely proven to occur among animals and plants. These germs are of extreme tenacity, and are borne from place to place, and from tree to tree, by the atmosphere which is never so quiet but that its movements are sufficient to keep such minute bodies afloat. At present we know of no certain means for rendering the trees insusceptible to the disease. Fumigation, spraying, or washing the tree with various known fungicides, notably sulphur and lime, have given no positive results. As the disease is local and spreads slowly, it is possible, as has long been known, to effectually check its progress by amputation. The smaller limbs should be cut off a foot or two below the lowest manifestation of the disease, and the spots on the trunk and larger limbs shaved out, cutting deep enough to remove all discolorations. The instrument used should be kept disinfected with carbolic acid or otherwise, to guard against conveying the disease to freshly cut surfaces, and the newly cut surfaces ought to be painted over, to exclude the germs that might reach them through the atmosphere."

It is to be hoped that our scientists may soon discover some remedy for this dreadful scourge, and we are glad to note that the Biologist of this Experiment Station is now making investigations in this line.

PEACHES.

In 1885 an orchard of 37 varieties of budded trees, 2 of each kind, and 50* seedlings, were planted; a few died in transplanting and three of the budded trees have since died. At the present writing, July 1, 1893, they are all in a healthy, vigorous condition, and, last year especially, bore an abundant crop of delicious fruit. The following list gives a complete succession from June to November, in the order of ripening, with a brief description:

ALEXANDER.—Of all early peaches tried this is the one preferred; fine color, semi cling, quality good, medium size and prolific. Ripe May 25 to June 10.

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* One row of the seedlings was not counted in the report given in Bulletin No. 11, which explains the difference in this number.

HALE'S EARLY.—Above medium size, prolific, white nearly covered with red, very juicy, high flavor, quality good semicling. Ripe June 20 to July 1.

EARLY TILLOTSON.—Small to medium, very prolific, white covered with red, very good quality, freestone. Ripe June 25 to July 10.

AMELIA.—Large and prolific, conical, white nearly covered with red, juicy, high flavor, sweet, quality best for home use; freestone. Ripe July 5 to 15.

CRAWFORD'S EARLY.—Large and productive, yellow with red, flesh yellow, juicy and rich, freestone. Ripe July 15 to 25.

CRAWFORD'S LATE.—Resembles Crawford's Early, but larger, and about two weeks later.

STUMP THE WORLD.—Very large, white with bright red cheek, quality very good, freestone. July 15 to 30.

THURBER.—Large, very prolific, white covered with greenish red, very juicy, high flavor, freestone. Bears some fruit every year, and in good crop years abundantly. Ripe July 15 to 30.

ELBERTA.—Large, yellow with red cheek, flesh yellow, juicy, very good quality, prolific, but has not given the satisfaction here that it has met in Georgia; freestone. Ripe July 20 to August 5.

DUGGARS' GOLDEN.—Medium to large, light yellow, firm and juicy; best quality. Ripe July 25.

GEN. LEE; and

STONEWALL JACKSON, seedlings of Chinese Cling, which they resemble, but are improvements on the parent stock, both clings. Ripe July 25 to August 10.

EATON'S GOLDEN.—Medium size, prolific, golden yellow, red cheek, juicy, sweet, quality very good, cling. Ripe August 20 to Sept. 1.

DENNING'S SEPTEMBER.—Large, yellow, quality good, cling. Ripe August 25 to September 10.

STINSON'S OCTOBER.—Medium, white, firm, quality good. Ripe September 10 to October 1.

HUDSON'S NOVEMBER.—Medium size, white with red cheek, firm, quality good. Ripe October 20 to November 1.

A few new varieties have been added, which only came into bearing last year, (1892) and promise well: Burke, Arietta, Parnell's No. 1, and Parnell's No. 2.

The BURKE, cling, is a delicious peach, resembles the Chinese Cling. Ripe July 14.

ARIETTA, freestone, resembles Stump the World; ripens July 25.

PARNELL'S No. 1 and No. 2, freestones, large white and medium red; ripen June 25 to July 1.

PLUMS.

In 1885, the following varieties of plums were planted: Weaver, Brill, Hendrix, Missouri, Cumberland, Indian Chief, Hughes, Southern Golden, Bassett's American, Hattie, Newman, Mariana, and 36 Wild Goose planted on different stocks.

Of all these, at this date July 1, 1893, only the Weaver, Southern Golden, Hattie and the Wild Goose grafted on peach stock, are now living and can be recommended.

Nine new varieties of the Japan type, were presented by G. H. Miller & Sons, Rome, Ga., in the Spring of 1889. The following bore their first crop in 1892. Magnificent fruit, ripening from June 6 to 30. Botan, Botankio, Chabot, Maru and Ogon. The other four are vigorous trees, but have not yet borne any fruit.

QUINCES.

Five varieties of quinces were planted in 1885, but only the Champion, and the Chinese or Quincedonia, have ever borne any fruit.

CHERRIES.

Eight varieties of cherries planted have *all* proved entire failures.

MULBERRIES.

Of the six varieties of mulberries planted, only two can be recommended, the Hicks and the Claude. They are rapid growers, of equal merit, and bear fruit for about three months.

NUT BEARING TREES.

Pecans, English and Black Walnuts have been planted, and are growing finely on the Station grounds. We advise the planting of these nuts on every farm in the State. The Pecan will bear at eight years old, and Walnuts from five to six years.

RASPBERRIES.

The difficulty in propagating the Black Cap raspberry, and the shortness of its bearing season, will prevent its ever becoming popular for open culture, but in shaded places, near walls and fences, it will do fairly well.

Of the 16 varieties of the red cap raspberries tested here, the preference is given to the Turner and the Cuthbert. They put up a great many shoots which must be treated as weeds, and kept down, reserving only enough to make the next year's crop, but the length of their fruiting season, their excellent quality, and great productiveness, make them the most valuable of any variety.

STRAWBERRIES.

From the long list of different varieties of strawberries tested on the Experiment grounds, (See Bulletins No. 2, 1887, and No. 2, 1888 old Series, and Bulletins Nos. 1, 20, and 29, new series,) the following six have proved most successful and desirable. They are given in the order in which they stand as to excellence.

1st Sharpless, 2d Wilson, 3d Belmont, 4th Bubach, 5th Eureka or 1001, 6th Haverland.

The Everbearing all died during the Summer of 1891. The Banquet, Smeltzers, Early No. 2, and Waller's Seedling, are new varieties and promise well.

MELONS.

For several years experiments have been conducted with watermelons and cantaloupes, in order to ascertain which of the many varieties offered by the seedsmen, are worthy of being recommended to our people. Of the 28 varieties of watermelons tested up to the present time, preference is given to the following: 1st Cuba, 2d Sugar Loaf, 3d Jones, 4th Pride of Georgia, 5 Cuban Queen, 6th Jordan's Gray Monarch. We advise to plant Kolb Gem only for shipping.

In cantaloupes 30 varieties have been tested, and we recommend the following, any of which will give perfect satisfaction if properly planted: 1st Improved Pine Apple, 2d Nutmeg, 3d Netted Gem, 4th Extra Early Hackensack, 5th Baltimore or Acme, 6th Atlantic City, and 7 Nixon.

NOTE.—For preparation of land, planting, cultivation, pruning, &c., see Bulletins Nos. 4, 10, 11, 28, 29 and 30, new series.

So many applications have been made recently for information about nursery stock, that it is thought well to give the following suggestions—not with a view to *advertise* any one, but simply to be of use to our people, by giving them the address of reliable parties with whom we have dealt.

Buy nursery stock direct from the nursery, if possible never from second hands. Always buy one year old plants—they give much better satisfaction than two year old.

Application by postal card to the following nurseries will procure a Catalogue.

Langdon Nurseries, Mobile, Ala.
Huntsville Nurseries, Huntsville, Ala.
P. J. Berckmans, Augusta, Ga.
G. H. Miller & Sons, Rome, Ga.
E. J. Van Lindsay, Pomona, N. C.

Bulletin No. 48. July, 1893.

AGRICULTURAL EXPERIMENT STATION
of the
AGRICULTURAL AND MECHANICAL COLLEGE

AUBURN, ALABAMA.

ISSUED BY THE
DEPARTMENT OF AGRICULTURE, MONTGOMERY, ALA.

H. D. Lane, Commissioner,
L. A. Smith, Chief Clerk.

1. The effect of organic Matter on Natural Phosphates.
2. Commercial Fertilizers.

N.T.Lupton, State Chemist.

The Bulletins of this Station will be sent free to any citizen of the State on application to the Commissioner of Agriculture, Montgomery, Alabama, or Agricultural Experiment Station, Auburn, Ala.

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The Brown Printing Company, Montgomery, Ala.

The above is a copy of the title page of Bulletin No. 48, which contains 80 pages composed almost entire of analyses of fertilizers made by N. T. Lupton, Auburn, Alabama.

Bulletin No. 49, : : October, 1893.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

VARIETIES OF WHEAT AND GRASSES.

ALEX. J. BONDURANT, AGRICULTURIST.
JAMES CLAYTON, ASSISTANT HORTICULTURIST.

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* In charge of Soil Tests.

EXPERIMENTS IN WHEAT AND GRASSES.

BY JAMES CLAYTON, ASSISTANT IN HORTICULTURE.

These experiments in varieties of wheat were begun in 1890, the results of which were published in bulletins 32 and 39, but as further investigation was necessary before definite conclusions could be drawn, the experiments were continued in 1892.

The land used had been planted in vegetables for a succession of years, had been highly fertilized and was in a good state of cultivation.

On the 16th November, 1892, the ground was broken flush, plots each 1-100 of an acre were measured, rows laid off with a scooter and a mixture of 600 lbs. cotton seed meal and acid phosphate, equal parts of each, applied at the rate of 400 lbs. of mixture per acre broad-cast, and 200 lbs. in the drill. A scooter was run in the open furrow after the fertilizers were distributed, to mix them with the soil, and wheat at the rate of 1¼ bushels per acre was planted in the drill and covered with a harrow.

The following is the analysis of the acid phosphate and cotton seed meal, as furnished by Dr. N. T. Lupton, State Chemist, Jan. 21, 1893,

ANALYSIS.

Edisto Acid Phosphate: Water Soluble 9.73, Citrate Soluble 4.83, Acid Soluble 1.41. Total 15.74. Cotton seed meal, Acid soluble 2.73, Nitrogen 6.58, Potash 1.43.

The names of the varieties sown with results, and a brief description, are given below. The Large Red and Large White Wheat were furnished by the U. S. Department of Agriculture, and were first sown on the station in 1890.

The Purple Straw was obtained in the neighborhood of Auburn, and the twelve other varieties were presented by James Carter & Co., High Holborn, London, England.

1. Large White, ripe June 6. Four feet high, some rust; heads from four to seven inches long—not bearded; one to two grains to the mesh; white, plump grains; yield 21 bushels per acre; quality very good.

2. Stand up. Ripe June 12. Three and a half feet high, rusted very badly ; heads smooth two to four inches long; from none to two grains to the mesh; amber color. yield 7 3-10 bushels per acre; grains imperfect; quality very poor.

3. *Bird Proof.* Ripe June 12. 4 ½ feet high; rusted badly; heads smooth, two to three inches long, one to two grains to mesh; color, white; yield 8.16 bushels per acre; grains imperfect; quality very poor.

4. *Anglo Canadian.* Ripe June 8. 4½ feet high; some rust; heads bearded, three to six inches long; one to three grains to the mesh; color, amber; yield 29 bushels per acre; grains medium in size and perfect; quality best.

5. *Holborn's Wonder.* Ripe June 15. 3 feet high; rusted very badly; heads smooth; 3 to 4 inches long; from none to two grains to mesh; color red, grain very small and imperfect. Yield 5.33 bushels per acre; quality poor.

6. *Earliest of All.* Ripe June 6. 4 ft. high; rusted badly; heads smooth 5 to 8 inches long; one to two grains to mesh; color white; grains large, but imperfect; yield 23 bushels per acre; quality very good.

7. *Large Red.* Ripe June 6. 3½ feet high, rusted badly, heads bearded, 3 to 6 inches long, one to two grains to mesh; color red; grains medium size and not perfect; yield 19.3 bushels per acre; quality good.

8. *Pride of the Market.* Ripe June 10. 3 feet high; Rusted very badly; heads smooth; from none to two grains to mesh; color red; grains small and imperfect; yield 7.33 bushels per acre; quality poor.

9. *Queen.* Ripe June 10. 3½ feet high; rusted badly; heads smooth, 2 to 3 inches long; one to two grains to mesh; color white; grains small and imperfect; quality poor.

10. *Purple Straw.* An old standard. Ripe May 23. 3½ feet high. Almost free from rust; heads smooth. 2½

to 3½ inches long; two to three grains to mesh; color red; grains small and plump; yield 30.5 bushels per acre; quality best.

11. *Flour Ball.* Ripe June 15. 3½ feet high; badly affected with rust; heads two to three inches long, one to two grains to mesh; color white; grains small and imperfect; yield 7.83 bushels per acre, quality poor.

12. *Prince of Wales.* Ripe June 12; 3 feet high; rusted very badly; heads smooth, 3 to 5 inches long; from none to two grains to mesh; color red; grains very small and imperfect; yield 6.16 bushels per acre; quality very poor.

13. *Hundred Day.* Ripe June 10. 4 feet high; rusted badly. Heads smooth, 2 to 3 inches long; from none to two grains to mesh; color white; grains small and imperfect; yield 10.66 bushels per acre, quality poor.

14. *Miller's Delight.* Ripe June 10. 4 feet high; rusted badly; heads smooth and from 2 to 3 inches long; from none to two grains to mesh; color white; grains small and imperfect; yield 11.66 bushels per acre; quality poor.

15. *White Chaff.* Ripe June 5. 4 feet high; some rust; heads beardless; 3 to 5 inches long; one to two grains to mesh;. color white; grains medium size, plump; yield 30 bushels per acre; quality best.

Only six of the above fifteen varieties can be recommended to the farmers of this State for cultivation, which are given below in the order of their excellence. The other varieties are quite worthless here.

1. Purple straw.
2. White Chaff.
3. Anglo Canadian.
4. Large White.
5. Large Red.
6. Earliest of All.

SPURRY.

This plant was grown here for the first time in 1886, but as no record was kept of the results obtained, it was thought advisable to try it again this year. It is a new plant in

Alabama, and not generally known in the United States, but in some parts of Europe it is highly esteemed as a forage plant for hay and pasturage, and for renovating the soil. It is a vine like, jointed plant, branching out near the ground, and at some of the joints, and at the top; and forming from 25 to 250 seed vessels, according to vigor of plant, each seed vessel containing from 6 to 26 small seeds resembling those of an onion. The average growth of the plant here on our thin sandy land, is from 8 to 12 inches in height.

Further trial is necessary before positive conclusions can be drawn, but from one year's experiment the indications are that it is inferior to either Bermuda or Crab grass, for hay and pasturage, and its meager growth will keep it from competing in the South with clay peas as a renovator of poor soils.

ANALYSIS OF SPURRY, (AIR DRIED.)

Furnished by Dr. James T. Anderson in charge of Chemical Department (August 24th, 1893) of the State Agricultural and Mechanical College :

Moisture	11.05
Ether Extract	6.31
Crude Fiber	16.58
Ash	7.59
Crude Protein	10.28
N. free Extract	48.19
	100 00
Phosphoric Acid	0.90
Potash	1.88
Nitrogen	1.64

The above sample was gathered on June 28th, 1893, sixty days from time of planting.

While this plant does not ripen like wheat, the seed maturing all at the same time, yet at the time of gathering it was sufficiently matured and in a suitable condition for analysis.

The following is a list of Grasses planted on Experiment Station March 20th, 1893:

	BOTANICAL NAME.	COMMON NAME.	SEEDS FROM WHERE.
1	Cynodon Dactylon	Bermuda	U. S. Dept. Agr'l
2		English Rye	"
3	Lolium Italicum	Italian Rye.	"
4	Poa Pratensis	Kentucky Blue Grass	"
5		Lawn Mixture	"
6	Dactylis Glomerata	Orchard Grass	"
7	Agrostis Vulgaris	Red Top	"
8	Poa Arachnifera	Texas Blue Grass	"
9	Arundo Festuciodes		Miss. Expt. Station.
10	Bromus Adoensis		"
11	Bromus Mollis	Soft Brome	"
12	Bromus Unioloides	Rescue Grass	Ala. "
13	Festuca Heterrophylla	Fescue	Miss. "
14		Festuca No. 1	Jas. B. Olcott, Manchester, Conn.
15	Festuca Sylvatica	Forest Fescue	Miss. Expt. Station.
16	Poa Compressa.	Wire Grass	"
17	Poa Trivialis.	Rough-Stalked Meadow	"
18	Paspalum Platycaule	Rough Meadow	"
19	Phalaris Coerulencens	Blue Canary	"
20	Desmodium Molle		"
21	Sainfoin		"
22	Trisetum Pubescens	Downy Oat Grass	"
23	Aira Flexuosa	Wood Hair Grass	"
24	Eragrostis Oxylepis		"
25	Stipa Tenacissima	Tough Feather Grass	"
26	Halens Mollis	Creeping Soft Grass	"
27	Tetrapoyon Tetrastachys		" "
28	Panicum Teneriffe		"
29	Diplachne Imbricata		"
30	Chloris Virgata		"
31	Glyceria Fluitans.	Floating Meadow Grass	"
32	Eragrostis Pilosa	Slender Meadow	"
33	Melica Altissima		"
34	Melica Ciliata		"
35	Calamagrostis Avenaria		" "
36	Elymus Canadensis	Wild Rye	"
37	Cynosurus Cristatus	Crested Dog-tail	"
38	Millium Effusum	Millet Grass	"
39	Cenchrus Montannus		"
40	Themea Membrenacea		"
41	Aira Coespitosa.	Tufted Hair Grass	"
42	Phalaris Paradoxo	Bristled Spiked Canary.	"
43	Holcus Lanatus	Velvet Grass	"
44	Elymus Arenarius	Upright Sea Lyme Grass	"
45	Avena Sterilis		"
46	Panicum Frumentaceum	Panic Grass	" "
47	Vicia Villosa.	Vetch or Tare	"
48	Medicago Sativa	Alfalfa or Lucerne	"
49	Trifolium Hybridum	Alsike or Sweetish Clover	"
50	Trifolium Incarnatum.	Crimson Clover	"
51	Lathyrus Silvestris	Flat Pea	"

Bromus unioloides (Rescue Grass) related to chess or cheat, seed furnished by U. S. Department of Agriculture, and planted on the Experiment Station, 1889.

This grass is said to have been named Rescue Grass by Gen. Iverson of Columbus, Ga., who first brought it to the attention of the planters in 1853. It has been extensively advertised in our State, under the name of "Arctic Grass," seeds of which were procured by the director of this station in 1891, and when compared with the Rescue Grass, were found to be one and the same. In the winter of 1889, a plot of ground was planted in Rescue Grass, which ripened in May. All the seed that could be saved were gathered by hand, although many were shattered-out and thought to be lost. Immediately after harvesting the seed the plot of ground was sown in peas and the same plowed under, and in September following a perfect stand of grass came up.

From the time of the first planting of the seed until now, a perfect stand appears annually in September, which is secured by sowing the ground in peas, and thereby turning under the seeds that fall, as was done in the first instance.

While it has been used only as a soiling crop, yielding two good cuttings in late winter and early Spring, it is also said to be fine for grazing.

Poa arachni (Texas Blue Grass) can be grown from sets or seeds. A plot of land was planted on this station in February, 1889 with sets, 18 by 18 inches apart, requiring careful cultivation the first year. A perfect sod was secured in about two years. It is now growing vigorously and is a valuable winter grass, the greatest objection to it being the amount of cultivation required before the sod is obtained.

Festuca No. 1. Mr. James B. Olcott of New Manchester, Conn., presented this station with some sod of the above named grass in 1890. It is a beautiful and attractive winter grass for yards and lawns, but sun-scalds and dies-out badly during the summer months on our sandy soils.

Some of the grasses mentioned in the foregoing list are promising, viz : Chloris virgata, Panicum teneriffe and Lathyrus silvestris and others, but further trial will be necessary before conclusions can be drawn. Our experience to date is that nothing better has been found for our soil and climate, than rye for winter and Bermuda for summer.

Bulletin No. 50, : November, 1893.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

Fruit-Tree Blight in General.

J. M. STEDMAN.

CONTENTS.

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*In charge of Soil Tests.

FRUIT-TREE BLIGHT IN GENERAL.

J. M. STEDMAN.

INTRODUCTION.

Blight is a disease of plants that has of recent years attracted considerable attention, especially to the fruit grower, due to the fact that certain kinds of fruit trees have become affected with this disease, which has spread each year doing increasing harm. With the rapid yearly increase in the number of fruit trees affected, together with the equally rapid increase in the geographical area of distribution of the disease, has come a wide spread interest in this subject throughout the whole country. And this subject is attracting attention more and more; and it has so increased that it is now not confined to the fruit grower, but the farmer and even the general public have come to recognize this disease as a most serious one. The fact that its exact nature is not generally known, and the remedy perhaps even less, has helped to increase the dread of it, and to allow many to neglect their trees and permit them to die in consequence. Hundreds of instances have come under my observation in this state where village people with a few fruit trees, as well as farmers and even fruit growers, allow their trees to go unattended to when the disease appears, and the disease to increase and kill the trees and spread to others unaffected. So great has been this sad neglect of trying to check this disease, due no doubt to a want of information, together with the great yearly financial loss due to it, that this bulletin has been written with the sole purpose of giving to the public, and to the fruit growers and farmers of this state in particular, a general knowledge of what is at the present time known to biologists in regard to the nature and cause of the disease, and of the remedies to be used to combat it and to prevent its spreading to unaffected trees and areas.

The blight is at present more common in the northern part of the State. A fruit grower from that locality who depends almost exclusively upon his fruit trees for a living, states that his apple trees are so badly affected with blight that he has lost nearly his entire crop and a large percentage of the trees. One can readily see what the disease blight means to such a citizen. While attending farmers' institutes in various parts of the state this past summer, I had a good opportunity to observe the effect and extent of this blight; and it was sickening to note the great amount of damage and loss by it, not only of this years' crop, but of the trees themselves; and what is still more, to note the neglect, which must result in the great increase and spread of the disease next year. It is to be hoped that all who read this bulletin will take every precaution themselves and inform their neighbors on this subject; and let all work together to greatly lessen, if not annihilate this, the worst of all plant diseases.

The different kinds of plants that are subject to the attack of the disease—blight—is very great; and it is by no means confined to fruit trees, but even shade and forest trees are subject to it. In some localities in the northern part of this state, I have observed the oak trees affected to such an extent, that with certain species, it was almost impossible to find one perfectly healthy, and as a rule the entire tree was more or less diseased. Fortunately this seems at present to be confined to a few localities only, but one of these is at least five miles in diameter. Should this blight increase as it seems certain to do, we may in a few years have an even greater problem to contend with than that of our fruit trees.

The blight appears in many cases soon after the trees are leaved out, but more often later, and may appear at any time during the summer. Its growth ceases in the Fall at about the time the leaves begin to dry and turn preparatory to shedding, or at the approach of cool weather. The blight makes itself manifest by causing the affected parts, both leaves and stems, and it may be also the fruit, to turn a brown color, which varies from a light brown to a dark tobacco brown, or in some cases an almost black appearance. This coloration of the leaves due to the blight is readily distinguished from the coloration of the leaves due to any other cause, as the partial or total breaking of a stem, or the girdling of the trunk or stems, or an injury of the roots. In the case of coloration by blight the leaves do not appear dried or shriveled as a rule, except in the case of the water oak, but preserve their proper shape; whereas in the coloration due to other causes the leaves appear dried and shriveled and have a lighter brown color. Moreover, the coloration due to blight may not at the time being affect the entire leaf, but may appear on any portion of the leaf or in several places, and cause it to be spotted. Ultimately, however, the entire leaf will become affected unless the growth of the disease be checked by some cause. The disease appears first as a rule at the buds or growing tips of stems or young leaves where the tissues are tender; and from these places it spreads down the stem, involving ultimately all the branches and leaves of the affected limb together with its fruit. As a rule a tree is attacked in several places at once; it may be on many different limbs or on several twigs of the same limb or both; and when a tree is attacked in a great many localities involving a large number of limbs, and this early in the season, the disease will often so increase as to involve the entire tree above the roots and kill it in one summer, if unattended to. It is not an uncommon occurrence, when such a tree has been cut down close to the ground soon after it died, to have new shoots appear from the old roots and grow to be good bearing trees. (Pear.)

Blight always kills the parts of the plant affected. Although the term *blight* is restricted in its true sense to this particular disease of the leaves and stems with their fruit which is often itself affected, due to a spreading of the disease to it from the stem, nevertheless, there are diseases of the fruit itself that do not involve other parts of the tree, which diseases are the result of a cause, the nature of which is like the cause of true blight. When the fruit alone is effected with a *blight* that does not spread to other parts of the plant, we call this disease *Rot* as a rule, although the term rot is also applied to diseases of the fruit, the cause of which is entirely different from that of true blight. There are cases, however, where true blight may begin in the fruit or even blossom before the fruit is formed, and from it spread to the stem and leaves. In this case Waite has demonstrated that insects are the active agents in carrying the disease from one place to another; and that they inoculate the flowers which may have produced minute fruit before the disease increased so as to kill it and spread to the twig, or the disease may have increased so as to prevent the least formation of fruit.

THE NATURE AND CAUSE OF BLIGHT.

The disease known as *blight* is caused by bacteria. Bacteria are plants that are so small that in some cases twenty-five thousand (25,000) of them placed side by side would extend but one inch. Most bacteria, however, are a little larger than this, while many are smaller. They are as a group the smallest of living things, but what they lack in size they make up in numbers. Their power of multiplication is so great that in many cases, when every thing is favorable as regards food and temperature, the result of the growth and multiplication of a single individual plant would be many thousand in one day.

Each plant or bacterium consists of nothing more than a single cell, or to make it more plain to the cultivator, of a single minute sack or mass of living matter. The rapid multiplication of these organisms takes place by a simple division of this single cell into two usually equal parts, each one now constituting a new and independent plant, which repeats the same process of division after a little growth. Bacteria also have another mode of reproduction by what are called spores. These spores are as a rule much smaller than the adult bacteria, and are capable of withstanding greater hardships and live. The adult bacteria themselves can withstand in many cases prolonged drying and a very high or low temperature, but the spores can withstand much more. The spores of many species or kinds of bacteria will withstand boiling for an hour or even more, and some at an even higher temperature, while the spores of *Bacterium anthracis* are stated by Pasteur to remain alive in absolute alcohol.* The spores will also withstand the action of many fungicides and insecticides. This will give the reader some idea of the great vitality of these micro-organisms, and enable one to understand why these creatures can live in the soil, not only during the dry and hot summer weather, but also during the cold of winter. Their minute size will also enable one to readily see how it is that they can float about in the air in great numbers, and be carried from one place to another.

Many bacteria are harmless, since they feed upon only dead or not living tissues or organic substances, and some are even beneficial; but many are injurious since they feed upon and live within other living organisms, both plant and animal, and in this case may produce disease and death. This death or disease may be the result of the direct action

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*Charbon et Septicemie, Compt. Rend. lxxxv. p. 99.

of the bacteria in consuming the tissues, or it may be as a result of the chemical action of the waste products (ptomaines) thrown off during the growth and metabolism of the bacteria. Hence it is observed that there are many species or kinds of bacteria; and they not only act differently and produce different results and diseases, but each species as a rule has its particular animal or plant or substance in which it will grow and multiply and will not do so in any other.

The bacteria that cause the disease in fruit trees known as blight are carried by the wind, or by insects in some cases, from the soil to the buds or leaves of the trees. Here they gain access to the interior of the leaves by means of the stomata or minute openings in the epidermis of the leaf, of which there are in some cases many thousand to a square inch. Once on the tender buds or inside the leaves the bacteria find suitable food and conditions for their growth and multiplication. They feed upon the tissues of the host plant and destroy it, and as they increase in number, they gradually come to infest the entire leaf, and finally the petiole and the twig to the stem and other healthy parts. In this way the disease once started in a single place in the tree, will spread so as to include in time the entire limb or even the entire tree. The disease works down towards the trunk of the tree as well as in all other directions, and since the tissues affected soon die, it follows that if the blight start low down on a branch, it will necessarily kill the entire branch beyond the diseased portion.

The peculiar coloration of the blighted portion does not in reality indicate the entire area affected, since the bacteria are in many cases, especially in the stem, far below or down the branch before the coloration appears there, the coloration not being produced immediately upon the appearance of a few bacteria. Hence in cutting off of a diseased limb it is not sufficient to cut off the portion showing the coloration, since we would leave the stump affected with the bacteria for a considerable distance; and these would continue to multiply and spread, and shortly the disease would again make itself manifest. It is essential then in cutting off the blighted portion of a tree, to cut far below the portion that looks diseased, say from one to three feet according to the size of the limb. It is also safer to cut off the dieased portion just as soon as it appears, and before it has had time to spread to any considerable extent.

In the Fall the leaves that are diseased, as well as the unaffected ones, fall to the ground. Here they decompose and the bacteria are set free, for they do not decay, and are again carried to other localities. In this manner the disease is spread from one tree to another and from one field or locality to another, and thus it is that the blight has and is spreading all over our country. It is then readily understood why it is that, if one neglect to attend to his fruit trees, the blight will ultimately reach those of his neighbors.

During the past summer I made pure cultures of the bacteria causing the blight in the pear, quince, apple, and a coniferous tree. These were made in nutrient gelatine by the usual method of plate and tube culture. In this way the bacteria from each kind of diseased tree were grown in separate tubes of gelatine in which they fed and multiplied, and thus were obtained a large number of individuals of each special kind of bacteria, each tube containing but one kind or species.

Some of the bacteria from the tube containing the ones obtained from the pear tree blight were then inoculated into the healthy leaves of a pear tree by the use of a sterilized needle dipped into the culture, and then pricked through the epidermis of the leaf. Many leaves were thus inoculated in different localities and on different trees, and each inoculated part labeled. In five days every leaf thus inoculated had taken the disease blight, thus proving that these special bacteria were the cause of the disease.

The same method was also followed in regard to the blight of quince and apple trees, and also with the conifera, and in all cases the inoculated leaves took the disease.

I then tried to determine, if possible, whether or not the bacteria causing the blight in the pear tree would, if inoculated into the quince or apple tree, give the blight to those trees; and whether or not the bacterium of the quince tree blight would cause the blight in the pear or apple tree; and also the bacteria of the apple tree blight cause the disease in the pear or quince trees. To determine this I cross inoculated many leaves of the different fruit trees with the blight bacteria from the other kinds of fruit trees, and in no case was I able to produce the blight, except by the inoculation of the bacteria obtained from the blight of the particular kind of tree inoculated. It thus appears that each kind of fruit tree, at least so far as pear, quince and apple are concerned, has its special species of bacteria that produce the blight in that tree, and that this species of bacteria will not produce blight in the other kinds of fruit trees.

It should be mentioned, here, however, that I was able to produce blight in three different species of conifereus trees by the inoculation of the blight bacteria obtained from but one species of tree.

REMEDIES.

From the above it is readily seen that, since the cause of the blight is a minute plant—bacterium—that feeds upon and lives, grows and multiplies within the tissues of its host plant, that we can not reach the micro-organisms that are thus internal parasites, and kill them by the application of any substances to the tree in the form of a spray, as we can do for many fungoid diseases. We would kill the tree before the bacteria could be reached and affected. Hence the only means of combatting this disease *blight* at present known, is the cutting off of the affected portion far below the external signs of the disease. And since we have seen how the germs of this disease remain in the affected parts, as the leaves, that fall to the ground, and how they are eliberated and carried to infest other trees, it is plainly seen that if we cut off the diseased branches and leave them upon the ground, that we are doing no good whatever, for we have killed nothing, but are simply allowing the disease to multiply and spread so much the more, and next year the disease will appear with increased damage. The diseased portion of the trees that are cut off are to be gathered and burned, and especially the leaves, and thus the cause of disease will be destroyed and its spreading prevented.

The simple remedy is then to cut off all blighted portions of the trees far below the parts that appear diseased, and to burn all these cuttings, especially the leaves. The sooner this is done after one discovers the blight in a tree the better.

It is not enough that one thus guard his trees while his neighbors neglect theirs. We must all fight this blight, which is doing more harm already than any other single disease. If every person will thus attend to his fruit trees, we can almost exterminate the disease in a very few years.

I am now experimenting on the application of chemicals to the soilto be taken up with the sap in the Spring to kill or prevent blight, but as yet no definite results have been reached. Little has as yet been done in this line of preventing or curing bacterial diseases of plants, although the field looks promising, since we can in many cases cure bacterial diseases of animals by the internal application of chemicals.

Bulletin No. 51, : October, 1893.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

VEGETABLES.

ALEX. J. BONDURANT, AGRICULTURIST.

JAMES CLAYTON, ASSISTANT HORTICULTURIST.

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* In charge of Soil Tests.

EXPERIMENTS IN VEGETABLES.

By James Clayton, Assistant Horticulturist.

The following results of experiments with a few leading varieties of vegetables on the A. & M. College Experiment Station for 1893, are given in a brief and simple form, hoping that they may be of some practical use to our people. Where conclusions have been drawn, they are based upon the painstaking and careful observation of several year's experiments.

TOMATOES.

Seeds of the varieties named below were mostly furnished by the U. S. Department of Agriculture, Washington, D. C., and only a few packages were purchased from seedsmen.

The seeds were planted on an open bed March 15th and on April 27th, the plants were set in rows 3½ feet apart each way. On August the 10th cuttings about 10 inches in length were made from the "Matchless" and planted, just as plants grown from seed, all of which lived and grew vigorously. At this writing, October 20th, the vines are fruiting heavily and the tomatoes are beginning to ripen.

Especial attention is called to the above method of planting for a fall crop, as much difficulty is experienced in growing plants in the summer months. It is suggested however that the cuttings he planted about the middle of July, instead of in August.

The following is a brief description of the different varieties:

Atlantic Prize—Landreth. Light red, medium size, very wrinkled and flat. Prolific. Ripe July 10th.

Baltimore Prize Taker—Landreth. Light pink, medium to large size, wrinkled and round. Not prolific. Ripe July 12th.

Buckeye State—Dreer. Dark pink, medium to large size, smooth and roundish flat. Not prolific. Ripe July 12th.

Early Bermuda—Landreth. Light red, medium size, very wrinkled and flat. Very prolific. Ripe July 14th.

Extra Early Cluster—Landreth. Light red, medium size, very wrinkled and flat. Prolific. July 12th.

Extra Early Jersey—Landreth. Light red, medium size, very wrinkled and flat. Prolific. Ripe July 10th.

Early Richmond—Landreth. Dark red, medium to large, wrinkled and flat. Not prolific. Ripe July 6th.

Early Ruby—U. S. Department of Agriculture. Yellowish red, small to medium in size, smooth and round. Prolific. Ripe July 8th.

Ignotum—U. S. Department of Agriculture. Pinkish red, medium size, smooth and roundish flat. Prolific. Ripe July 6th.

Livingston's Beauty—U. S. Department of Agriculture. Yellowish red, medium size to large, smooth and roundish flat. Prolific. Ripe July 8th.

Livingston's Favorite—U. S. Department of Agriculture. Yellowish, medium size, smooth roundish flat. Prolific. Ripe July 10th.

Long Keeper—U. S. Department of Agriculture. Red, medium size, smooth and roundish flat. Prolific. Ripe July 10th.

Matchless—W. H. Maule. Light red, medium to very large, smooth and roundish flat. Very prolific. Ripe July 20th. This is one of the handsomest tested.

Paragon—U. S. Department of Agriculture. Yellowish red, medium size, perfectly smooth. Very prolific. Ripe July 12th.

Perfection—U. S. Department of Agriculture. Yellowish red, medium to large size, smooth and roundish flat. Prolific. Ripe July 12th.

Ponderosa—Henderson. Light pink, large to very large size, wrinkled and flat. Not prolific. Ripe July 16th.

Royal Red—Dreer. Red, medium size, wrinkled and roundish flat. Prolific. Ripe July 16th.

Telegraph—U. S. Department of Agriculture. Light red, medium size, wrinkled and flat. Very prolific. Ripe July 14th.

Money Maker—Landreth. Medium size, wrinkled and flat. Very prolific. Ripe July 14th.

Ten Ton—U. S. Department of Agriculture. Yellowish red, small to medium size, smooth and round. Prolific. Ripe July 16th.

The Stone—U. S. Department of Agriculture. Light red, medium to large, smooth and round. Ripe July 14th.

This variety is of recent origin, is a vigorous grower, dark green foliage and the fruit of very good quality.

Turner's Hybrid—U. S. Department of Agriculture. Pink, large to very large, smooth and round. Not prolific. Ripe July 16th. Peculiarly shaped leaves, resembling those of the potato.

Trucker's Favorite—W. H. Maule. Pink, small to medium, smooth and round. Prolific. Ripe July 20th.

Of Livingston's varieties, the following have been grown on this station for several years as a standard of comparison with those of more recent origin, and nothing has been found superior to them, both as to quality and productiveness:

Ignotum, Livingston's Beauty, Livingston's Favorite, Matchless, Paragon and Perfection.

IRISH POTATOES.

The varieties named below were purchased of Henry A. Dreer, Philadelphia, and planted March 16th, 1893.

The land having been thoroughly prepared, was fertilized with compost such as we use for corn, and after the potatoes were planted the plot was covered with pine straw about four inches deep. This was done immediately after the planting was finished. *As soon as the vines began to turn yellow,* the potatoes were harvested, which was from the latter part of June to the first of July, and they were then placed in a cool room, spread out on the floor and sprinkled with slaked lime.

It will be noticed, that, while the Freeman is not so productive as the Early Rose, it is about six days earlier, and being of an excellent quality, is therefore a very desirable variety. The following brief description is given of the varieties planted:

Burbank Seedling.—An old standard which needs no introduction. Long, white skin, free from scab and a good keeper. Prolific. Yield per acre 368 bushels.

Early Essex.—Large and roundish with pink skin, free from scab and knots. Yield per acre 355 bushels.

Early Puritan.—A long roundish variety, very light pink skin, free from scab and knots. Very prolific. Yield per acre 416 bushels.

Early Rose.—Too well known to need comment. A long variety, pink skin, free from scab,—some knots. Prolific. Yield per acre 388 bushels.

King of Roses.—Roundish, pink skin,—some scab and knots. Yield per acre 342 bushels.

Richmond Bell.—Roundish flat, straw colored skin, free from scab and knots. Very prolific. Yield per acre 424 bushels.

Freeman.—A new and beautiful straw colored variety, very early, roundish flat, free from scab and knots. Not very prolific, but about six days earlier than Early Rose. Yield per acre 304 bushels.

CABBAGE.

The following varieties of cabbage seed were sown in open beds March 15th, and transplanted on April 27th to thorougly prepared land in rows 2½ by 2½ feet:

All Seasons, American Drumhead, Early Summer, Express, Large Late Drumhead, Succession and Surehead.

Preference is given in the order named to Early Summer, Succession and All Seasons, and for later kinds to Large Late Drumhead, and American Drumhead.

EGG PLANT.

A comparison of home raised and bought seed of the New York Improved Purple variety, resulted in no perceptible difference, both being satisfactory. To germinate the seed, place some fresh compost, or any other kind of manure, that will heat easily in a box, filling it from one-half to two-thirds full. Cover this with earth from 4 to 6 inches deep, sow the seed and cover the box with cheese-cloth or muslin, using tacks to confine the edges. The cheese-cloth or muslin is sufficiently thin to admit the warmth of the sun necessary for germinating the seed, and also protects the plants from the ravages of bugs which are very destructive to them while young. It is best to place the box on the southside of a wall, or at some protected place. Keep the soil well watered.

Our best results have been obtained from thin or poor land highly fertilized; and a few plants transplanted and carefully cultivated will supply a family with an abundance of this excellent vegetable.

ONIONS.

To grow onions from seed, sow the seed in open beds in February, and transplant as early as the weather will permit to rows 12 to 15 inches apart, taking pains to have the ground highly fertilized.

Of the fifteen kinds tested on this station, preference is given to the following:

Large Tripoli, Silver King, New Pearl, New Queen, White Barletta, White Maggiajola, Red Wethersfield, which have all produced fair sized onions the first season from pursuing the plan above mentioned.

BUSH LIMA BEANS.

Seeds of Burpee's Bush Lima, Dreer's Bush Lima and Henderson's New Bush Lima, were purchased of Peter Henderson and planted this past season, and in so far, as one year's trial goes, Henderson's New Bush Lima is decidedly in the lead. It is earlier and more prolific than either of the other two.

Beets, Lettuce, Carrots, Salsify and Radishes, all grew to perfection on the station grounds the past season.

CONOVER'S COLOSSAL ASPARAGUS.

Seeds furnished by the U. S. Department of Agriculture, Washington, D. C., were planted, and the plants are now growing vigorously.

A limited supply of these plants, and the following in limited quantities, will be sent free (except postage) to residents of the State making application.

White Velvet Okra Seed, Jones and Sugar Loaf Watermelon, Pine Apple and Nixon Canteloupe seed, and Grape roots of the standard varieties.

Bulletin No. 52, : January, 1894.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLEGE,

AUBURN, : : ALABAMA.

CORN AND COTTON.

ALEX. J. BONDURANT, AGRICULTURIST.

CONTENTS.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Commissioner of Agriculture, Montgomery, Alabama, or Agricultural Experiment Station, Auburn, Alabama.
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EXPERIMENT STATION, AUBURN, ALA.

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VARIETIES OF CORN.

OBJECT OF EXPERIMENT.

(*a*) To ascertain the best yielding variety.
(*b*) To find a good early variety.

The corn was planted on plots 1–40 of an acre large, and in checks 3x5 feet. A fertilizer, composed of 200 lbs. acid phosphate, 66 lbs. muriate potash and 66 lbs. sulphate of ammonia, was applied in the drill before planting, at the rate of 300 lbs. per acre.

Four plots were planted in Experiment Station Yellow. Any difference in the fertility of the soil would be shown by the difference in the yield of those plots. A perfect stand was not secured and this with some inequality of the soil prevents drawing any reliable conclusions as to the best variety.

Cocke's Prolific, Blount's Prolific, Experiment Station Yellow and Pride of America gave best yields in the order named. Cocke's Prolific and Blount's Prolific bear from 2 to 3 small ears to the stalk. With the other varieties named the ears are larger, and two to the stalk an exception.

The best varieties of early corn were Clarke's Early Mastadon (yellow), Early Eclipse (yellow), Gentry's Early Market (white) and Improved Golden Dent.

All varieties were planted April 8th. The shuck on these four was dry August 7th. To the farmer whose corn crib is low ih the Spring, it will be quite a saving to plant one of these early varieties.

By planting early, any one of these would be dry by the first of August.

Plot No.	Names of Varieties.	Weight of corn on ear.	Weight of corn shelled.	Per cent. of cob.	Yield in bus. per Acre.	Date of first tassel.
1	Experiment Station Yellow...	30.7	24.	218	17.1	June 24th
2	Blount's Prolific..............	30.9	24.3	213	17.3	“ 18th
3	Clayton Bread Corn........	28.3	20.5	31	14.1	“ 24th
4	ocke's Prolific..............	41 6	32.	231	22 8	“ 23rd
5	Clarke's Early Mastadon.....	24.7	19.	23	13.5	“ 14th
6	Experiment Station Yellow...	30	21.6	28	15 4	“
7	Early Eclipse (Y)............	23.	18.6	191	13.2	June 9th
8	Gentry's Early Market...... .	23.4	18 1	217	12.9	“ 16th
9	Giant Broad Grain...........	26.6	20.1	206	14.3	“ 20th
10	Hickory King.................	22.6	17.8	216	12.7	“ “
11	Experiment Station Yellow...	22.6	17.7	216	12 6	
12	Improved Golden Dent.......	21 8	17.7	188	12.6	‘ 20th
13	Pride of America.............	24.1	19.9	174	14 2	“ 26th
14	Piasa King....	21.7	16.9	221	12.	“ 23rd
15	Experiment Station Yellow...	22.6	17.	247	12 1	
16	Ross Improved...............	24.7	19.5	21	13.9	July 1st
17	Shoe Peg White	21.8	18.	174	12 8	June 24th
18	Virginia Gourd Seed..........	24 2	18.6	231	13.2	“ “

INTERCULTURAL EXPERIMENTS WITH FERTILIZERS ON COTTON.

The object of this experiment was to ascertain whether it would pay to apply nitrogenous fertilizers interculturally.

Six rows 210 feet long by 3½ feet wide, equal to 1–0 of an acre, were used. Just before planting, the following mixture of fertilizers was applied to each plot, at the rate of 200 pounds per acre: 200 pounds Acid Phosphate; 66 pounds Muriate Potash; 66 pounds Sulphate Ammonia.

As soon as the cotton was up, it was chopped and sided with a heel scrape. About June 1st the stalks of cotton in each row were counted, and then all rows but one thinned to 90 stalks. The 5th row of plot 6 had only 76 stalks. The several numbers of stalks in this row probably accounts for the small yield of that plot.

On June 22nd and July 7th the cotton seed meal and nitrate soda were scattered broadcast and the cotton plowed with a large heel scrape. All the plots were the same size and color up to July 7th and after that date the plots fertilized interculturally became much larger and had better color than the plots which were not fertilized after planting.

CONCLUSIONS.

1st. It pays to apply nitrogenous fertilizers to cotton on sandy land, provided there are good rains following their applications.

2nd. 200 pounds applied in June will be as profitable as 100 pounds in June and 100 pounds in July.

The following table shows the yield per plot and the profit from each plot fertilized after planting.

In calculating profit, the cost of nitrate of soda laid down in Auburn is used, and cotton seed meal is valued at $22 per ton. The seed cotton is valued at .02½ cents per pound.

The following table shows the results of this experiment:

Plot No.	June 22nd Name and quantity of fertilizers applied interculturally.	July 7th Name and quantity of fertilizers applied interculturally.	Pounds yield seed cotton per plot.	Pounds yield seed cotton per Acre.	Value of fertilizers per Acre.	Profit per Acre.
1	100 lbs cotton seed meal..	100 lbs cotton seed meal	59.9	898.5	2.20	2.33
2	200 " " "	200 " " "	70.1	1051.5	4.40	3.95
3	Check	....	50.1	751.5	......	......
4	50 lbs nitrate soda.	50 lbs nitrate soda	67.6	1014.	2.82	4.60
5	100 " " "	100 " " "	63.6	954.	5.64	.28
6	Check	....	45.5	682.5	......	......
7	200 lbs cotton seed meal......	....	60.9	913.5	2.20	2.71

EXPERIMENTS WITH COTTON, 1893.

A COMPARISON OF VARIETIES.

This experiment consists of a comparison of twenty varieties of cotton. In preparing the land for planting, all the plots were fertilized alike. The rows were laid-off 3½ feet wide, and the cotton planted in checks 3½ feet apart. The culture of every plot, 1–20 of an acre, was the same. The cotton was carefully picked and weighed, and the following tabulated statement shows not only the total yield per acre, but the yield per acre of each variety at every picking, and the date of same. Each variety was kept to itself until the time of ginning, when it was re-weighed and ginned separately.

The following is the table, showing list of varieties:

Plot No.	Names of Varieties.	Yield per acre at different pickings.				Yield of seed cotton per acre when pick'd.	Yield of seed cotton per acre when ginn'd Dec. 8th.	Yield of lint cotton per acre.	Per cent. of lint.	No. of stalks per acre.	No. of stalks per plot.
		1st Picking.	2nd Picking	3rd Picking.	4th Picking						
1	Peerless (seed from C. M. Cory)	140	650	340	90	1220	1194	388	32.5	2600	130
2	Coltharps Eureka	135	600	390	190	1375	1346	416	30.9	2600	130
3	Coltharps Pride	140	610	340	210	1300	1264	402	31.8	2600	130
4	Dalkeiths Eureka	85	535	410	230	1260	1236	386	31.2	2600	130
5	Herlong	75	600	535	100	1305	1278	404	31.6	2600	130
6	Hawkins	90	580	480	80	1230	1224	424	34.6	2120	106
7	Jones' Long Staple	140	615	410	170	1335	1338	414	30.9	2600	130
8	Mathews Long Staple	110	590	400	220	1320	1256	384	30.5	2600	130
9	Okra	275	620	290	50	1235	1196	392	32.8	2600	130
10	Peerless (seed from C. M. Cory)	130	700	345	70	1245	1172	378	32.2	2480	124
11	Peterkin (M. W. JOhnson Seed Co	60	420	400	120	1000	968	338	34.8	1160	58
12	Peerless (old seed)	190	860	415	90	1455	1492	474	31.7	2600	130
13	Peeler	90	450	390	260	1190	1140	340	29.8	1840	92
14	Petit Gulf	160	710	430	130	1430	1440	456	31.6	2460	123
15	Truitt	100	620	410	110	1240	1186	380	32.04	1600	80
16	Wonderful	200	840	390	190	1620	1554	460	29.6	2600	130
17	W. A. Cook	205	830	370	190	1615	1554	460	29.6	2600	130
18	Welborn's Pet	340	730	270	50	1390	1388	446	32.1	2600	130
19	Whatley's Improved	230	520	350	130	1230	1208	388	32.1	2600	130
20	Peerless (seed from C. M. Cory)	205	810	350	70	1435	1410	456	32.3	2600	130

The following table shows the classification and grade of each kind of the twenty varieties of cotton as furnished by Mr. C. E. Porter, cotton broker of Opelika, Ala., whose long experience and good judgment guaranteed a correct report. A sample of the lint of each variety was taken and numbered so as to compare with the numbers on our record, sent to Mr. Porter and his report which follows, it is hoped will prove of interest to cotton producers:

Plot No.	CLASSIFICATION.	Length of staple.	GRADE.
1	Strict Low Middling	¾ inch	Very weak
2	" " "	1 5-16 to 1⅜	Irregular, but strong
3	" " "	1 inch	Regular and fine lint
4	Good Middling	1 3-16 to ¼.	Irregular, moderate strength.
5	Strict Middling	¾ to ⅞	Very irregular.
6	" Low "	⅝ inch	Very weak, poor staple
7	Strict Middling	I inch	Moderate strength.
8	" "	1 1-16 inch	Strong and regular
9	Middling	1 inch	Regular and fine lint
10	Strict Middling	1¾ to 1⅞	Weak lint
11	" "	¾ to ⅞	Irregular and fine lint
12	Good Middling	1¼ inch	Regular and strong
13	Middling	15-16 to 1 in	Fine lint and irregular
14	Strict Middling	⅞ to 1 inch.	Irregular, very fine lint
15	" "	⅞ to 1 inch.	Irregular, fair strength
16	Middling	1¼ inch	Regular and strong.
17	Good Middling	1 1-16 to 1⅛	Very irregular, but strong
18	Middling	¾ inch.	Very weak staple
19	Strict Low Middling	1 3-16 inch.	Very weak staple
20	Strict Middling	⅞ inch.	Very fine and regular staple

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Agricultural Experiment Station

OF THE

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AUBURN, : : ALABAMA.

A New Milk or Water Sterilizer.

C. A. CARY, VETERINARIAN.

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ASSISTANTS:

A NEW MILK OR WATER STERILIZER.

BY C. A. CARY.

A cheap and practical milk sterilizer, that will destroy all the disease-producing germs which may be present in milk, has been sought as a means of preserving milk and of protecting the health of little children, and others who use milk as a chief food.

Scientists and medical authorities almost universally agree that tuberculosis (consumption) in animals and in man is caused by the same microbe; that milk from a tuberculous cow is many times infected with living tubercle baccili; that when children or grown persons consume such infected milk they may, or do in many instances, contract tuberculosis. Besides this most dreaded germ, there are occasionally other disease-producing microbes in milk, and nearly always numerous septic (decomposition) germs which hasten the process of fermentation (souring) and also interfere with the taste, digestibility and nutritive value of milk.

Milk has been sterilized by heat, by freezing and by passing electrical currents through it. The first of these three methods is the most effectual, practical and the cheapest.

The sterilization of water has been attempted by filtration, by heat, by freezing, by electricity and by the addition of drugs. The filtration method can be relied upon only when every detail is most scrupulously attended to. The value of electricity in sterilizing water has not been sufficiently tested to justify its general use; furthermore, it is not within reach of people outside of the larger cities. The employment of drugs (antiseptics, etc.,) ruin the taste of water, and in most cases would prevent its use as a food. Also, water sterilization by heat has hitherto caused the water to taste "flat" or insipid, a result of the loss of the absorbed air, oxygen and nitrogen and possibly a little carbonic acid gas, which is usually found in well water. The sterilization of drinking water is a most valuable aid in preventing typhoid fever, cholera, yellow fever, malarial fever and indigestion. The infected water supply was the source of the cholera outbreak at Hamburg in 1892. Infected wells have been the cause of many cases of typhoid fever. It is also very probable that impure water plays an important part in the production of malarial fevers. Moreover, it is almost certain that impure water and non-sterilized milk are the primary cause of "summer complaint" in children, and infectious diarrhea and dysentery in older persons.

It matters not how scrupulously clean and careful the milkmen may be, the milk will become contaminated, more or less, by germs from the air and other sources. Consequently, were the cow perfectly healthy, and the milk to flow from the udder free from microbes, before it reaches the consumer, especially in the cities, it is sufficiently infected with bacteria to interfere with its taste, its digestive and nutritive value.

At present it is an open question as to which is the more healthful for the infant, mother's milk or properly sterilized cow's milk. Recently, in European countries extensive examinations of mother's milk have been made and in the majority of instances women's milk was found to contain microbes. This was more especially true when the mother was not perfectly healthy. Some investigators are inclined to believe that the germs entered the milk from the blood, while others are of the opinion that the microbes came from the skin over the nipple. This question, however, requires further investigation before any relatively true conclusions can be drawn.

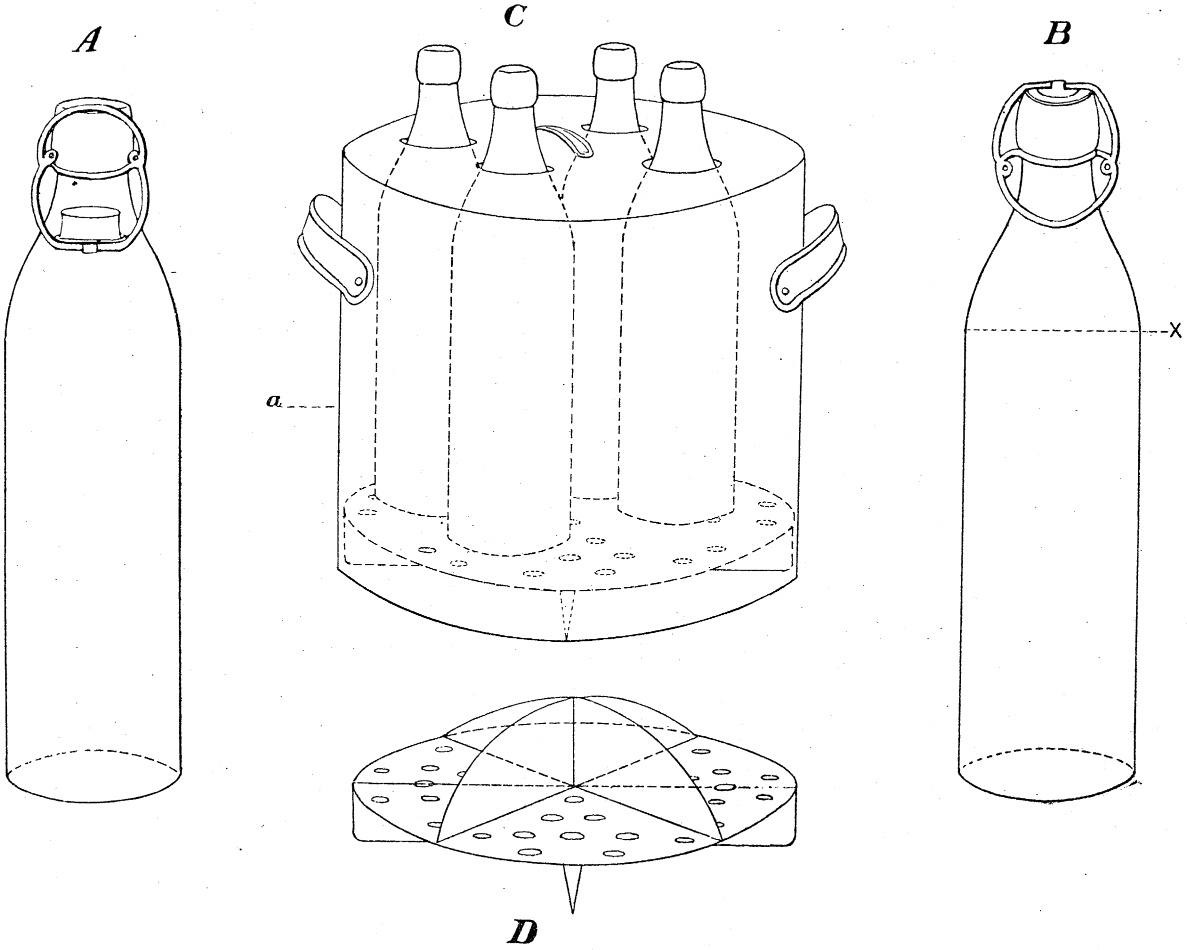
DESCRIPTION OF STERILIZER.

Figure C represents the sterilizing vessel, made of tin, copper or galvanized iron, with the milk or water bottles in position. This vessel, for 4 to 6 bottles, is 9 inches in diameter, and 9 to 12 inches high. The lid has 4 to 6 openings (according to the number of bottles) which are 1½ to 2 inches in diameter. Resting on the flat, true bottom is a false, loose bottom that is raised 1 inch above the true bottom by two strips standing on their edges, running at right angles to each other, and firmly soldered to the inferior surface of the false bottom. This bottom (see figure D) is perforated by several openings, one-half inch in diameter. It, also, has its upper surface divided into as many parts as there are bottles, by pieces that are two to three inches high at the center with their free borders gradually curving towards the circumferance of the false bottom.

The bottles, C and D, with a capacity of ½ pint to 1 pint, are made of heavy thick glass, and are hermetically (air tight) sealed by a rubber stopper, held in position by wires. This stopper is called the "lightning stopper" and is patented. Cork stoppers may be used, but must be held in place by wires or strong cords. The cork should fit tightly and be well secured.

After thoroughly cleansing the bottles, they are filled with milk, not higher than x, figure B. They are now closed and placed in the sterilizing vessel; cold water is poured into the vessel until it rises one-fourth of an inch above the false bottom. The sterilizer is then placed on an oil, a gasoline or a cook stove, and heated until the water in the vessel boils eight to fifteen minutes. As a rule, 11 minutes boiling is sufficient. But should the water in the vessel be heated very rapidly, let it boil 15 minutes. If, however, the water comes to a boil slowly, say 30 minutes after being put upon the stove, allow it to boil 8 to 10 minutes. The vessel must then be taken from the stove, covered with dry cloths, and allowed to stand thus for 30 to 40 minutes. After cooling, the bottles may be put on ice or kept in cool water, and the milk will remain sweet for 24 hours or longer.

The temperature of the milk, under the above conditions, rises to not lower than 150 degrees or higher than 167 degrees, F. According to the best bacteriologists, nearly all growing and adult microbes are killed if heated to 140 de-


A
C
B
a
X
D

grees, F. But physiologists claim that when milk is heated 167 degrees, F., it undergoes a chemical change that impairs its digestibility and nutritive value. By heating milk higher than 167 degrees, F., its starch dissolving ferment is destroyed; a part of the albumin is coagulated, and the caseine will not readily coagulate in the presence of rennet. By prolonged heating of milk at a high temperature, the fat globules separate from the milk and this is said to interfere with the assimilation of the fat. Prolonged heating at a high temperature is said to destroy the milk sugar. But according to the bacteriologists and physiologists, heating milk to 140–167 degrees, F., will kill the adult forms of all kinds of germs, preserve the milk and render it more healthful, without impairing its value, in any way as a food. These comparatively low temperatures will not destroy the spores of many decomposition (septic) germs; consequently the milk "sours" in the course of 24 hours, or as soon as the spores develop into adult microbes. According to Fraenkel, heating cholera bacilli to 122 degrees, typhoid bacilli to 140 degrees, or tubercle bacilli to 158 degrees, F., will destroy them in a short time; this is especially true if the bacilli are in such liquids as milk or water when heated. Furthermore, it is almost absolutely certain that none of these three germs form spores.

If one should desire to keep the milk indefinitely, it must be heated as above directed for three consecutive days. To raise the temperature of the milk to 185 degrees, varying from that up to 205 degrees, F., fill the vessel, C, with cold water, one-third to one-half as high as the level of the milk in the bottles; then boil the water in the vessel 20 to 40 minutes, usually 30 minutes is sufficient to preserve the milk 2 to 4 days, Repeat the process the next day and the milk may be preserved indefinitely. I prefer this method to the preceeding for sterilizing milk in the summer.

To raise the milk or water in the bottles to 206 or 212 degrees, F., fill the sterilizing vessel with cold water as high as the level of the milk or water in the bottles, cover the vessel with a non-perforated lid, or cover the perforated lid with cloths; then allow the water in the vessel to boil 30 to 60 minutes. This will usually keep the milk sweet as long as the bottles are kept closed. During the hot part of last summer I kept milk that had been so sterilized for 6 weeks, and the bottles stood in a window where the sun could shine on them part of the day. As a rule, on account of reasons previously stated, it is not good to sterilize milk at such a high temperature. But drinking water should always be sterilized by this method.

If milk is acid in reaction (slightly sour) before sterilization it will coagulate after sterilization, although it may be free of germs. Sometimes the milk is acid when it comes from the udder and this is said to be due to improper feeding of the cow. In order to determine if the milk is appreciably acid before sterilization, put a small strip of blue litmus paper into the milk; if it turns red the milk is acid, but if this produces no change in the blue paper the milk is neutral or alkaline. If the milk is slightly acid it may be made neutral or slightly alkaline by the addition of a sufficient quantity of a saturated solution of bicarbonate of potassium, or common baking soda, to make the red litmus paper turn blue. This may be done without injuring the milk, if practiced with care.

In sterilizing water, always heat it to 212 degrees, F., for 30 to 60 minutes. After the water in the sterilizing vessel has become partially cooled, the bottles may be placed on ice, put in cold water or transferred to a bucket that may be hung in the well.

The only practical method of using the thermometer, when sterilizing milk, is the one suggested by the Bureau of Animal Industry. It is adjusted in the lid so that the bulb is immersed in the water of the vessel. The vessel is filled with water as high as the level of the milk in the bottles. When the water reaches the desired temperature (160 to 167 degrees, F.,) the vessel is removed from the fire, covered with cloths and allowed to stand 30 to 40 minutes.

CAUTIONS.

Always scrupulously clean the bottles before using. Coarse sand or a bottle brush will remove the dry milk from the inner surface of the bottle. It is best to fill the bottles with water immediately after using the milk.

Never fill the bottles higher than indicated in figure B.

Always keep the bottles closed air tight during and after sterilizing. Never pour cold water into the sterilizer after the water in the sterilizer has commenced to boil.

Never take the bottles from the vessel when they are hot; because cold air or cold water will break them.

Never put cold bottles into boiling water.

A MILK DEALER'S STERILIZER.

This process of sterilization in closed bottles may be employed by dairymen.

A large sterilizing pan could be made after the pattern of a syrup or a sorghum evaporating pan. It may be from 6 to 10 feet long, 2 to 4 feet wide, and 12 to 15 inches deep. The bottom should be made of copper and the sides of plank. The false bottom should be constructed lattice-or slat-like, of wood strips. The bottles should have a capacity of one quart. A tight fitting lid could be constructed of wood, having but one opening, in which a thermometer may be inserted. A heating furnace, something like the one used in evaporating sorghum or cane juice, may be employed, but arranged to suit the different conditions.

After filling the bottles as previously directed, and placing them in the sterilizing pan, it may be filled with cold water as high as the level of the milk in the bottles. Now heat the water to 160 degrees, F., or higher if desired; the temperature will be indicated by the thermometer extending through the lid down into the water. When the water reaches the desired temperature the sterilizing pan, resting on rollers, may be rolled to one side, upon a platform as high as the furnace, and there left undisturbed for 30 to 40 minutes. It is important that the sterilizer remain covered for 30 to 40 minutes after removing it from the fire ; because the milk in the bottles will not reach the same temperature as the water in the sterilizing pan, until 5 or 10 minutes after removal from the fire. When the bottles have partially cooled they may be removed to the ice chest, or to cooling pans. Crates, similar to those used by pop and beer venders, may be employed in delivering the milk.

I claim to have originated this process of sterilizing milk or water in hermetically sealed bottles.

Milk sterilized by this process may be heated to a higher temperature than in open vessels without changing its chemical composition, or interfering with its taste, digestibility or nutritive value.

This closed bottle process is not exposed to infection after sterilization.

As a water sterilizer it does not change the taste of the water ; it leaves the water just as palatable as it was before sterilization. Furthermore, the sterilizer is cheap and may be used by any cook or nurse after a little instruction.

I believe it can be successfully and effectually used by dairymen.

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TOBACCO.

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R. L. Bivins	Clerk, and Assistant Botanist.
T. U. Culver	Superintendent of Farm.

TOBACCO EXPERIMENT.

I.

OBJECT OF EXPERIMENT.

Experiments in Tobacco, which were commenced on the Station in 1892, and were reported in Bulletin No. 44, were continued the past year with seed from several varieties raised in Virginia, purchased from R. L. Ragland & Co. Hyco, Va., who are raisers of tobacco seed, to supply the agricultural department at Washington, D. C. Seed were also used of the Connecticut Seed Leaf and Havana, furnished by the agricultural department at Washington. Seed furnished by the Florida Agricultural Experiment Station, and seeds procured from Meguiar, Harris & Co., Louisville, Ky., of the Burley tobacco.

These experiments were undertaken to ascertain the kinds of tobacco that seemed best adapted to this climate and soil.

Experiment Station work, conducted in a general way, was more with reference to the growth of the different varieties planted, their qualities, and methods of curing, than to the particulars of fertilizers suitable to the crop in this climate and on this soil.

Methods of raising the plants. These Experiments were commenced on the twenty-sixth of January, and at that time preparation was begun for raising the plants in the Phytopathological, or plant laboratory, in open air beds burnt in the woods and in a hot bed covered with cheese cloth. A brief account of the method followed in each case will be given.

[a] *Phytopathological laboratory.* Rich wood mould, free

from grass seed, was well fertilized with equal parts of nitrate of soda, acid phosphate and kainit. This was placed in boxes to the depth of six inches, the seed were carefully planted in rows a few inches apart, labeled and the soil kept moist by sprinkling late in the evenings when necessary. Very few plants came up from this process. Those that did reach the surface soon died. There are two rational causes for accounting for the failure of these seeds to germinate and grow. The first is, owing to the extreme heat in the Phytopathological, or plant laboratory, which was covered with glass and not protected with awning at that time, thereby destroying the vitality of the seeds. The second cause is, that the boxes containing the mixture of soil and fertilizer were so small that the proportion of fertilizer may have been too large for the quantity of soil used, and hence in this concentrated or caustic form the germinating power of the small seeds was destroyed.

There were two other sowings of the seed in this laboratory, viz : February 28th, and March 29th, with the same results as with the first sowing.

[b] *The woods bed.* This bed was prepared on January 27th, after the plan practiced in the old tobacco States, by burning the ground and then getting the bed in a fine pulverized condition with hoes and rakes. The bed was fertilized after the same method as before mentioned, and the seeds were sown and covered with a light covering of pine straw. These did well, and by the first warm days of March there was an abundance of young plants in sight ; yet notwithstanding the covering of pine straw, some were killed by freezing weather, but enough left for use.

About the twentieth of March it was discovered that the flea beetle, which seems as abundant in Alabama as in the old tobacco States, had commenced to attack the young plants, and then by liberal manuring the plants began to grow rapidly, and soon became sufficiently strong to resist the ravages of this pernicious insect, and although they were later than those raised under canvass, yet many good plants were gotten from this bed for replanting the experimental grounds.

From experiments made in raising plants in open beds, we find that they are liable to be destroyed by the flea beetle and other insects; and as a remedy, I would advise spraying the bed with one ounce of Paris Green, mixed with fifteen or twenty gallons of weak soap suds. This same application can also be used after the plants reach the surface. Pyrethum, commonly called insect powder, can be used in the place of Paris Green, either dry or mixed with water, but it is not considered so effective as Paris Green, and besides it is costlier, and more difficult to procure unadulterated.

(c) *Covered Bed.* This bed was prepared on the 4th of February, by making a frame 8 by 16 feet, cased-in with inch plank one and a half feet high on the north side, and one foot high on the south side. The method of fertilizing was the same as that followed with the two before-mentioned beds, seeds being sown in drills a few inches apart. The bed was then covered with cheese cloth sewn together to make a close covering to keep in as much heat as possible and then fastened to the planks with tacks. The bed being near a hydrant, was kept watered with a spraying hose. The plants came up well and grew rapidly, and from this bed most of the plants were gotten for the experiments.

II.

PREPARING FOR PLANTING.

The land upon which these experiments were conducted was bottom branch land, and poor sandy upland. The bottom land, which was in cotton the year before, was the first that was prepared, by breaking it well with a turning plow on April the third, and equal parts of cotton seed meal, kainit and acid phosphate were applied broadcast, at the rate of one thousand pounds per acre, and plowed in with a scooter.

Each plot of two rows each contained one-forty-second of an acre. The rows were laid off with a shovel plow, three pounds of nitrate of soda, six pounds of kainit, and six of acid phosphate mixed, were applied in the shovel furrow, then bedded with Dixie plow and the beds harrowed. Rows were then run cross, three and one-half feet wide, and plants set in checks. April the twentieth the planting commenced, using plants from the canvas bed. April twenty-fifth and May second, all missing hills were replanted, and no more replanting was done on this ground after that time.

The land on which this experiment was made, was sandy and of moderate fertility. A succession of crops, principally cotton, had been grown on it for many years.

The following table shows the results of yield from land known as branch bottom sandy soil. The plants were set in checks 3½ feet each way:

Plot No.	Names of Varieties.	Pounds yield per acre green Tobacco.	Pounds yield per acre cured Tobacco.	Type.
1	Comstock Spanish.............	6888.0	1029 0	Cigar.
2	Connecticut Seed Leaf.........	9681.0	1268.4	"
4	Havana Seed Leaf............	5607.0	852.6	"
8	Vuelta de Abajo...............	7014.0	1436 4	"
13	Pure Havana..................	4179.0	814 8	"

Plot No.	Names of Varieties.	Pounds yield per acre green Tobacco.	Pounds yield per acre cured Tobacco.	Type.
3	Conqueror....................	5901.0	1163.4	Plug
5	Hester........................	8366.4	1192.8	"
6	Hyco..........................	8484.0	1247.4	"
7	Long Leaf Gooch...............	6699.0	1159.2	"
9	Yellow Orinoco................	6913.2	1310.4	"
10	White Stem Orinoco...........	7719.6	1104.6	"
11	Burley.......................	5985.0	1176.0	"
12	Gold Finder..................	3746.4	688.8	"
14	Yellow Pryor.................	3234.0	575.4	"

The soil on which the second experiment was made, is upland and known as white sandy soil, very poor without the aid of fertilizers. On this the plants were set, three feet apart on rows three feet wide.

The first application of manure was in shovel furrows laid off three feet apart, stable manure at the rate of five thousand pounds per acre was applied in the drill, then, in the same furrow, at the rate of five hundred pounds per acre, the following fertilizers in this proportion: sixty-six pounds sulphate of ammonia, sixty-six pounds nitrate of soda and two hundred pounds acid phosphate. A scooter furrow was then run in this fertilized furrow, mixing the fertilizer and soil, it was then bedded with the Dixie plow.

The table on next page shows the yield from light sandy soil upland. Rows were three feet apart and plants were set three feet apart:

Plot No.	Names of Varieties.	Pounds yield yer acre green Tobacco.	Pounds yield per acre cured Tobacco.	Type.
1	Comstock Spanish	5382.0	1242.8	Cigar.
2	Connecticut Seed Leaf	5304.0	1505.4	"
4	Havana Seed Leaf	3796.0	881.4	"
8	Vuelta de Abajo	1495.0	439.4	"
13	Pure Havana	*	452.4	"

Plot No.	Names of Varieties.	Pounds yield per acre green Tobacco.	Pounds yield per acre cured Tobacco.	Type.
3	Conqueror	8114.6	1645.8	Plug
5	Hester	7124.0	998.4	"
6	Hyco	8073.0	1591.2	"
7	Long Leaf Gooch	6877.0	1294.8	"
9	Yellow Orinoco	6848.4	1744.6	"
10	White Stem Orinoco	7228.0	1271.4	"
11	Burley	8769.8	1235.0	"
12	Gold Finder	4308.2	720.2	"
14	Yellow Pryor	4630.6	860.6	"

*Green weights of this variety were misplaced and consequently can not be given.

Cultivation. The cultivation was shallow throughout, being done with Terrell heel scrape ; on the bottom land the plowing was done both ways, which reduced the expense, as the hoe was not much used.

Harvesting and Curing. The gathering of the crop commenced July the seventeenth, and was continued for every eight or ten days thereafter until the entire crop was gathered, as it required that length of time to make a curing, to bring the tobacco in order, to take it down out of the house and bulk it. The curing was done in a modern tobacco barn, with heating apparatus, as was shown by illustrations in bulletin No. 44, May 1893.

The following is the method of curing that was followed :

CURING TOBACCO.

—FOR YELLOWING OR SWEATING—

Temperature of Barn before firing Stoves, 86 degrees.

July 19, 10 o. c., a. m. Fire started and thermometer kept on average of 90 degrees until 12 o. c. that night. From 12 o. c. at night (July 19th) to

July 20, 9 o. c. An average heat of 95 degrees. All openings, ventilators, &c. closed, temperature not rising much over the average, Twenty-three hours now since fire begun; tobacco yellowed, which is earlier than the rule, thirty hours being usually required to yellow.

SETTING THE COLOR.

July 20, 9 o. c., a. m. Opened ventilators over the Stoves, made two openings in conduits next to door on either side, and half of ventilator on top of Barn. Temperature raised to 100 degrees.

July	20,	10 a. m.	"	"	"	105	"
"	"	11 "	"	"	"	110	"
"	"	3 p. m.	"	"	"	115	"
"	"	6 "	"	lowered	"	110	"
"	21	3 a. m.	"	raised	"	115	"
"	"	6 "	"	"	"	120	"
"	"	9 "	"	"	"	125	"
"	"	3 p. m.	"	"	"	130	"
"	"	9 "	"	"	"	135	"

CURING TOBACCO, JULY 31, 1893.

Monday, July 31st. Gathered 4 varieties of tobacco and put in Barn and started fire about 3 o. c., p. m. Thermometer raised to 90 degrees and kept at this heat until

Wednesday, Aug. 2nd, 3 o. c., p. m., when temperature was raised to 95 and 100 degrees, using about 4 barrels water in sprinkling floor to prevent drying too rapidly.

Thursday, Aug. 3rd, temperature raised to 130 to 140 degrees; tobacco drying as fast as possible.

Saturday, Aug. 5th, finished drying and wet basement.

Monday, Aug. 7th, took down tobacco and packed away in barn.

Bulking. The tobacco was taken down out of the curing barn as soon as it was cured, and bulked down in the new Agricultural Laboratory, so as to have use of the curing house for more tobacco. In curing tobacco by artificial heat, this barn is an economical method. By commencing to take off the leaves, say the middle of July that are ripe, and continuing to gather the leaves as they ripen until all of the crop is gathered, in this climate with frost delayed until November, as much as eight or ten thousand pounds of tobacco can be cured in a tobacco barn sixteen by twenty feet, from the middle of July to the first of November. Another important advantage in curing by this process is, that a larger per cent. of bright tobacco can be obtained than by curing with open fires.

The tobacco, as it was taken down from the curing house, was in as dry condition as it could be handled without breaking. Unless the stems were thoroughly cured, it would be unsafe to place tobacco in bulk from the curing house as early as was done in this experiment. As all of the tobacco that was cured by this process was thoroughly cured before it was taken from the curing house for bulking in the Agricultural Laboratory, it went through a moderate sweating process, and was found to be all sound and sweet when the bulks were opened about the first of December for assorting and binding into hands.

Assorting. The tobacco was assorted and classified according to the color and quality.

In assorting, three grades were made ; *first quality*, which consisted of the largest and best quality of leaf ; *second quality*, leaves of smaller size than the first, and *third quality*, or lugs, which were composed of the lowest grade, usually the leaves grown nearest the ground.

After the different qualities were assorted, they were tied in bundles or hands, a thin pliant leaf being used to make the tie. From seven to ten leaves of the best quality were sufficient to make a bundle of a convenient size for handling, from eight to twelve leaves of the second quality were placed in a bundle, and from ten to fourteen of the third quality.

III.

CLASSIFICATION AND VALUATION.

With the view of ascertaining the quality and value of the tobacco raised on the Station, samples of the different varieties were sent for examination to dealers in New York, Richmond, and Danville, Va., Florence, S. C. and New Orleans, La.

At the time of writing this bulletin, reports have been received from the following. As these reports may be of interest to the farmers of this State, and the South, who are interested in this new industry, the essential part of the different reports are given :

REPORT OF H. T. DUFFIELD.

The first report received was from Mr. H. T. Duffield, of the Tobacco Leaf Publishing Co., New York, enclosing the classification of Mr. Wallace, an experienced "judge of tobacco." Mr. Duffield wrote, "the samples you sent are very much like the tobacco grown in the celebrated Owensboro district in Kentucky, this is the opinion of Mr. Wallace ; he is a fine judge and never says anything except what he thinks. Mr. Wallace was formerly a member of the firm of Sawyer, Wallace & Co. I have known that house to make one sale of tobacco which amounted to about one million and a half of dollars. I have taken great pleasure in showing the samples, for I am a native of Mississippi, and was reared in Kentucky, and am always glad to do what I can to assist the brethren down South."

OPINION OF MR. WALLACE.

Yellow Pryor. This perhaps is the most serviceable tobacco of the lot. Sample in good condition, shows a very good leaf indeed. If the leaf were a little longer it would be better.

Hester. Brighter than the preceding ; better color than it, rather short.

Conqueror. A very nice long leaf ; well cured, long enough to be of use to the manufacturers.

Gold Finder. Good brown color ; some good leaf and some too thin and papery.

White Stem Orinoco. Green color, with a few leaves of good color, quality uneven.

Long Leaf Gooch. Would never pay to grow, except for the very lowest grades.

Burley. Too green and slazy. If it cannot be grown of better color and more body, it had better be left alone.

Yellow Orinoco. No comparison with the other light colored samples; not nearly so yellow and more green, lifeless.

First Quality Brown. Much larger leaf than second quality brown ; a little slazy, color comes more from the growth than from curing. Samples rougher than number two ; good body; a good shipping leaf for England ; delicious flavor.

Second Quality Brown. Some remarkably good leaf in the sample ; rather short—too short for stripping purposes.

First Quality Bright. Shows a very good leaf; well cured; nice small stems.

Second Quality Bright. Shows considerable green and too short to do anything with, except for granulating purposes.

The samples of plug manufacturing leaf, clearly show that the soil and climate are well adapted to the growing of this class of tobacco profitably.

The tobacco, as a rule is too short measuring, that is, the longest sample twenty-one to twenty-two inches, when it should be from twenty-two to twenty-five.

The best varieties are Conqueror, Yellow Prior, and First Quality Brown, in the order named. When compared with the rest, Conqueror seems to justify its name.

Your bright tobaccos are worth just what a man fancies. Some fancy bright wrappers bring fifty cents per pound, while the very commonest bright will fetch six cents or so, on the market now.

REPORT OF MR. FRANK M. ROGERS, FLORENCE, S. C.

I feel sure that the development of the culture of bright tobacco in your State will add materially to the prosperity of the farmers when they give it proper and careful attention.

The industry in this section has become quite a prominent feature in our agriculture, and to those of our farmers who are industrious and attentive, tobacco has proven one of the best paying crops introduced.

There is great prejudice in all the markets of North Carolina and Virginia against all new sections.

They tried in every way to discourage and kill-out the business in this State at first, by paying very low prices for our products; the same prejudice still remains. Owing to our soil, climate and length of season, we can far surpass States north of us in quality of leaf, production per acre and cost of production. They fully realize this, and should the industry spread through two or three of our Southern States, they would practically be unable to compete.

The following is the valuation of the samples, as far as made by Mr. Rogers;

Number one is worth from eight to nine cents per pound.

Number two is worth from seven to eight cents per pound.

Number three is worth from five to six cents per pound.

REPORT OF DIBRELL BROTHERS, DANVILLE, VA.

We have examined the samples carefully, and have put the following valuations on them:

First Quality Brown,	we value at	4	cents.
Second " "	" " "	4½	"
First Quality Bright,	" " "	10	"
Second " "	" " "	8	"
White Stem Orinoco,	" " "	4	"
Burley,	" " "	6⅓	"
Gold Finder,	" " "	4½	"
Hester,	" " "	6½	"
Hyco,	" " "	8	"
Yellow Orinoco,	" " "	4½	"
Yellow Pryor,	" " "	7	"
Conqueror,	" " "	9	"
Long Leaf Gooch,	" " "	5	"

We think the Hyco and Conqueror are of better quality and more decided character than any of the others.

REPORT OF S. P. CARR, RICHMOND, VA.

I have carefully examined the samples of tobacco you sent. You have a fine field for the dark tobaccos and a fighting chance with our North Carolina bright varieties, owing to your soil being of similar quality to the North Carolina best tobacco soils.

I think you have at least thirty per cent. advantage in culture—certainly ten per cent. in length of seasons and sunshine, and twenty per cent. in the advantage of a curing season, for unless you are forced to cut through an abnormally wet season, there is no reason why you cannot always have a select time for cutting and curing, which rarely happens in our latitude. In short, we have six weeks margin to cut and cure our tobacco, and you have ten weeks certain.

There was a time in our tobacco industry, dating only a few years back, that no part of our country could raise tobacco worth anything, but North Carolina and Virginia, the home of its first commercial culture; but it has been fully demonstrated that this is a mistake. It is in your power to make the very best type of cigar filler, binder and wrapper, and in these grades you will have a world-wide outlet.

Below find description and comments on your types.

Gold Finder. Coarse leaf, worth eleven to twelve cents per pound.

Conqueror. Very good quality, worth twelve to fourteen cents per pound.

Comstock Spanish. A fair cigar filler, not large enough for wrappers; some of it large enough for binders.

Havana Seed Leaf. Very good binder and common filler, but the laterals or veins too coarse for perfect combustion.

Connecticut Seed Leaf. Too heavy for wrapper, will make fair filler and possibly a binder.

Vuelta de Abajo. A very good filler, but a fraction too rich in body for a mild smoke.

Pure Havana. The best of all the cigar types, only needs a little to make it perfect for wrapper, binder and filler. This is the kind to direct your energies to; you can supplant the genuine Havana in this country, if you will direct your attention to this kind.

Hester. Leaf and texture all right.

Yellow Pryor. Good body, and texture all right.

White Stem Orinoco. Very fair goods.

Long Leaf Gooch. Fair stemmer for the English market.

Yellow Orinoco. A good stemmer for English export, but rather coarse.

Burley. Fair quality, worth from eight to ten cents per pound.

IV.

FACTS FROM STATISTICS OF THE U. S. DEPARTMENT OF AGRICULTURE.

From the report of the U. S. Department of Agriculture on the crops for the year 1893, the estimate placed on the crop of tobacco raised in sixteen States, all that are reported as having raised tobacco, is 483,023,963 pounds from 702.952 acres, and valued at $39,155.442. This will give an average of $55.70.1 per acre for the sixteen States that cultivated tobacco in 1893. The last estimate made by the Department of Agriculture of the acreage, production and valuation of tobacco, prior to those given above, appeared in the annual report of the Department for 1889, being the estimate of the crop for 1888. The acreage as estimated for 1888 was 747,326, producing 565,795,000 pounds of tobacco, at a total value of $43,666.665. The crop the following year, 1889, was returned by the U. S. Census at 488,255,896 pounds, the product of 692,990 acres, with a total valuation of $34, 844.449.

From a comparison of the estimates of 1888 with the Census figures of 1889, it would seem that the former were considerably too high. These discrepancies have been eliminated in the Department Report for the year 1893. The figures of acreage for the whole, vary little from year to year, there being an increase of about 10,000 acres over the Census figures. The yield, on the contrary, varies greatly; and for 1893 was below the average. This is shown by the total production being 5,000,000 pounds less than for the Census year, despite the increased acreage. The average yield of tobacco for the year 1893 in the sixteen tobacco States amounted to 687 pounds per acre.

The final estimates of the average farm price of tobacco, December 1st, 1893, for the sixteen States that produced tobacco, are as follows:

Massachusetts,	16.0	cents	per	pound,
Connecticut,	14.0	"	"	"
New York,	15.2	"	"	"
Pennsylvania,	13.5	"	"	"
Maryland,	7.6	"	"	"
Virginia,	6.2	"	"	"
North Carolina,	8.0	"	"	"
Arkansas,	10.0	"	"	"
Tennessee,	8.8	"	"	"
West Virginia,	10.2	"	"	"
Kentucky,	7.6	"	"	"
Ohio,	6.5	"	"	"
Indiana,	7.3	"	"	"
Illinois,	7.0	"	"	"
Wisconsin,	6.3	"	"	"
Missouri,	7.6	"	"	"

This report makes no allusion to tobacco raised in the Southern States. It is well known that Florida and Southern Georgia produce good cigar tobacco, and South Carolina good plug and smoking, and all of these States have tobacco manufactories for cigars, plug and smoking tobacco.

The report of the government for cotton for the year 1893 for acreage and yield is not at hand, only the prices of the staple from eleven States that cultivated cotton are given. From the report of 1888, which gave the essential features of the cotton crop for that year, it appears that the average yield per acre for cotton that year, for all the cotton States, was one hundred and eighty pounds, and the average price at that time was eight and one half cents per pound, which would amount to fifteen dollars and thirty cents per acre. Since that time the average production may not have decreased, but it is certain that the price of the staple has declined, and it is reasonable to conclude from the following table that the farmers in the cotton States did not average gross, over $ 12.61 per acre for their cotton, for the year 1893.

The average farm price for cotton for 1893, in the eleven States that raised cotton, is as follows :

Virginia,	7.1	cents	per	pound.
North Carolina,	7.2	"	"	"
South Carolina,	7.1	"	"	"
Georgia,	7.3	"	"	"
Florida,	7.3	"	"	"
Alabama,	7.0	"	"	"
Mississippi,	7.0	"	"	"
Louisiana,	7.0	"	"	"
Texas,	6.9	"	"	"
Arkansas,	6.8	"	"	"
Tennessee,	6.5	"	"	"

As far as Experiments have progressed on the Station, the indications are that tobacco, of good quality, particularly for manufacturing plug, for pipe smoking and cigarettes, and possibly for cigars, can be raised in this part of Alabama at a profit. From samples sent to the Station for examination, from different parts of the State, it is fair to conclude that in that portion of the State bordering on the Gulf coast, that tobacco of good quality, fine flavor for wrappers, binders and fillers for cigars, can be produced. Some of this kind was received this season from Dr. John Gordon, Healing Springs, Washington county, which apparently possessed all the requisite qualities for making cigars of excellent quality, after being put through the proper process. Samples of tobacco were also received from Mr. Z. T. Stroud, Aberfoil, Bullock county. These samples were in a badly damaged condition, owing to the fact that they were very wet. After the samples were dried-out, they were examined and found to be a leaf of good size and color—good flavor in smoking, free from pungency, a decided cigar flavor, burning well and leaving a pearl ash.

Some good samples were received from Mr. R. D. Martin, Florence, Ala., suitable for making plug and smoking. The variety which Mr. Martin calls the Brazil Gold Leaf, has been grown by him for several years, and he writes that he has sold all he has for sale at thirty cents per pound. He reports that he has gotten three crops a year from this variety on the same ground, by planting early.

One of the most important things to be done to make the tobacco industry a success in this State, is the establishment of home manufactories. The freight charges on tobacco from Auburn to Florence, S. C., or Danville, Va., are $1.05 per 100 pounds, which reduces the profit too much in this age of sharp competition.

The cotton crop of this State brings annually $30,000,000 to $35,000,000, and from the best information that has been gotten, as much as one-fourth or one-fifth of the amount that the cotton crop sells for is spent in tobacco raised in other States. If our own people raised and manufactured enough tobacco for their own consumption, a large amount of money that is now sent out of our State annually for an article that we could produce at home, would be kept in our own State.

The Station saved seed from last years crop of all of the varieties planted, and will distribute a limited quantity to the farmers of the State on application.

Bulletin No. 55, : : April, 1894.

Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

A NEW DISEASE OF COTTON.

COTTON BOLL-ROT.

J. M. STEDMAN, BIOLOGIST.

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☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala. All communications should be addressed to

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ASSISTANTS:

COTTON-BOLL ROT.

A NEW BACTERIAL DISEASE OF COTTON AFFECTING THE SEEDS, LINT AND BOLLS.

BY J. M. STEDMAN.

During the middle of August, 1893, I received from the Department of Agriculture, Montgomery, Ala., some samples of cotton-bolls supposed to be suffering from the attack of insects. The cotton-bolls were accompanied by a note stating that they had been received from Mr. A. W. Bryant, Stockton, Baldwin county, Alabama, and asked for the name and habits of the insect affecting them, and for the remedies to be used to combat or destroy the same. On the 13th of September, I received a box of diseased cotton-bolls from Mr. W. A. Bryant himself.

A short examination of the bolls and of the numerous insects in them was sufficient to convince me of the fact that the insects were not the direct cause of the disease, but that on the contrary, they were present in order to eat of the already dead and decaying vegetable matter. The insects were Coleoptera (beetles) of the family Nitidulidæ (Sap-suckers), and were present in all stages of development. The larvæ, one of which is represented in figure 7, and the adult beetles, represented in figure 5 and 6, were very numerous, while their pupæ were not uncommon. The larvæ are about one-fourth of an inch in length and are nearly white in color. Figure 7 represents one magnified about five diameters.

A closer examination revealed the presence of two species of adult beetles both of which are about one-eighth of an inch long. Figure 5 represents one of these sap-beetles, *Epuræa æstiva*, magnified six diameters, while figure 6 shows the other species, *Carpophilus mutilatus*, equally magnified. Both of these beetles are well known among fruit growers in the Southern States, Mexico, and Central and South America. They are widely distributed throughout the south, feeding both in the larval and adult condition upon decaying or injured fruit of all kinds, and are sometimes found sucking the sap from wounded portions of trees. They are common in cotton-bolls that have been injured by the boll-worm, and in decaying heaps of cotton seed. Neither the adult beetles nor the larvæ are known to eat or attack healthy fruit or living vegetable tissue. The presence of these insects, then, in the diseased and decaying cotton-bolls is not surprising, and their presence can have at least only a secondary connection with the true disease in that they may, by their burrows cause, perhaps, a more rapid spreading of the disease.

Neither the beetles nor their larvæ were to be found in all the disease cotton-bolls, but only in such as were greatly damaged by the disease having spread so as to involve nearly the entire contents of the boll and to have caused the tips of the corpels to open slightly. In such bolls I also observed several species of ordinary saprophytic fungi, and in a few cases the fungus, *Colletotrichum Gossypii*, Southworth, that produces the disease in cotton-bolls known as anthracnose.* But no fungi were observed in the bolls that were only slightly diseased or decayed inside.

The presence of fungi and insects in those cotton-bolls only that were greatly diseased and decayed inside, and that had either the tips of the carpels opened or the disease had spread so as to involve a portion of the outer surface of the bolls, together with the entire absence of insects and fungi in all cases where the disease was confined to the contents of the boll, led me to suspect the bacterial nature of the disease in question. Accordingly, pure cultures of the bacteria from the disease inside the closed cotton-bolls were then made by the usual plate culture method, and the inoculations made in both tubes of nutrient gelatine and of agar-

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*See Bull. No. 41, On Some Diseases of Cotton, by G. F. Atkinson, p. 40.

agar by means of a sterilized platinum needle. In four days the growth of the bacteria in the gelatine tubes had become very profuse, and had clouded the entire mass of gelatine, giving it a slight greenish hue. The growth of the bacteria in the agar-agar tubes was different. Here the bacteria spread out as a milky cloud around the entire length of the path of the inoculating needle through the agar, and also over the surface of the agar as a more or less white, semi-transparent and glossy growth. See figure 3, which represents the growth as it appears in agar-agar tubes.

That this difference in the growth of the bacteria in the agar-agar and gelatine tubes was not due to a difference in the kind of bacteria in each was proven by the numerous cross inoculations that were made. Fresh agar-agar tubes were inoculated with the bacteria from a gelatine tube culture, and fresh gelatine tubes inoculated with the bacteria from an agar-agar tube culture, in all cases by means of a sterilized platinum needle; and in no case was there any signs of a deviation in the method of growth or apperance of the cultures peculiar to either the agar or to the gelatine as above stated.

In order to determine whether or not the bacteria of which I had made pure cultures were the cause of the disease in the cotton-bolls, I selected ten healthy cotton plants, and with a sterilized needle, I made two punctures into four healthy cotton-bolls on each of the plants, numbers 1, 3, 5, 7, 9, and labeled each boll. Then by means of the same needle, sterilized and then infected with the bacteria from the pure tube culture, I made two punctures into four healthy cotton-bolls on each of the plants, numbers 2, 4, 6, 8, 10, and labeled each boll. In twelve days all the cotton-bolls inoculated with the bacteria from the tube cultures had taken the disease in varying degrees, and in twenty days they were entirely destroyed; the entire contents of the bolls having rotted, and the outer surface to a more or less extent. On the contrary, the four bolls used as a control experiment on each of the other five plants were perfectly healthy and showed no signs of a disease, except one that had been attacked by a fungus at the place where the needle had caused an injury, thus enabling the fungus to develop there; but this boll was not affected with the disease in question.

Hence it is demonstrated that this specific bacterium was and is the cause of the disease in question.

From one of the original bolls some diseased tissue including seed was hardened in increasing strengths of alcohol, infiltrated with paraffine in the usual manner, cut into sections which were fastened to the slide by clove-oil-collodion, stained with gentian violet or with carbofuchsin, and mounted in balsam. On examination with a high power (1-24 inch Hom. Imm. Obj. of Winkel) of the microscope, most of the cells in the diseased region of the tissues were found to contain bacteria in abundance. Figure 4 represents a portion of a section of such a tissue as seen under the microscope, and is magnified 800 diameters.

Several cover-glass preparations from the pure cultures of bacteria in both agar-agar and gelatine were made and stained with either gentian violet or with carbafuchsin, and examined with the 1-24 inch Hom. Imm. The appearance of these bacteria as seen under such a high power of the microscope is shown in figure 1, which represents them as magnified 1500 diameters. When magnified equally, the bacteria in the sections of diseased tissue will be seen to be identical in appearance with those from the culture tubes.

Not being able to identify this species of bacteria with any heretofore described, I have named it

BACILLUS GOSSYPINA.

Obtained by Stedman (1893) from the inside of diseased cotton-bolls suffering from a rot of the seed and lint.

Morphology.—Short, straight bacilli, truncate with slightly rounded corners, 1.5 micron long and 0.75 micron broad; usually solitary, sometimes in pairs, and occasionally in chains of from three to four.

Stains readily with the usual aniline colors.

Biological characters.—An aërobic, non liquefying (slight liquefaction in old gelatine cultures), motile bacillus. Forms spores. Grows at the room temperature in the usual culture media, but more rapidly at 25° to 35° C. In gelatine tube cultures, the growth in three days gives a milky appearance, which spreads from the line of puncture of the inoculating needle, until in five days the entire gelatine becomes milky and assumes a slight greenish color. In agar-agar the growth on the surface appears as a smooth, semi-transparent, milky layer; while the development along the line of the puncture of the inoculating needle through the agar takes place as a cloudy, more or less even growth, gradually becoming thinner at the periphery.

Pathogenic.—Inoculated into healthy cotton-bolls, a disease resulting in a rotting or decaying of the seed and lint is produced in from one to two weeks, which soon involves the carpels, and thus destroyes the entire cotton-boll.

This new rot disease of the cotton-boll is readily distinguished from the only disease likely to be confounded with it, namely anthracnose, by the fact that the anthracnose first makes its appearance as small, reddish brown spots on the surface of the boll, which spots enlarge and become dark, gray or pink according to circumstances. Finally, when the spots have attained a considerable size, they will be found to consist of a pink centre surrounded by a dark band, and this in turn surrounded by a dull, reddish brown band. The anthracnose is caused by a fungus, *colletotrichum Gossypii, Southworth** which originates on, and is usually confined to, the carpels of the boll, and only occasionally infects the lint.

The new rot disease of the cotton-boll, on the contrary, originates within the boll, and does not make itself visible, as a rule, until the entire or nearly entire contents of the boll has become involved and decayed, when the carpels may become affected and show signs of decay in places. The cotton-boll rot is caused by a bacterium, *Bacillus gossypina, Stedman,* and first appears as a small black or dark brown area on some of the young and developing seed and lint inside the boll near the petiole. This area gradually enlarges and causes the affected parts of the seed and

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* See Bull. No. 41, On "Some Diseases of Cotton," by G. F. Atkinson p. 40.

lint to decay or rot, and ultimately spreads so as to involve all the seed and lint within the boll, and may then even affect portions of the carpels. Figure 2 shows a diseased boll cut open, the seed and lint being affected. If the boll becomes diseased early in its growth, say four weeks before it is ripe, the disease will cause the entire boll to rot before the carpels can open at all. If, however, the disease appears later, when the boll is full size or nearly so, and the seed and lint nearly developed, the carpels may open or separate slightly at the tips, and thus admit the small sap-beetles that will enter and feed upon and breed in the decaying contents of the boll, and thus help to disentegrate it. Saprophytic and other fungi finding here a suitable pabulum may now appear and infest the decaying boll. Of course these diseased bolls can never mature lint or seed.

Should the disease appear still later when the boll has partially opened, or is nearly ready to open, the rot may affect only a few seed and a small portion of the lint before the boll opens and dries. In this case the boll would appear nearly normal and a large portion of the lint and seed would be perfect, especially that exposed to view, while that nearest the petiole would be affected. This is really the most serious condition so far as the cotton growers at large are concerned, since it is probably here that the great danger of spreading the disease to unaffected areas is to be found. In the other cases the contents of the boll is either wholly or more or less destroyed, and the boll fails to mature or develop lint; and if it opens it is but slight, and the boll is known to be diseased or imperfect and is never picked. But when the disease is so slight as to allow picking, the effected seed and lint is mixed unconsciously and taken to the gin, where the seed becomes mixed with seed from unaffected district; and thus all the seed that passes through the gin is liable to be infested with the germs of the rot disease, and finally to become distributed to distant parts of the country. Too great a precaution in regard to this method of spreading the disease can not be taken. The cause of the disease has been shown to be a micro-organism (bacteria) of extreme minuteness, and one that is found in innumerable numbers in the diseased tissues; and since the presence of a single one of these bacteria may cause the disease, we should guard against dangers of contamination.

Although it has never been demonstrated, yet it seems probable that the bacteria present in the diseased seed, lint and carpels, after they fall to the ground and become disentegrated, are eliberated and find their way to the roots of the cotton plant which they enter, and pass up through the plant to the bolls, inside of which they find conditions suitable for their development. Or the seed may be unaffected but the lint left attached to it may contain the bacteria, which would thus be in close connection with the young cotton plant when it germinates, and then could find its way into the roots. And it also seems very probable that those seed which are affected with the bacteria, but not in sufficient quantities to prevent their germination, may produce young plants with the rot bacteria already within their tissues (seed leaves), and thus these bacteria may then easily find their way into the bolls when they appear. But it seems to me even more probable that the bacteria are carried by the wind or insects from the soil to the flowers, where they remain attached to the moist and viscid stigma or in the nectar; and that they not only thus readily find their way into the young and developing bolls, but that they even multiply in the nectar or on the stigma; and that the insects which visit the flowers are thus contaminated and inoculate other flowers. This seems even more probable since we know of certain other bacterial diseases of plants, as pear blight, that is thus carried from one tree to another, and from one flower to another on the same tree. This explanation of the spread of the disease helps us over one difficulty, namely, the fact that the disease is principally confined to the middle and top crop. For if the bacteria are in the young cotton plant before the bolls are formed, one would expect the first or lower crop to be equally affected. If the bacteria enter by way of the flowers, we could explain the scarcity of the disease in the lower or first crop of bolls by the supposition, that the insect which carries the disease from one flower to another does not appear until the flowers of the middle crop are beginning to open. The lower crop would have simply the wind to introduce the disease, while the middle and top crop would have in addition the greater agency, insects. An effort will be made this summer to determine whether or not the bacteria do normally enter the bolls through the flower, and also to determine the insects which carry the disease from one flower to another. Experiments are now being conducted to determine the truth of the other four supposed methods of the distribution and entrance of the bacteria into the interior of the cotton-bolls.

So far as my observations and experiments are concerned, I have never been able to induce the rot bacteria to develop the disease or cause pathological disturbances in any part of the cotton plant other than the interior of the bolls, although they will live and even multiply to a slight extent within the tissues of the other parts of the plant.

All the facts in the case go to show that the cotton plants naturally become affected either by the rot bacteria entering the roots from the soil, or that the plants begin their existence as affected ones by the bacteria having entered the cotyledons (seed leaves) of the seed while still within the boll, or that the bacteria are carried by the wind or insects from the soil to the flowers, and from one flower to another, and enter the bolls in this way. It hardly seems probable that the bacteria could be blown by the wind or carried by other agencies upon the surface of the cotton-bolls and enter by that route, since the rot disease always makes its first appearance as a small diseased area of the seed and lint inside the boll near the petiole, and only later involves the carpels, and makes itself apparent on the exterior. Nevertheless, the bacteria may enter in this way and migrate to the seeds, for we have no definite proof to the contrary.

The rot disease seems to be principally confined to the middle and top crop, and makes itself manifest to the ordinary observer about the first of August. It is usually pretty evenly distributed over a field, and as yet is not as troublesome to river plantations as to high lands. That this rot disease is a very important one can be seen from the fact that it is damaging the cotton crop to the extent of 35% in certain parts of the State, and is on the increase and spreading. Mr. A. W. Bryant writes me that he has counted as many as nineteen diseased bolls on one stalk, and there were no doubt many more that were not diseased enough to appear on the exterior.

As regards the remedies and precautions to be taken in fighting this disease, it will be readily understood from the nature of the disease as above described, that the remedy must be a preventive one; and that we can not resort to any thing like spraying the plants with a fungicide or other chemicals, since we would kill the plants before the seat of the disease could be reached. We can then do nothing towards curing a boll once diseased, but we may help the cotton plant as a whole, and lessen the chances of having other bolls diseased, if we will remove the diseased bolls. But since the bacteria in the diseased tissues are not readily killed by such natural means as cold of winter or heat of summer, drying or becoming wet, nor by the decaying of the tissues in which they are found, but are simply eliberated and thus allowed to work through the soil to infest other cotton plants, we must, therefore, carefully preserve the diseased bolls and burn them, and not allow one to fall to the ground and remain there. If the diseased bolls are not picked and burned, but are simply allowed to remain on the cotton plant, they will sooner or later fall to the ground, and thus distribute millions of new bacteria in the soil, and rapidly increase the chances of having diseased bolls next season. It will not answer to leave the diseased bolls on the stalk after the cotton is picked, since the rain will wash the decayed and affected interior of the bolls out, and distribute it upon the soil. The diseased cotton-bolls should all be picked off and burned just as soon as discovered, or at least during the first picking of the lint, and ever afterwards as discovered.

It is a simple matter to carry a second bag in connection with the one used in picking lint, and to place in the second bag all diseased bolls as discovered, and to put them into small heaps and burn them. By this means the rot disease can be greatly lessened. Of course all cotton that appears to be imperfect in the boll should be glanced at, to see that it is not diseased farther in the boll, before it is placed with the good lint, otherwise diseased seeds will find their way to the gin and be distributed and planted.

When the cotton field is badly affected with the cotton-boll rot disease, it would be advisable to plant some other crop there for two years, and to use other fields previously occupied by a different crop for the raising of cotton. In this way the bacteria in question might be gotton rid of.

We may sum up briefly as follows :

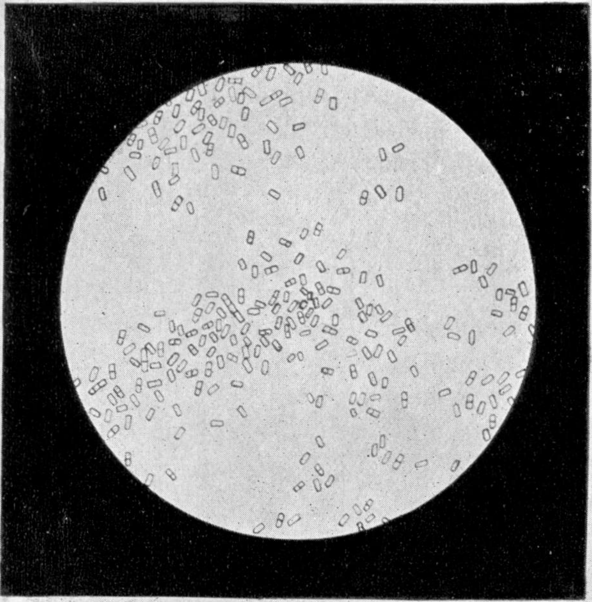
a. The *cotton-boll rot disease* is caused by a bacterium (*Bacillus gossypina, Stedman*) which works within the boll, causing its contents (seed and lint) to decay. And since the bacteria are inside the tissues, it would be unless to spray the plant with any chemicals at present known, since we would kill the plant before the diseased region could be reached.

b. The disease is multiplied in and carried from one crop of cotton to another, and also to unaffected areas, by means of the diseased tissues, with probably the help of the wind and insects.

c. The bacteria may possibly enter the cotton plant from the soil, through the roots, although it is possible they may enter through the epidermis of the boll; but more probably they were already in the seed-leaves of the seed, or enter the bolls from the flower.

d. All diseased cotton-bolls should be picked off and *burned* just as soon as discovered, or at least while the lint is being gathered, and the field gone over again immediately after the last picking of the lint.

e. Cotton seed coming from a gin known to have ginned cotton from an affected district should not be planted in unaffected districts.



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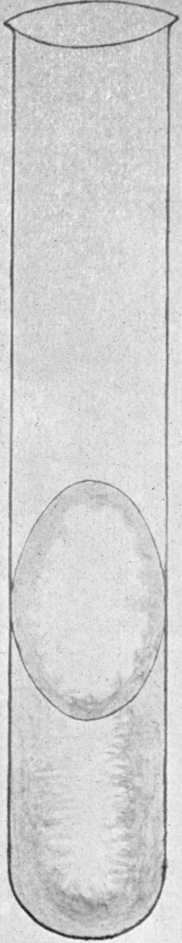

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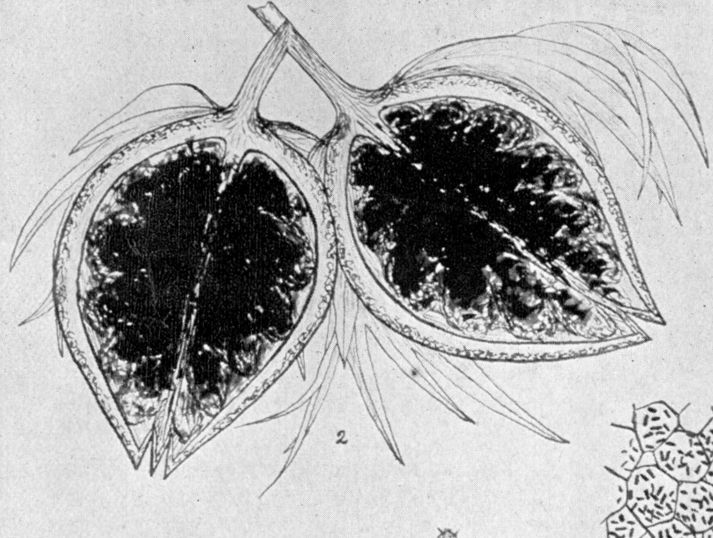

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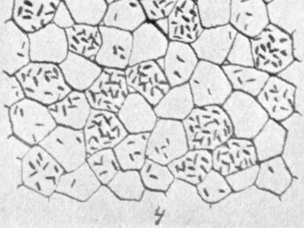

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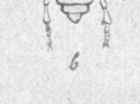

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J. M. Stedman Del.

Bulletin No. 56, : : May, 1894.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

Experiments in Crossing for the Purpose of Improving the Cotton Fiber.

P. H. MELL, Botanist.

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INTRODUCTION.

In as much as this bulletin is prepared largely for the benefit of the farmer, who is but little versed in botanical literature, scientific terms have been carefully avoided where simple language will intelligibly convey the information desired without destroying scientific accuracy.

There are also some remarks presented on the subject of plant growth, with which all botanists are familiar; but it is deemed best to submit them in this connection in order to make the topic under discussion more clear to the farmer, and, therefore, no other apology is necessary for reprinting these well known principles of botanical knowledge.

The author of this bulletin makes no claim to new discoveries; and, although problems have been presented for solution, little more than an introduction to future investigations on the subject under consideration, has been attempted. The effort has been made to give an intelligent account of how the cotton plant might be developed so as to force it to yield the planter the greatest remuneration for his labor. Nature has been carefully followed, as far as her works have been understood, and all theories have been eliminated. The bulletin is intended to be one of facts and not of theories.

The conclusions submitted are based on the results of investigations extending over a period of three years. Several hundred crosses were successfully made, and the developments from year to year carefully watched and studied. A large amount of microscopic work was required to determine the transformation of the fiber.

The following represent the so-called varieties used in the experiments:

Allen's long staple, Bailey, Barnett, Cherry's cluster, W. A. Cook, J. C. Cook, Dixon, Gold Dust, Hawkins' improved, Herlong, Hunnicutt, Jones' improved, Jones' long staple, Keith, T. J. King, Okra leaf, Peeler, Peerless, Peterkin, Petit Gulf, Rameses, Rust proof, Storm proof, Southern Hope, Truitt, Welborn's Pet, Wonderful, Zellner.

The following species, included in the table of results, were also planted the past season to acclimate them for future experiments:

Two Egyptian types, "*Mit-Afifi,*" and "*Bamieh;*" *Nankin; Sea Island.* The name, "Mit-Afifi," is derived from a village in Egypt, near which place a Greek merchant first discovered this variety of cotton. The form closely resembles the Sea Island in many particulars, although it is distinct enough to be determined a separate species. This cotton is very highly thought of by the Egyptian planters and is extensively cultivated by them. The staple has a light brown tinge and is long and moderately strong. The seed are black, and, with the exception of a bluish tuft at the extremity, they are smooth. The plants grew on the college farm at Auburn, Alabama, to the height of twelve feet. The leaves are large, three to five lobed and dark green in color. The stem is more or less branched with three or four bolls at each joint of the branch. The bolls are small, slender and pointed, and divided into three cells or carpels. The flowers are bright yellow with a red spot at the base of each of the five petals. This plant seems to be a variety of *Gossypium Braziliense.* The "Bamieh" is about as valuable as the Afifi in the development and strength of the fiber. The plant is tall, reaching a height of ten feet. The leaves are dark green with red veins, very large and five lobed. The bolls grow on slender stalks, six inches in length, attached to the main stem. There are no limbs. The divisions of the bolls are three, and, in some cases, four in number. The involucre is very prominent, almost covering the boll. The flowers are bright yellow with a red spot at the base of each of the five petals. Cotton caterpillars refuse to attack these plants, although all the ordinary plants around them were stripped of their leaves.

THE PLAN OF THE COTTON FLOWER AND THE METHOD ADOPTED BY NATURE FOR MATURING THE SEED.

In entering upon the prosecution of any work we must first have an adequate conception of the nature of the object upon which we propose to experiment. Few people, who cultivate the cotton, can give an intelligent description of the plant and the methods used by it for maturing its seeds. Not many persons understand that the fiber consists of elongated cells growing from the outer surface of the seed-coat. Yet these very parties are amazed when they fail to make the plant accomplish what is so readily secured under the management of a more intelligent and careful agriculturist—the farmer who studies all the peculiarities of the plant, watching each development as it is unfolded under the guidance of natural laws. To the observant man it may be unnecessary to say that the best developed flower on the healthiest plant will produce the best staple. It is not the fast growing plant, greatly multiplied in leaf and wood surface, that is apt to produce the best matured flowers and bolls. The food necessary for all the demands of a healthy flower must come to it unstinted. If it is diverted from its flow by the demands of rapidly growing leaves and wood the generative organs must suffer, and this deficiency of food may cause the flower to wither and fall off—at least it will dwarf the organs and result in immature bolls.

Before proceeding to discuss the results of the experiments secured in the cross-fertilization of the cotton it may be best to describe the construction of the flower for the benefit of some of my readers who are not well acquainted with the working of this organ. This knowledge is necessary to a correct understanding of the experiments, the results of which are given in this bulletin. The flower consists of five separate sets of organs. 1. An outside green circle of three leaves, called *involucre* (see *a* fig. 1), the leaflets of which are united and heartshaped at the base, deeply incised, and remain in contact with the boll during its entire growth. The peculiar shape of these forms gives the name "square" to the young buds. 2. An inner circle of cup shaped leaves, obtusely five toothed, called *calyx*, the divisions of which are termed *sepals*. These forms are not visible in the fig. 3. Just inside the calyx cup is another circle of leaves called *corolla*, divided into five *petals* (see *b* fig. 1). The petals are generally of a delicate cream color when they first unfold from the bud, but in a few hours they change to deep red, after which they wither and fall off. These outside circles of leaves are termed the *non-essential* organs, because they simply serve a secondary purpose in the development of the seed—they are in fact the *protecting* organs for the delicate germ. 4. The next set of organs is called *stamens;* they are found crowded in large numbers around, and growing upon, the *pistil* (see *a* fig. 2). These stamens produce the male function, called *pollen*, which has the appearance, to the unassisted eye, of a mass of fine yellow powder. A grain has been greatly enlarged in fig. 3. Without the presence of

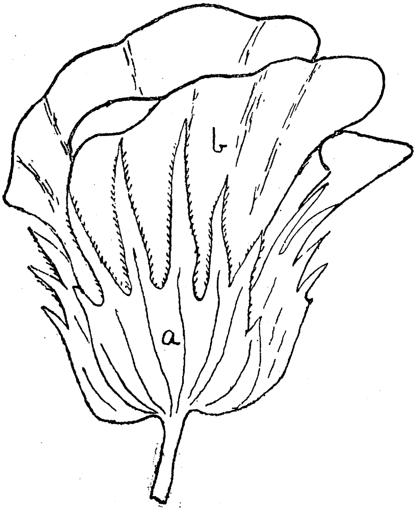


Fig 1

R.M.Mell.Del.

this pollen the seed cannot be produced. 5. The *pistil* (bd fig. 2), is the female organ, and there are three to five in each flower, united and twisted around each other. The pistil consists of three parts: (1) *stigma b*, to which the pollen is first attached after it leaves the stamens; (2) the *style*, a slender shaft separating the stigma from the (3) *ovary d.* The ovary, after fertilization with pollen, forms the boll in which the seed and fiber are found.

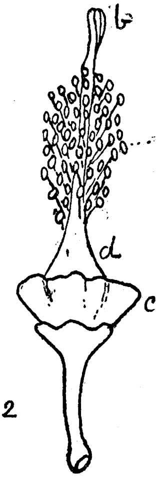


Fig 2

Sea Island Pistil.

Now a few words as to the action of the pollen grains after they find lodgment on the stigma or female organ. A cotton pollen grain is a sphere covered with two coatings, or thin membranes, inside of which is a mass of matter (A fig. 3), that carries the male principle. The coat, P, has

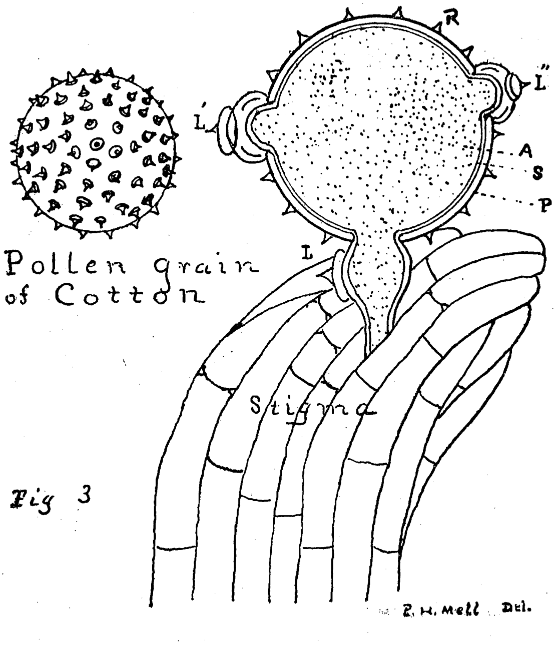
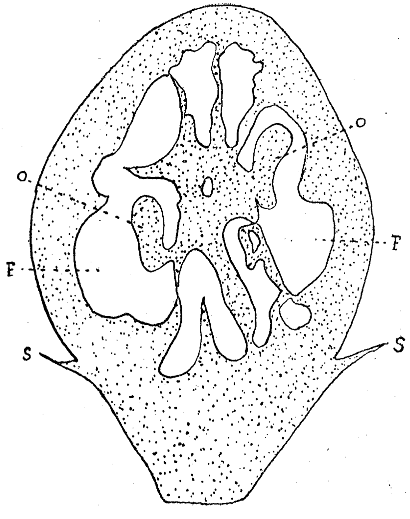


Fig 3

a number of circular openings closed by lids, L, L', L'', R, underneath which the inner membrane, S, is thickened. When the flower opens in early morning the pistil exudes a quantity of sticky fluid on and about the numerous fine hairs growing on the stigma, by means of which the pollen grains are caught when transported by the wind and insects. Very soon after the pollen lodges on the pistil, the lid, L fig. 3, is thrown aside by the growing of the inner membrane coat, S, into a tube. This tube pushes its way between the tissues of the stigma down the style and into the ovary at d fig. 2, where the end of the tube opens and the female germ becomes fertilized, thus producing the seed. The most remarkable fact in regard to this matter is the rapid growth of the pollen tube in such a short time, because the work must be accomplished in twenty-four hours.

Shortly after the fertilization has taken place in the ovary, the petals, stamens and the upper portions of the pistil wither and fall off, leaving the ovary and its surrounding involucre leaves. This ovary, as has been already stated, is the young boll containing the rapidly growing seeds with their fiber coatings. A section of a half grown boll is given in fig. 4. This is a longitudinal section showing seeds at oo, and the cells (or *carpels*) FF which will be filled with the staple when the boll is complete in its growth. SS represent the calyx. The involucre is not shown in the drawing.

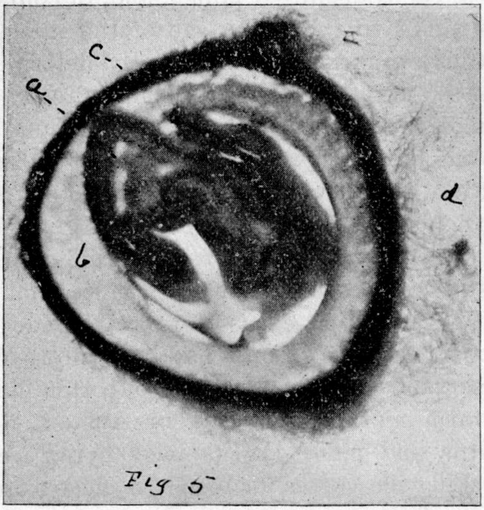


Section of Ovary.

Fig 4

R.H.Mell Del.

Fig. 5 is a cross section of the seed exhibiting the young germ or plant at *a;* the food stored up for its use at *b;* and the fiber *d* growing from the outer surface of the seed coat *c*. When the germ *a* begins to enlarge under the influence of the moisture of the soil and the invigorating power of the sun's rays, it breaks the coat or "hull" *c* and starts with its leaves towards the light. In this young stage of its growth it lives upon the delicate food prepared and stored up by its parent plant at *b*. When this food is exhausted the young plant is old enough to take care of itself and drink in through its roots and assimilate the food materials from the soil in which it is growing.



It will be readily understood from the foregoing how important it is to have pollen grains of the best character and a well developed pistil, if we expect to secure high grade fiber. Inferior plants cannot produce healthy organs and superior seed, any more than inferior grades of stock can produce fine blooded cows and horses. So little attention is paid to this subject by planters generally no comparative estimate can be made on the results after the seed are planted. The farmer does not know whether the seed came from first-class plants or not; whether they are good, bad or indifferent. No attempt is made to select the seed, but good, bad and worthless are planted in the drill together. When the plants are ready to bloom the inferior as well as the superior individuals are permitted to grow side by side, while the insects and winds are busy blending the two together by means of the transmitted pollen, and, of course, the healthy plants suffer to the advantage of the inferior forms. The seed thus produced become greatly deteriorated in the course of a few years, and the farmer is ready to heap denunciations on the head of the man from whom he bought the improved seed a few years before, at a high price. It does not pay to cultivate inferior grades of cotton in the neighboring fields where improved cotton is growing. Insects will soon transmit pollen from one grade to the other so as to cause the fine seed to greatly lose its vitality and superior qualities, and soon cause it to retrograde to the original inferior stock from which it had been improved. An intelligent, observant man, standing in a cotton field during a bright, warm morning, in July or August, will notice humming birds and many insects busy flying from flower to flower sucking the nectar for food. A close examination of the bodies of these insects will disclose the fact that over them is scattered quantities of pollen. When the insect crowds down into the corolla cup to reach the nectar at its base, the pollen on its body is attached to the stigma and fertilization is accomplished. Now if the insect has visited the flowers of inferior grades of cotton before reaching the improved flower, the inferior pollen will have a chance to put in its effects on the germ of the improved cotton. *All seed should be carefnlly selected each season; and inferior plants noted in the field should be rooted out before they begin to bloom.*

With these facts concerning the development of the flower well understood we are prepared to enter upon the discussion of the results secured from the experiments in crossing.

METHODS ADOPTED IN THE FIELD FOR PRODUCING THE CROSSING.

The term "crossing" in botany signifies the blending of two varieties of the same species by transmitting the pollen of the flower of one form to the pistil of the other. In this manner the peculiar properties of both varieties are united in a new offspring, and results of special advantage are often secured.

In the experiments conducted at Auburn the "W. A. Cook" and "Peerless" varieties were selected to carry the female function, because these plants had distinctive and desirable features which were strongly marked; and a stable basis was thus offered upon which to develop the future improved bolls.

Having succeeded in raising strong and healthy plants of all the varieties mentioned in another part of this bulletin, a number of flowers on the best plants of the W. A. Cook and Peerless were prepared in the following manner, on an evening just before sundown, when there was no indication of rain for at least forty-eight hours:

The buds on the most mature limbs were selected, the petals of which would fully expand during the early hours of the next morning, and by means of small scissors these petals (*b* fig. 1) were cut off just above their bases, thus exposing the stamens and pistils fully to view. The stamens (*a* fig. 2) were then carefully removed by means of a pair of forceps, without bruising the pistil. Thus denuded of all male organs the pistil was covered with a thin paper bag, as a protection against the wind and insects, and left until next morning by which time it was fully developed with all its functions ready for the reception of the pollen. A healthy flower from a plant of another variety was plucked next morning and carried to the flower prepared the afternoon before, and, by means of a small soft brush, the pollen was dusted on the stigma (*b* fig. 2) of the pistil. The bag was replaced and carefully fastened around the limb so as to prevent any possibility of pollen from any other source being introduced upon the pistil. A tag, properly labeled, was suspended at the base of the flower for future reference. After two or three days this bag was taken off and the new boll left to grow under the influence of the sun's rays. Many hundreds of these bolls were grown, the fiber gathered and the seed carefully selected and planted the following season. The seeds were again gathered, carefully selected and planted the third season. The fiber of the last planting was then subjected to the most rigid examination under the microscope and submitted to severe tests to determine its valuable and weak properties.

The strands of fiber, as already stated, are elongated tubes growing from the outer surface of the seed coat. In their young state they are filled with a fluid, but as maturity advances this fluid disappears, the walls of the tube collapse, and a twisted form is assumed which is more and more complete as the development of the tube approaches perfection. The value of the staple is largely controlled by the degree of this twist; and this property also enables the spinner to manipulate the fiber to the best advantage.

Now, in as much as the fiber is a portion of the seed coat, the full and perfect maturity of the seed will also produce in the staple a complete twist and maximum degree of strength. The plant, therefore, in all its stages should be closely watched and carefully studied in order to fully understand its peculiar properties—what characteristics are desirable and what are objectionable. Two varieties of the same species, well understood, should be blended, in the manner already indicated, so as to intensify the desirable traits and greatly diminish the inferior qualities. For instance, if the male organ on one plant matures fine grades of pollen, and the female organ is healthy and well developed on the other, the blending of the two will tend to improve the resulting form. A careful selection of the seed, planting only the best, will still further aid in producing superior results.

In conducting the experiments at Auburn special importance has been placed on eliminating all objectionable and weak forms, as progress is made, and in intensifying the strong features until the best types are firmly established. The fact has been borne in mind at all times that no satisfactory results could be secured from this work unless the plants under investigation were cultivated far removed from inferior grades of cotton.

SOME OF THE PROBLEMS TO BE SOLVED.

1. Are all the so-called " varieties " of cotton grown in the South entitled to separate names?

2. How many species of the *Gossypium* are cultivated in the cotton-belt? Are the upland forms—so-called "Upland Cotton"—true species or are they hybrids, the product of blending two or more distinct species during the long period of years in which the cotton has been cultivated in the South?

3. In "improving" the cotton plant is the fiber strengthened and developed, or is there simply an increase in the size of the plant to the detriment of the fiber? Is it not often the case that the fiber is weakened and damaged by forcing the plant, as we sometimes notice is the case when certain forms of fruits are forced to ripen earlier than the usual period, causing the outside coating to mature before the inferior is thoroughly developed?

4. At what stage of growth of the boll does the fiber attain its full development?

5. What are the properties of a well formed cotton fiber?

Some of these problems are not yet fully answered by the results so far secured, but valuable information has been obtained on all the questions propounded, and, in some instances, decided answers will be rendered.

1. Are all the "so-called" varieties entitled to separate names?

This question seems to be answered in the following classification of these "varieties."

(1) Short staple forms, under 1.2 inches:

Bailey, Barnett, Cherry's cluster, J. C. Cook, Dixon, Gold dust, Hawkins' improved, Herlong, Hunnicutt, Jones' improved, Keith, King, Okra leaf, Peeler, Peerless, Peterkin, Petit gulf, Rust proof, Rameses, Southern hope, Storm proof, Truitt, Welborn's pet, Zellner.

(2) Long staple, 1.3 inches and above:

Allen's long staple, W. A. Cook, Jones' long staple, Wonderful.

(3) Prolific forms:

Allen's long staple, Bailey, Barnett, Cherry's cluster, W. A. Cook, Dixon, Gold dust, Hawkins' improved, Herlong, Hunnicutt, Jones' improved, Keith, King, Okra leaf, Peerless, Truitt, Welborn's pet, Wonderful.

(4) Non-prolific:

J. C. Cook, Jones' long staple, Peeler, Peterkin, Petit gulf, Storm proof, Southern hope, Zellner.

(5) Those forms which have leaves alike:

Allen's long staple, Cherry's cluster, Dixon, Jones' improved, Jones' long staple, Gold dust, Hunnicutt, Keith, King, Peeler, Truitt, Wonderful, Zellner. (Three to five lobed leaves.)

W. A. Cook, Hawkins' improved, Peerless, Petit gulf, Southern hope, Storm proof, Welborn's pet. (Four to five lobed leaves.)

(6) Long limbed forms:

Allen's long staple, J. C. Cook, Gold dust, Herlong, Hunnicutt, Jones' long staple, King, Peeler, Peerless, Peterkin, Petit gulf, Rameses, Southern hope, Truitt, Wonderful, Zellner.

(7) Short limbed forms:

Bailey, Barnett, Cherry's cluster, W. A. Cook, Dixon, Hawkins' improved, Jones' improved, Keith, Okra leaf, Storm proof, Welborn's pet.

(8) Clustered varieties:

Cherry's cluster, Herlong, Peerless, Welborn's pet.

(9) Large boll varieties:

Allen's long staple, W. A. Cook, Hawkins' improved, Hunnicutt, Jones' long staple, Wonderful.

(10) Medium and small varieties:

Bailey, Barnett, Cherry's cluster, J. C. Cook, Dixon, Gold dust, Herlong, Jones' improved, Keith, King, Okra leaf, Peeler, Peerless, Peterkin, Petit gulf, Rameses, Southern hope, Storm proof, Truitt, Welborn's pet, Zellner.

(11) The dark, smooth seed forms:
Bailey.

(12) The furry, dark and small seed forms:
J. C. Cook, Petit gulf.

(13) The large light brown, furry seed forms:
Allen's long staple, W. A. Cook, Gold dust, Hawkins' improved, Hunnicutt, Jones' long staple, Keith, King, Peeler, Peerless, Peterkin, Rameses, Southern hope, Storm proof, Truitt, Welborn's pet, Wonderful, Zellner.

(14) The small, light brown, furry seed forms:
Barnett, Cherry's cluster, Dixon, Herlong, Jones' improved, Okra leaf.

Selecting from the above classification those forms which have features alike, we may rearrange our plants into the following seven groups:

1. Allen's long staple, W. A. Cook, Hunnicutt, Jones' long staple, Wonderful.
2. Bailey, Okra leaf.
3. Cherry's cluster, Herlong, Peerless, Welborn's pet.
4. J. C. Cook.
5. Barnett, Dixon, Hawkins' improved, Jones' improved, Keith, King, Rameses, Truitt.
6. Gold dust.
7. Peterkin, Peeler, Petit gulf, Storm proof, Southern hope, Zellner.

It may not be far wrong to assert that each of the many so-called varieties now on the market belong to one of these groups; and, in a number of instances, coming under the observation of the writer, the "new cotton" has no right to a new name, but is only an improved production of seed under an excellent system of cultivation and selection from year to year.

The second problem in our investigations, viz.: How many species of the gossypium are cultivated in the cotton belt, &c., is quite difficult to solve with the present data at hand. We may say, however, that indications point to the presence of the following species at least:

Gossypium herbaceum, L.; gossypium roseum, Tod; gossypium nankin, Mey; gossypium Mexicanum, Tod; gossypium maritimum, Tod; gossypium hirsutuw, Mill; gossypium barbadense, Linn.

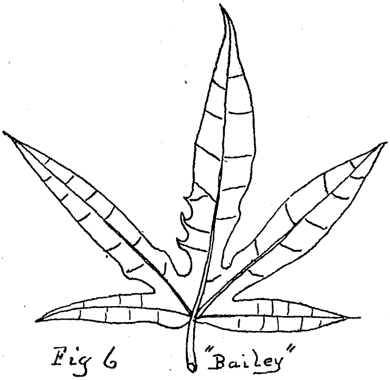
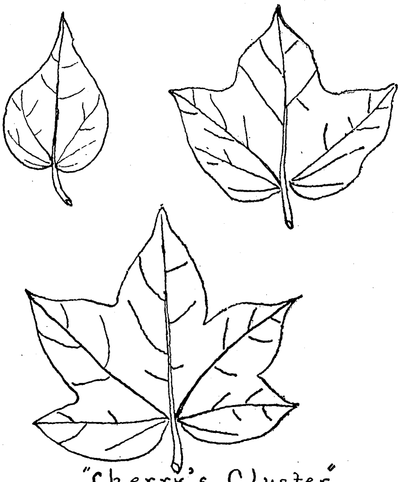


Fig 6 "Bailey"

P. H. Mell. Del.

Some of these have been blended and intercrossed to such a degree as to almost conceal the distinctive features of each species. There is strong reason to suppose that the "upland cotton" is a hybrid produced by blending the properties of several species, under the cultivation of a long series of years. For instance the Bailey and Okra leaf varieties seem to be the offsprings from the *gossypium maritimum Tod,* and *g. roseum Tod.* They have the Sea Island properties in the small black, smooth seed, the long fiber and the deep lobing of the leaves. Cherry's cluster, and other forms like it, have properties resembling *gossypium Wightianum* Tod, *g. Mexicanum* Tod, and *g. maritimum* Tod. Cotton has been cultivated in the South for such a long period, and seed from so many different sources have been planted in such near localities to each other, every opportu-



"Cherry's Cluster"
Fig 7

P. H. Mell. Del.

nity has been presented for favorable hybridizing, and in the repeated replanting of these seed year after year, the types have been well established. It becomes, therefore, a difficult problem to determine from what kind of species the individuals are derived. Investigations will be continued on this line and it is hoped that future results will warrant a more decided answer to the problem.

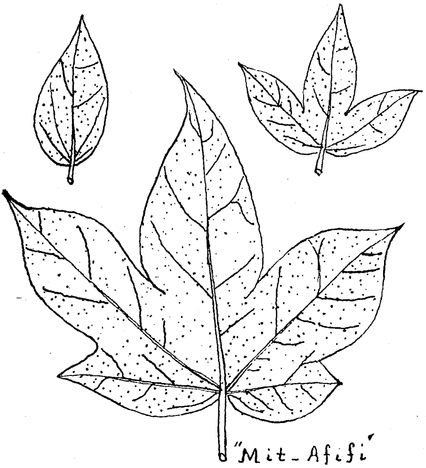


Fig 8

E. H. Mell Del

Figures 6, 7, 8, and 9, show the forms of the leaves grown on the plants cultivated at Auburn for our experiments, and they also represent the number of species. It may not be far wrong to say that they also give us the majority, if not all, the types grown in the South. If this position is correct these leaves will be of some interest in enabling us to answer the problem concerning the number of species now found in the cotton belt.

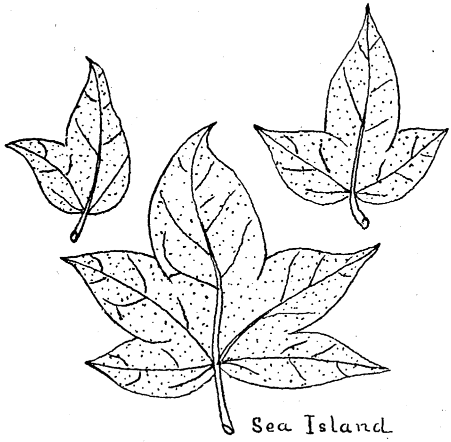


Fig 9

E.H. Mell Del

In a future bulletin this subject of the identification of the cotton will be more fully and definitely treated.

3. *In improving the cotton plant is the fiber strengthened and developed, or is there simply an increase in the size of the plant to the detriment of the fiber?*

The experiments seem to give an unmistakable answer to this question. It was only on those plants which were large, strong and healthy that the best condition of the fiber was secured. But, this being true, it was noticed on the other hand, that on those plants where there was a very rapid growth of wood-limbs and leaves there was a diminution in the number of flowers. This was caused, no doubt, by the great draft on the supply of sap to satisfy the demand of these growing parts. All things being equal, therefore, it is safe to say that the best condition of the fiber will be secured by a steady, constant growth of the plant in all its parts. It should not be stunted or retarded for lack of proper fertilization and cultivation, but every demand should be met so that a vigorous growth will be secured in all the functions of the plant. Nature often needs assistance to enable her to do her best work, particularly in her attempt to accomplish healthy results in the poor soils so prevalent throughout the cotton belt. The plant must be fed with the same judicious care that the stockman bestows upon animals under his intelligent management. It must be equally fed for wood-making, leaf development and seed maturity. And these ends can only be reached through painstaking care and observation of all stages of the plant growth and development.

The experiments conducted at Auburn give conclusive evidence that the improvement of the cotton plant under the influence of the crossing processes does not deteriorate the fiber, but tends greatly towards making it superior in its properties. There was no effort made to force the plant in its growth, but every inducement was offered it to perfect itself in all its functions. In the careful examinations made of the cotton stalk in the field it was noticed that on those plants which were strong and vigorous from the start and grew slowly to large, well developed stalks the flowers were larger, brighter in color and the bolls were also well formed and healthy in looks. The resulting fiber, of course, under such conditions, was possessed of the best qualities. The twenty-eight best forms given in another part of this bulletin (page 21) were large, finely developed plants that were well fruited, and in all respects healthy and vigorous.

The experiments are not yet far enough advanced to answer the fourth question, and it will, therefore, be deferred until progress will warrant the printing of another bulletin on this subject.

5. *What are the properties of a well formed cotton fiber? and how near do the crossed forms in this bulletin approach the perfect condition?*

Experience has proven that the perfect staple must have—

(1) Complete maturity throughout the entire length.
(2) Uniform twist from end to end.
(3) Uniform width in all parts.
(4) Maximum length.
(5) Purity in color.

The table of results show that the crosses, in nearly every instance, have improved the condition of the cotton, and, in some individuals, remarkably so. The length of the fiber has been increased in numerous cases, and the strength almost doubled. It is true that the percentage of fiber is not as great as we would desire, but this is due to the increased size of the seed. Both female forms on which the crosses were made, are large seed varieties and the resulting cross would naturally tend towards an increased size in the portion of the plant. Experiments may enable us to raise the percentage of the fiber after the seed-coat has been evolved into a stable, healthy condition. It may be noticed, however, that although the percentage of fiber in the crossed plants is smaller than that produced by the originals, still, the actual weight of the former is frequently nearly double that of the latter.

After a careful study of the tables in this bulletin the following plants have been selected because they seem to sustain in great measure the best traits of superior grades of fiber, viz., strength, maturity, length, twist and purity of color. These are named in the order of their superiority, and, in some cases, they show a remarkable degree of development from the original forms. For instance, the cross resulting from blending Barnett and Peerless, the first mentioned in the list following, shows certain decided improvements that are interesting. The number of seed to each boll increased from 27 in Barnett and 42 in Peerless (or an average of 34.5) to 38 in the crossed plant. The increase in weight of seed is from 3.115 grammes in Barnett, 3.217 grammes in Peerless to 4.866 grammes in the crossed plant, or a gain of 1.700 over the average results of the two originals. In the case of the fiber the weight has increased over the original forms in the following manner: Barnett, 1.737 grammes; Peerless, 1.751 grammes, and the crossed plant, 2.244 grammes, or an increase of 0.500 of a gramme over the average results of the originals. These facts are quite interesting, because they show the possibility of wonderful results if the experiments of crossing are continued far enough to established these tendencies towards perfected forms of development. If nothing else is gained than simply an increased length in the fiber with maturity in twist the results of the investigations will more than repay the amount of work and time expended.

The table on pages 22 and 23 was prepared to show more strikingly the decided improvement secured over the original varieties, and some most remarkable and interesting facts are shown in this comparison. The marked improvement in every instance establishes beyond doubt the importance of the experiments, the results of which are submitted in this bulletin.

TABLE I.

Twenty-eight of the best forms of cotton produced by the crossing process. Named in order of superiority.

No.*	NAMES.	STRENGTH.†	MATURITY.	LENGTH.‡	TWIST.
12.	Barnett on Peerless	14.57	Excellent	1.6	Excellent.
70.	Truitt on Peerless	14.14	Very good	1.1	Excellent.
14.	Cherry's Cluster on Cook.	13.08	Very good	1.3	Excellent.
56.	Petit Gulf on Peerless	13.04	Good.	0.9	Good.
43.	King on Cook	12.79	Good	1.0	Excellent.
58.	Rust Proof on Peerless	12.58	Very good	1.0	Very good.
54.	Peterkin on Peerless	12.46	Excellent	1.1	Excellent.
76.	Wonderful on Peerless	12.44	Excellent	1.2	Excellent.
55.	Petit Gulf on Cook	11.96	Good	0.9	Good.
2.	Allens long staple on Peerless	11.95	Good	1.3	Very good.
79.	Wonderful on Peerless	10.79	Very Good	1.2	Very good.
74.	Welborns pet on Peerless	10.75	Excellent	0.9	Excellent.
38.	Jones' long staple on Peerless	11.71	Good.	1.2	Good.
51.	Peerless on Cook	11.56	Very good	1.4	Good.
83.	Zellner on Cook	11.56	Very good	1.4	Very good.
46.	Okra leaf on Peerless	11.32	Good.	1.1	Very good.
77.	Wonderful on Peerless	11.28	Excellent	1.0	Excellent.
3.	Allen's long staple on Peerless	11.04	Good.	1.3	Good.
49.	Peeler on Peerless	10.97	Good.	1.2	Good.
33.	Hawkins' improved on Peerless	10.89	Very good	1.2	Excellent.
71.	Truitt on Cook	10.78	Excellent	1.2	Excellent.
19.	J. C. Cook on Peerless	10.55	Good.	1.4	Good.
15.	Cherry's cluster on Cook	10.51	Excellent	1.2	Excellent.
37.	Jones' improved on Peerless	10.39	Very good	1.2	Good.
7.	Bailey on Cook	10.27	Good.	1.2	Good.
11.	Barnett on Cook	10.21	Good	1.4	Good.
50.	Peeler on Cook	10.06	Very good	1.4	Very good.
47.	Peeler on Peerless	10.05	Good.	1.4	Very good.

* The numbers in this column are the same found in Table IV—first column. † The measurements of strength are in grammes (a gramme is equivalent to 15.4 grains). ‡ The length is determined in inches.

TABLE II.

Comparison between the Original Plants and 25 of the Best Improved Forms.

Numbers (Table IV.)	Name of Plant.	Number Seed.	Wt. Seed in grammes	Wt. Lint in grammes.	Per cent. Seed.	Per cent. Lint.	Length of Fiber in inches.	Diameter of Fiber in millimeters.	Character of Twist.	Max. strain for breaking one strand in grammes.	Min. strain for breaking one strand in grammes.
12	**Barnett on Peerless**	**38**	**4.866**	**2.244**	**68.4**	**31.6**	**1.10**	**0.022**	Excellent	**14.99**	**13.95**
	Peerless	42	3 217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**34.5**	**3.166**	**1.744**	**64.5**	**35.5**	**0.94**	**0.020**			
	Barnett	27	3.115	1.737	64.2	35.8	1.00	0.020	Fair.		
70	**Truitt on Peerless**	**37**	**5.197**	**2.580**	**68.1**	**31.9**	**1.10**	**0.021**	Excellent	**15.38**	**12.79**
	Peerless	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**37.5**	**4.122**	**2.085**	**66.2**	**33.8**	**0.89**	**0.017**			
	Truitt	33	5.027	2.419	67.6	32.4	0.90	0 015	Poor.		
14	**Cherry's Cluster on Cook**	**36**	**4.326**	**1.979**	**68.6**	**31.4**	**1.30**	**0.020**	Excellent	**14.20**	**12.31**
	Cook, W. A.,	42	5.675	2.740	67 4	32.6	1.50	0.020	Good.		
	Average	**42**	**4.796**	**2.465**	**65.5**	**34.6**	**1.20**	**0.018**			
	Cherry's Cluster	42	3.917	2.190	63.5	36.5	0.90	0.017	Fair.		
56	**Petit Gulf on Peerless**	**44**	**4.276**	**3.214**	**57.1**	**42.9**	**0.90**	**0.018**	Good.	**13.71**	**11.75**
	Peerless,	42	3.217	1.751	64 8	35.2	0.87	0.020	Very good		
	Average	**42**	**4.557**	**2.251**	**66.5**	**33.5**	**0.94**	**0.020**			
	Petit Gulf	42	5.897	2.751	68.2	31.8	1.00	0.020	Very good		
43	**King on Cook**	**38**	**4.656**	**2.007**	**69.7**	**30.1**	**1.00**	**0.018**	Excellent	**14.47**	**10.81**
	Cook, W. A.,	42	5.675	2.740	67.4	32.6	1 50	0.020	Good.		
	Average	**43 5**	**4.082**	**2.135**	**64.4**	**35.6**	**1.10**	**0.019**			
	King,	45	2 470	1.530	61.4	38.6	0.70	0.018	Fair.		
58	**Rust Proof on Peerless**	**33**	**4.608**	**2.396**	**65.8**	**34.2**	**1.00**	**0.022**	Very good	**13.10**	**12.10**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0 020	Very good		
	Average	**41.5**	**4.279**	**2.229**	**65.6**	**34.0**		**0.017**			
	Rust Proof,	41	5.340	2.706	66.3	32.7		0.014	Fair.		
54	**Peterkin on Peerless**	**43**	**4.945**	**2.630**	**65.3**	**34.7**	**1.10**	**0.022**	Excellent	**14.40**	**10.43**

	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**43.5**	**3.522**	**2.125**	**62.6**	**37.5**	**0.94**	**0.020**			
	Peterkin,	45	3.826	2.499	60.3	39.7	1.00	0.020	Fair.		
76	**Wonderful on Peerless**	**34**	**5.010**	**2.575**	**64.7**	**35.3**	**1.20**	**0.020**	Excellent	**14.48**	**11.22**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**42**	**4.316**	**2.087**	**66.9**	**33.1**	**1.11**	**0.019**			
	Wonderful,	42	5.415	2.423	69.0	31.0	1.35	0.018	Very fair.		
55	**Petit Gulf on Cook**	**43**	**4.216**	**2.507**	**62.7**	**37.3**	**0.90**	**0.016**	Good.	**15.30**	**9.25**
	Cook, W. A.,	42	5.675	2.740	67.4	32.6	1.50	0.020	Good.		
	Average	**42**	**5.786**	**2.746**	**66.8**	**32.2**	**1.25**	**0.020**			
	Petit Gulf,	42	5.897	2.751	68.2	31.8	1.00	0.020	Very good		
2	**Allen's Long Staple on Peerless**	**34**	**4.540**	**2.194**	**67.4**	**32.6**	**1.30**	**0.020**	Very good	**12.25**	**11.77**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**43.5**	**3.469**	**1.893**	**64.8**	**35.2**	**1.09**	**0.020**			
	Allen's Long Staple,	45	3.722	2.035	64.7	35.3	1.30	0.020	Fair.		
79	**Wonderful on Peerless**	**40**	**5.154**	**2.490**	**67.4**	**32.6**	**1.20**	**0.017**	Very good	**11.34**	**9.78**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**42**	**4.316**	**2.087**	**66.9**	**33.1**	**1.11**	**0.019**			
	Wonderful,	42	5.415	2.423	69.0	31.0	1.35	0.018	Very fair.		
74	**Welborn's Pet on Peerless**	**38**	**4.123**	**1.394**	**74.7**	**25.3**	**0.90**	**0.037**	Excellent	**12.98**	**10.32**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**38**	**2.265**	**1.320**	**62.2**	**37.8**	**0.89**	**0.017**			
	Welborn's Pet,	34	1.312	0.890	59.6	40.4	0.90	0.014	Good.		
38	**Jones' Long Staple on Peerless**	**43**	**6.337**	**2.500**	**71.7**	**28.3**	**1.20**	**0.020**	Good.	**16.76**	**8.24**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**42**	**4.329**	**2.156**	**66.4**	**33.6**	**1.06**	**0.020**			
	Jones' Long Staple,	42	5.440	2.560	68.0	32.0	1. 5	0.020	Very poor		
51	**Peerless on Cook**	**33**	**4.607**	**1.941**	**70.4**	**29.6**	**1.40**	**0.020**	Good.	**15.20**	**8.85**
	Cook, W. A.,	42	5.675	2.740	67.4	32.6	1.50	0.020	Good.		
	Average	**42**	**4.446**	**2.246**	**66.1**	**33.9**	**1.19**	**0.020**			
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
83	**Zellner on Cook**	**41**	**4.916**	**1.653**	**74.8**	**25.2**	**1.40**	**0.021**	Very good	**14.88**	**10.50**
	Cook, W. A.,	42	5.675	2.740	67.4	32.6	1.50	0.020	Very good		
	Average	**37.5**	**5.345**	**2.289**	**70.6**	**29.7**	**1.20**	**0.020**			
	Zellner,	33	5.015	1.837	73.8	26.8	0.90	0.020	Fair.		

TABLE II—Continued.

COMPARISON BETWEEN THE ORIGINAL PLANTS AND 25 OF THE BEST IMPROVED FORMS—Continued.

Numbers (Table IV).	NAME OF PLANT.	Number of Seed.	Wt. Seed in grammes.	Wt. Lint in grammes.	Per cent. of Seed.	Per cent. of Lint.	Length of Fiber in inches.	Diameter of Fiber in millimeters.	Character of Twist.	Max. strain for breaking one strand in grammes.	Min. strain for breaking one strand in grammes.
46	**Okra Leaf on Peerless**	**37**	**4 933**	**2.630**	**65.3**	**34.7**	**1.10**	**0.020**	Very good	**14.84**	**9.27**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**36.5**	**3.035**	**1.804**	**62.7**	**37.3**	**1.04**	**0.021**			
	Okra Leaf,	31	2.852	1.857	60.6	39.4	1.20	0.022	Very fair.		
77	**Wonderful on Peerless**	**38**	**5.344**	**2.660**	**66.8**	**33.2**	**1.00**	**0.022**	Excellent	**13.77**	**9.25**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**42**	**4.316**	**2.087**	**66.9**	**33.1**	**1.11**	**0.019**			
	Wonderful,	42	5.415	2.423	69.0	31.0	1.35	0 018	Very fair.		
49	**Peeler on Peerless**	**39**	**4.988**	**2.216**	**69.2**	**30.8**	**1.20**	**0.022**	Good.	**14.42**	**9.10**
	Peerless,	42	3.217	1.751	64.8	35 2	0.87	0.020	Very good		
	Average	**42.5**	**4.039**	**2.037**	**66.7**	**33.8**	**1.04**	**0.017**			
	Peeler,	43	4.860	2.322	67.6	32.4	1.20	0 014	Fair.		
33	**Hawkins' Improved on Peerless**	**43**	**5.260**	**2.346**	**69.2**	**30.8**	**1.20**	**0.020**	Excellent	**16.78**	**7.38**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average	**41.5**	**2.444**	**1.424**	**62.6**	**37.5**	**0.87**	**0.020**			
	Hawkins' Improved	41	1.670	1.096	60.3	39.7	0.87	0.020	Fair.		
71	**Truitt on Cook**	**43**	**5.670**	**2.554**	**68.9**	**31.1**	**1.20**	**0.014**	Excellent	**12.35**	**9.68**
	Cook, W. A.,	42	5.675	2.740	67.4	32.6	1.50	0.020	Good.		
	Average	**37.5**	**5.352**	**2.580**	**67.5**	**32.5**	**1.20**	**0.017**			
	Truitt,	33	5.029	2.419	67.6	32.4	0.90	0.014	Poor.		
19	**J. C. Cook on Peerless**	**35**	**4.363**	**1.793**	**70.9**	**29.1**	**1.40**	**0.021**	Good.	**13.87**	**7.87**
	Peerless,	42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
	Average										
	J. C. Cook,										
15	**Cherry's Cluster on Cook**	**44**	**4.840**	**2.545**	**65.5**	**34.5**	**1.20**	**0.022**	Excellent	**12.08**	**8.61**

	Cook, W. A.,		42	5.675	2.740	67.4	32.6	1.50	0.020	Good.		
		Average	**42**	**4.796**	**2.465**	**65.5**	**34.6**	**1.20**	**0.018**			
	Cherry's Cluster,		42	3.917	2.190	63.5	36.5	0.90	0.017	Fair.		
37	**Jones' Improved on Peerless**		**42**	**5.240**	**2.490**	**67.8**	**32.2**	**1.20**	**0.020**	Good.	**11.00**	**9.75**
	Peerless,		42	3.217	1.751	64.8	35.2	0.87	0.020	Very good		
		Average	**36**	**3.894**	**2.246**	**63.8**	**36.3**	**0.89**	**0.017**			
	Jones' Improved,		30	4.570	2.740	62.8	37.4	0.90	0.014	Good.		
11	**Barnett on Cook**		**35**	**5.175**	**2.090**	**71.2**	**28.8**	**1.40**	**0.020**	Good.	**11.01**	**8.85**
	Cook, W. A.,		42	5.675	2.740	67.4	32.6	1.50	0.020	Good.		
		Average	**34.5**	**4.395**	**2.239**	**65.8**	**34.2**	**1.25**	**0.020**			
	Barnett,		27	3 115	1.737	64.2	35.8	1.00	0.020	Fair.		
50	**Peeler on Cook**		**40**	**6.382**	**2.252**	**73.9**	**26.1**	**1.40**	**0.018**	Very good	**11.16**	**8.54**
	Cook, W. A.,		42	5.675	2.740	67.4	32.6	1.50	0.020	Good.		
		Average	**42.5**	**5.263**	**2.531**	**67.5**	**32.5**	**1.35**	**0.017**			
	Peeler,		43	4.860	2.322	67.6	32.4	1.20	0.014	Fair.		

TABLE III.

Characteristic Features of Original

Name of Cotton.	Length of Branches.	Height of Stalk in feet	Number of lobes to leaves	Number of bolls to each limb.	Size of bolls.	Shape of bolls.
Allen's L'g St'ple	Long...	5.6	3.	....	Large........	Pointed.......
on Cook...	Long...	5.6	3.5	4-6	Medium......	Pointed......
on Peerless	Medium	5.6	3.	6-7	Large........	Pointed.....
Bailey..........	Medium	3.	5.	....	Small..........	Round.......
on Cook...	Medium	4.5	3.4.5	6-7	Medium......	Pointed.....
on Peerless	Long...	5.	3 4 5	6-7	Large........	Pointed......
Barnett........	Short...	Tall..	....	....	Medium......	Round.......
on Cook...	Medium	4.5	3.	5-8	Medium......	Pointed......
on Peerless	Medium	4.	3.4.5	4-6-7	Medium......	Round.......
Cherry's Cluster	Medium	4.	3.5	....	Small..........	Round.......
on Cook...	Long...	6.7	3.	5-9	Small..........	Pointed......
on Peerless	Long...	7.	3.	6-7	Medium......	Pointed.....
W. A. Cook.....	Short...	Tall..	5.	....	Large........	Tapering.....
J. C. Cook*.....	Long...	4.	....	....	Small........	Round.......
on W.A.Cook*	Long...	4.6	3.5	3-6	Large........	Tapering.....
on Peerless..	Short...	4.5	3 5	8-10	Small........	Round.......
Dixon..........	Short...	Short.	3.5	Scatt'rd	Small........	Round.......
on Cook...	Long...	6.	3.5	7-12	Small........	Tapering.....
on Peerless	Medium	4 5	3 5	4	Small........	Round......
Gold Dust......	Long...	Short.	3.5	....	Small........	Round.......
on Cook...	Long...	5.6	3.	7-8	Medium......	Tapr'ng round
on Peerless	Long..	4.5	3 5	5-7	Medium......	Round.......
Herlong........	Long...	4.	3 4	....	Medium......	Round.......
on Cook...	Long...	5.6	3.	4	Long..........	Tapering.....
on Peerless	Short...	4.	3.5	6-8	Small........	Tapering.....
Hawkins' Imp.	Short...	Tall..	3.4.5	....	Large........	Round.......
on Cook...	Long...	5.6	3.5	5-6	Large........	Tapering.....
on Peerless	Long...	4.5	3.	7	Small........	Round.......
Hunnicutt......	Long...	Tall..	3.5	....	Large........	Pointed......
on Cook...	Long...	6.7	3.5	5	Medium.....	Tapering.....
on Peerless	Long...	4.6	3.5	3-4	Large........	Pointed......
Jones' Improved	Short...	3.	3.5	....	Medium......	Round.......
on Cook...	Long...	3.4	3.	5-8	Small........	Round.......
on Peerless	Long...	4.5	3.5	5-7	Small........	Round.......
Jones' L'g Staple	Long...	Tall..	3.	....	Large........	Pointed......
on Cook...	....	....	....	....	....	....
on Peerless	Long...	4.5	3 5	5-6	Medium......	Tapering.....
Keith..........	Short...	5.	3.5	....	Medium......	Round......
on Cook...	Long...	6.8	3.5	8-10	Large........	Tapr'ng round
on Peerless	Long...	3.4	3.	3	Small........	Round.......
T. J. King......	Long...	3.	3.5	....	Small........	Round.......
on Cook...	Long...	3.4	3.	3-4	Small........	Tapering.....
on Peerless	Long...	5.6	3.	5-6	Medium......	Tapering.....
Okra Leaf......	Medium	4.	3.5	5-7	Small........	Tapering.....
on Cook...	....	....	....	....	....	....
on Peerless	Long...	6.	3.5	5-7	Small........	Round.......
Peeler..........	Long...	Tall..	3.5	....	Medium......	Tapering.....
on Cook...	Average	4.5	3.	3-4	Small........	Tapering.....
on Peerless	Long...	6.7	3.4.5	5	Large........	Tapering.....
Peerless........	Long...	4.	4.5	....	Small........	Round.......
on Cook...	....	4.6	3.5	3-5	Large & small	Tapr'ng round

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* This type is probably a hybrid from a blending of the *G. nanking* or *sanguineum* on the upland types. The color of stalk and smooth, black seed indicate *G. nanking or sanguineum* and shape of leaves, bolls, etc., the upland type.

†Fiber adheres tenaciously to the boll rendering it troublesome to pick.

TABLE III—Continued.

’LANTS AND THE CROSSES PRODUCED.

Prolific or Non-prolific.	Color of Seed.	Length of Staple.	Time of maturity.	Remarks.
Prolific	Light brown	Long.	Medium	Seed large, furry.
Prolific	Light brown	Long.	Medium	Seed large, furry.
Prolific	Light brown	Long.	Medium	Seed large, furry.
Prolific	Black	Med.	Early	Seed small, smooth.
Prolific	Light brown	Long.	Medium	Seed large, furry.
Prolific	Light brown	Long.	Early	Seed large, furry.
Prolific	Light brown	Med.	Late	Seed medium, furry—limbs scarce.
Prolific	Light brown	Long	Medium	Seed medium, furry—limbs numerous.
Prolific	Dark brown	Short.	Medium	Seed small, furry—limbs numerous.
Prolific	Light brown	Short.	Early	Seed med., furry—resembles Peerless clust’d.
Prolific	Light brown	Long	Early	Clustered Seed med., furry—limbs num’ous.
Prolific	Light brown	Short.	Early	Seed medium, furry—limbs numerous.
Prolific	Light brown	Long.	Late	Seed large, furry.
Non-prolific	Dark brown	Short.	Vry late	Purple stem—Seed small, furry.
Average	Dark brown	Long	Medium	Seed medium, furry—limbs numerous.
Prolific	Dark brown	Long	Medium	Seed medium, furry—limbs numerous.
Prolific	Brown	Short.	Early	Seed medium, furry.
Prolific	Brown	Long	Early	Seed medium, furry—limbs numerous.
Non-prolific	Brown	Short.	Early	Seed medium, furry—limbs numerous.
Mod. Pr’lific	Brown	Short.	Early	Seed large, furry—limbs few—very yel. pol’n.
Prolific	Light brown	Long.	Early	Seed large, furry—limbs numerous.
Prolific	Light brown	Short.	Early	Seed large, furry—limbs numerous.
Prolific	Green	Short.	Early	Seed medium, furry—clustered.
Non-prolific	Light brown	Long.	Early	Seed large, furry—limbs numerous.
Prolific	Dark Green	Short.	Early	Seed medium, furry—limbs numerous.
Prolific	Light brown	Short.	Medium	Seed large, furry.
Prolific	Light brown	Short.	Medium	Seed small, furry—limbs numerous.
Prolific	Light brown	Short.	Medium	Seed small, furry—limbs numerous.
Prolific	Light brown	Short.	Late	Seed large, furry—limbs numerous.
Mod. Pr’lific	Light brown	Long.	Medium	Seed large, furry—limbs numerous.
Non-prolific	Light brown	Short.	Medium	Seed large, furry—limbs numerous.
Moderate	Light brown	Short.	Early	Seed medium, furry—limbs drooping.
Prolific	Light brown	Short.	Early	Seed large, furry—limbs numerous.
Prolific	Light brown	Short.	Early	Seed large, furry—limbs numerous.
Non-prolific	Light brown	Long.	Late	Seed large, furry—limbs straggling.
....	Light brown	.....	....	Cross failed.
Prolific	Light brown	Short.	....	Seed large, furry—limbs numerous.
Prolific	Light brown	Short.	Early	Seed large, furry—limbs few.
Prolific	Light brown	Long.	Early	Seed medium, furry—limbs numerous.
Non-prolific	Light brown	Long	Early	Seed medium, furry—limbs numerous.
Prolific	Brown	Short.	Early	Seed large, furry—limbs few.
Non-prolific	Brown	Short.	Early	Seed medium, furry.
Prolific	Dark Brown	Short.	Early	Seed medium, furry.
Prolific	Light brown	Med.	Early	Seed medium, furry.
....		......	....	Cross failed.
Prolific	Light brown	Short.	Early	Seed large, furry—limbs numerous.
Non-prolific	Brown	Long	Late	Seed large, furry—limbs straggling.
Non-prolific	Brown	Long.	Medium	Seed large, furry.
Non-prolific	Brown	Long.	Medium	Seed large, furry—limbs numerous.
Prolific	Light brown	Short.	Early	Two bolls at joints—seed large, furry, clust’d.
Non-prolific	Brown	Long.	....	Seed medium, furry.

TABLE III—Continued.

CHARACTERISTIC FEATURES OF ORIGINAL

Name of Cotton.	Length of Branches.	Height of Stalk in feet	Number of lobes to leaves	Number of bolls to each limb.	Size of bolls.	Shape of bolls.
Peterkin Imp'd.	Long...	Tall..	......	....	Small........	Round.......
on Cook...	Long...	3.4	3.	2-3	Small.......	Tapering.....
on Peerless	....	5.6	3.4.5	5-6	Large.......	Tapering......
Petit Gulf......	Long...	Tall..	5.	.. ...	Medium......	Tapering.....
on Cook...	Long...	4.	3.	3	Medium......	Tapering ....
on Peerless	Long...	6.	3.	4	Small........	Round.......
Rameses........	Long...	4.	......	....	Medium......	Round.......
on Cook...	Long...	4.5	5.	5-6	Small........	Round.......
on Peerless	....	4.	3.	4-5	Small	Tapering.....
Storm Proof † ..	Medium	Tall..	3.4.5	.....	Medium......	Pointed......
on Cook...	Long...	4.5	3.	2-3	Medium......	Pointed......
on Peerless	Long ..	4 5	3.5	4-6	Medium......	Pointed..... .
Southern Hope.	Long...	Tall..	4.5	....	Medium......	Pointed......
on Cook...	Long...	4.5	3.	3-5	Large & small	Pointed round
on Peerless	....	5.	3.	6-7	Small..... ..	Round.......
Sea Island......	....	6.	5.	5-6	Small	Pointed .....
Bamieh ‡	No limb	10.	5.	2-3	Long.........	Pointed .....
Afifi ‡..........	Short...	12.	3.5	3-4	Small........	Pointed. ....
Truitt	Long...	Av'ge	3.5	....	Small	Round.......
on Cook...	Very l'g	3.4	3.5	3	Small.......	Tapering.....
on Peerless	Long...	4.5	3.5	5-7	Small	Round.......
Welborn's Pet..	Short...	Tall..	4.5	....	Medium	Round ....
on Cook...	Medium	6.	3.5	3-4	Large.......	Pointed......
on Peerless	Long...	4.6	3.5	3-5	Small........	Round.......
Wonderful.	Long...	Tall..	3 5	....	Large........	Pointed......
on Cook...	Long...	4.6	3.	2-3	Large........	Pointed......
on Peerless	Long...	6.7	3.5	5-7	Large	Pointed......
Zellner.........	Long...	4.	3.5	....	Medium......	Round.......
on Cook...	Long...	5.6	5.	3	Small.......	Pointed .....
on Peerless	Long...	3.4	3.5	3-4	Small.......	Round.......

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‡ The cotton worm passed these plants by even after all other plants had been stripped of leaves.

TABLE III—Continued.

Plants and the Crosses Produced.—Continued.

Prolific or Non-prolific.	Color of Seed.	Length of Staple.	Time of maturity.	Remarks.
Non-prolific	Brown	Med.	Late	Seed medium, furry—plant straggling.
Non-prolific	Brown	Long	Early	Seed medium, furry.
Prolific	Brown	Short	Average	Seed medium, furry.
Non-prolific	Dark brown	Med.	Late	Seed medium, furry—plant straggling.
Non-prolific	Dark brown	Short	Late	Seed medium, furry.
Non-prolific	Dark brown	Short.	Late	Seed medium, furry.
Prolific	Brown	Short	Early	Seed large, furry.
Prolific	Brown	Short.	Early	Seed medium, furry.
Mod. Pr'lific	Brown	Short.	Early	Seed medium, furry.
Non-prolific	Brown	Med.	Late	Seed large, furry.
Non-prolific	Brown	....	Late	Seed large, furry.
Mod. Pr'lific	Brown	Long	Average	Seed large, furry—very little rust present.
Non-prolific	Brown	Long	Late	Seed large, furry—plant straggling.
Mod. Pr'lific	Brown	Short.	Average	Seed medium, furry.
Prolific	Brown	Long.	Average	Seed medium, furry.
Prolific	Black	Long.	Late	S'd sm'l, sm'h-lvs larg-b'ls 3 lob.—st'lks red'h.
Non-prolific	Black	Long	Late	S'd sm'l, sm'h-leaves larg'-bolls on main stem.
Non-prolific	Black	Long.	Late	Leaves large—seed small, smooth.
Prolific	Brown	Short	Average	Seed large, furry.
Non-prolific	Brown	Long.	Average	Seed medium, furry—limbs numerous.
Prolific	Brown	Short.	Average	Seed large, furry—limbs numerous.
Prolific	Brown	Short.	Early	Seed large, furry—clustered.
Non-prolific	Brown	Long	Early	Seed large, furry.
Non-prolific	Brown	Short.	Early	Seed large, furry—limbs numerous.
Prolific	Light brown	Long.	Late	Seed large, furry.
Non-prolific	Light brown	Long	Average	Seed medium, furry.
Prolific	Light brown	Long	Average	Seed large, furry—limbs numerous.
Non-prolific	Brown	Short.	Early	Seed large, furry.
Non-prolific	Brown	Long	Early	Seed small, furry.
Non-prolific	Brown	Long	Early	Seed small, furry—limbs numerous.

TABLE IV.

Number.	Name of Varieties containing male flowers supplying pollen.	Name of variety with female organ.	Length of bolls original varieties in inches.	Circumference of bolls original varieties in inches.	Number of carpels to boll—original varieties.	Length of boll on crossed plant—inches.	Circumference of boll on crossed plant—inches.
1	Mit Afifi				3		
2	Allen's Long Staple	Peerless	2.5	4.8	4		
3	Allen's Long Staple	Peerless					
4	Allen's Long Staple	Cook, W A					
5	Allen's Long Staple	Cook, W A				2.3	4.4
6	Bailey	Cook, W A	2.0	5.0	5	2.5	5.0
7	Bailey	Cook, W A					
8	Bailey	Peerless				2.5	4.5
9	Bailey	Peerless					
10	Barnett	Cook, W A	3.3	4.4	3	2.3	4.5
11	Barnett	Cook, W A				2.5	5.0
12	Barnett	Peerless					
13	Bamieh				3 4		
14	Cherry's Cluster	Cook, W A	2.1	4.3	5	2.5	4.8
15	Cherry's Cluster	Cook, W A					
16	Cherry's Cluster	Peerless				2.2	4.1
	Cook, W A		2.1	4.8	5		
17	Cook, J C	Cook, W A	2.1	4.3		2.4	4.8
18	Cook, J C	Cook, W A				2.4	4.9
19	Cook, J C	Peerless				2.1	4.0
20	Dixon	Cook, W A	2.1	4.5	5	2.5	5.0
21	Dixon	Cook, W A					
22	Dixon	Peerless				2.0	4.0
23	Gold dust	Cook, W A	2.0	4.1	5		
24	Gold dust	Cook, W A				2.4	5 2
25	Gold dust	Peerless					
26	Gold dust	Peerless					
28	Herlong	Cook, W A	2.3	4.7	5	2.4	4.7
29	Herlong	Cook, W A				2.5	4.9
30	Herlong	Peerless					
31	Herlong	Peerless					
32	Hawkins' Improved	Cook, W A	2.5	5.1	4	2.8	5 5
33	Hawkins' Improved	Peerless				2.3	3.7
34	Hunnicutt	Cook, W A	2.5	4.6	5		
35	Hunnicutt	Peerless				2 5	5.0
36	Jones' improved	Cook, W A	2.4	4.8	5	2.5	5.3
37	Jones' improved	Peerless				2.1	4.4
38	Jones' long staple	Peerless	2.3	4.8	5	2.1	4.3
39	Jones' long staple	Peerless				2.4	4.6
40	Keith	Cook, W A	2.0	4.3	4		
41	Keith	Cook, W A				2.3	4.5
42	Keith	Peerless				2.3	4.3
43	King, T J	Cook, W A	2.4	4.5	5	2.4	4.3
44	King, T J	Peerless				2 3	4.7
45	Nankin				3 4		

TABLE IV—Continued.

Number of carpels to boll on crossed plants.	Number of seed to boll—original variety.	Number of seed to boll—crossed plants.	Weight of seed original plants per boll—grammes.*	Weight of seed per boll crossed plants—grammes.*	Weight of fiber per boll original plants—grammes.*	Weight of fiber per boll crossed plants—grammes.*	Per cent of seed per boll original plants.	Per cent of seed per boll—crossed plants.	Per cent fiber per boll—original plants.
......	20	......	3.096	......	1.582	......	66.6	......	33 8
4	45	34	3.722	4.540	2.035	2.194	64.7	67.4	35.3
5	......	40	......	5.117	......	2.309	.....	69.0	......
5	......	43	......	4.283	......	2.210	......	66	......
5	......	39	.....	6.430	......	3.160	......	67.2	......
5	35	41	4.2578	6 132	2.4860	2.639	74.6	70.0	25.4
5	......	39	......	6.104	......	2.706	......	69.3	......
5	......	45	......	5.702	......	3.058	.....	65.4	......
5	......	42	......	5.707	......	2.704	......	67.8	......
5	27	42	3 115	4.779	1.737	2.859	64.2	67.9	35.8
4	......	35	....	5.175	......	2.090	......	71.2	......
5	.....	38	......	4.866	......	2.244	......	68.4	......
......	21	......	3.158	......	1.429	......	68.8	......	31.2
4	42	36	3.917	4.326	2.190	1.979	63.5	68.6	36.5
5	......	44	......	4.840	......	2.545	.....	65 5	......
4	......	36	......	4.090	......	1.950	......	67.7	......
5	42	......	5.675	......	2.740	......	67 4	......	32.6
5	......	44	......	4.556	......	2.993	65.5	60.4	34.5
5	......	44	......	4.866	......	2.399	......	66.9	......
4	......	35	......	4.363	......	1.793	......	70.9	......
5	44	35	5.1068	4.976	2.5456	2.363	66.8	67.8	33.2
5	......	40	......	5.817	......	2.421	......	70.6	......
5	.....	37	....	3.860	......	1.907	......	66.3	......
5	39	39	4.5850	4.841	2.1200	2.655	69.9	64.6	30.1
4	......	31	......	4.079	......	1.944	......	67.7	......
5	......	45	......	4.873	......	2.140	......	69.5	......
5	......	44	......	5.038	......	2.819	......	64.1	......
5	45	44	4.7900	5.892	2.4670	2.512	67.9	60.6	32.1
4	......	36	......	5 222	.....	2.578	.....	66.9	......
4	......	38	......	4.430	......	1.778	......	71.3	......
4	......	40	......	4.686	.. ..	2.093	......	69.1	......
5	41	43	1.670	7.020	1 096	3 557	60.3	66.3	39.7
5	......	43	......	5.260	......	2.346	......	69.2	......
4	42	34	5.4136	4.940	2.4518	2.120	69.2	69.8	30.8
5	......	47	......	6.471	......	2.846	......	69.5	......
5	30	41	4.570	5.340	2.470	2.289	62.6	70.0	37.4
5	......	42	......	5.240	.....	2.490	......	67.8	......
5	42	43	5.440	6.337	2.560	2.500	68.0	71.7	32.0
4	......	34	......	3.927	.....	1 992	......	66.2	......
4	35	34	4.1076	4.675	1.6756	2.062	69.9	69.4	30.1
5	......	40	......	4.984	......	1.870	......	72.7	......
5	......	42	......	6.766	......	3.376	......	66.7	......
5	45	38	2.490	4.656	1.530	2.007	61.4	69.7	38.6
5	......	34	......	4.724	......	2.228	......	67.9	......
......	......	36	4.067	......	1.838	......	68.9	......	31.1

TABLE IV—Continued.

Number.	Name of varieties containing male flowers supplying pollen.	Name of variety with female organ.	Per cent. fiber per boll—crossed plants.	Length fiber original plants expressed in inches—4 tests.	Diameter of fiber original plants in millim's—av.6 str'nd†	Length of fiber cros'd plants in inches—av. 6 strand.
1	Mit Afifi	.....	.....	1.30	0.013	.....
2	Allen's Long Staple	Peerless	32.6	1.30	0.020	1.3
3	Allen's Long Staple	Peerless	31.0	.....	.....	1.3
4	Allen's Long Staple	Cook, W. A.	34.0	.....	.....	1.4
5	Allen's Long Staple	Cook, W. A.	32 8	.....	.....	1.3
6	Bailey	Cook, W. A.	30.0	1.10	0.016	1.5
7	Bailey	Cook, W. A.	30.7	.....	.....	1.2
8	Bailey	Peerless	34.6	.....	.....	1.2
9	Bailey	Peerless	32.2	.....	.....	1.4
10	Barnett	Cook, W. A.	32.1	1.00	0.020	1.6
11	Barnett	Cook, W. A.	28.8	.....	.....	1.4
12	Barnett	Peerless	31.6	.....	.....	1.1
13	Bamieh	.....	.....	2.50 1.70	0.017	.....
14	Cherry's Cluster	Cook, W. A.	31.4	0 090	0.017	1.3
15	Cherry's Cluster	Cook, W. A.	34.5	.....	.....	1.2
16	Cherry's Cluster	Peerless	32.3	.....	.....	1.0
	Cook, W. A.	.....	.....	1 50	0.020	.....
17	Cook, J. C.	Cook, W. A.	39.6	0.75	0.020	1.5
18	Cook, J. C.	Cook, W. A.	33.1	.....	.....	1.2
19	Cook, J. C.	Peerless	29.1	.....	.....	1.4
20	Dixon	Cook, W. A.	32.2	0.75	0.020	1.4
21	Dixon	Cook, W. A.	29.4	.....	.....	1.3
22	Dixon	Peerless	33.7	.....	.....	0.9
23	Gold dust	Cooh, W. A.	35.4	0.75	0.014	1.2
24	Gold dust	Cook, W. A.	32.3	.....	.....	1.3
25	Gold dust	Peerless	30.5	.....	.....	0 9
26	Gold dust	Peerless	35.9	.....	.....	1.0
28	Herlong	Cook, W. A.	39.4	0.75	0.022	1.2
29	Herlong	Cook, W. A.	33 1	.....	.....	1.2
30	Herlong	Peerless	28.7	.....	.....	1.1
31	Herlong	Peerless	30.9	.....	.....	0.9
32	Hawkins' Improved	Cook, W. A.	33.7	0.87	0.020	1.1
33	Hawkins' Improved	Peerless	30.8	.....	.....	1.2
34	Hunnicutt	Cook, W. A.	30.2	1.00	0.020	1.4
35	Hunnicutt	Peerless	30 5	.....	.....	1.1
36	Jones' Improved	Cook, W. A.	30.0	0 90	0.014	1.1
37	Jones' Improved	Peerless	32.2	.....	.....	1.2
38	Jones' Long Staple	Peerless	28.3	1.25	0 020	1.2
39	Jones' Long Staple	Peerless	33.8	.....	.....	1.1
40	Keith	Cook, W. A.	30.6	1.00	0.020	1 2
41	Keith	Cook, W. A.	27.3	.....	.....	1.3
42	Keith	Peerless	33.3	.....	.....	1.4
43	King, T. J.	Cook, W. A.	30.1	0.70	0.018	1.0
44	King, T. J.	Peerless	32.1	.....	.....	0.9
45	Nankin	.....	.....	.....	0.018	0.9

TABLE IV—Continued.

Diameter of fiber crossed plants in millim's–av.6 str'nd†	Condition of twist original plants.	Condition of twist crossed plants.	Strength of fiber—original plants—grammes.‡	Strength of fiber crossed plants—grammes.‡	Degree of maturity of fiber—crossed variety.	Degree of maturity of fiber—original variety.
......	Fair.	......	14.2	......	......	Fair.
0.020	Fair	Very good	8.92	11.95	Good	Fair.
0.018	......	Good	......	11.04	Good	
0.018	......	Good	......	8.42	Good	
0.020	......	Fair	......	10.37	Good	
0.021	Fair.	Excellent	8.10	8.15	Very good	Fair.
0.019	......	Good	......	10.25	Good	
0.018	......	Poor.	....	8.19	Poor.	
0.018	......	Fair	......	8.45	Fair	
0.020	Fair.	Excellent	5.57	6.95	Excellent	Good.
0.020	......	Good	......	10.21	Good	
0.022	......	Excellent	......	14.57	Excellent	
......	Fair.	......	15.17	......	......	Fair.
0.020	Fair.	Excellent	14.75	13.08	Very good	Fair.
0.022	......	Excellent	......	10.51	Excellent	
0.020	......	Fair.	......	13 23	Good.	
......	Good.	......	7.59	......	......	Good.
0.013	Good	Fair	11.67	11.88	Good.	Good.
0.013	......	Fair	......	12.45	Good.	
0.021	......	Good	9.85	10.55	Good.	
0 018	Fair	Excellent	10.24	8.58	Excellent	Good.
0.014	......	Poor.	......	9.37	Poor.	
0.020	......	Fair.	......	9.23	Fair	
0.016	Fair	Fair.	10.74	13.04	Fair	Fair.
0.018	......	Poor.	......	13.03	Poor.	
0.020	......	Good	......	6.47	Good.	
0.016	......	Poor	......	13.83	Very poor	
0.021	Poor.	Fair	8.85	13.00	Good.	Fair.
0.016	......	Fair.	......	9.94	Fair.	
0.018	......	Fair.	......	8.42	Fair.	
0.017	......	Poor.	......	9.04	Poor.	
0.018	Fair	Poor.	4.31	9.75	Poor	Fair.
0.020	......	Excellent	......	10.89	Very good	
0.017	Very good	Good	7.89	7.86	Good.	Very good
0.021	......	Good	......	6.16	Very good	
0.018	Good	Poor.	9.75	6.57	Good.	Good.
0.020	......	Good	......	10.39	Very good	
0.020	Very poor	Good	7.55	11.71	Good.	Good.
0 020	......	Fair.	......	11.05	Fair	
0.020	Very fair.	Very good	7.12	7.08	Excellent	Good.
0.017	......	Fair.	......	8.89	Good.	
0.020	......	Very good	......	7.72	Good.	
0.018	Fair	Excellent	7.91	12.79	Good.	Fair.
0.014	......	Fair.	......	11.28	Fair.	
......	Very fair.	......	8.88	......	......	Good.

TABLE IV—Continued.

Number.	Name of Varieties containing male flowers supplying pollen.	Name of variety with female organ.	Length of bolls original varieties inches.	Circumference of bolls original varieties inches.	Number of carpels to boll—original varieties.	Length of boll on crossed plant—inches.
46	Okra leaf	Peerless	2.1	4.4	5	2.3
47	Peeler	Peerless	2.4	4.5	5	
48	Peeler	Peerless				
49	Peeler	Peerless				
50	Peeler	Cook,W A				2.5
51	Peerless	Cook,W A	2 3	4.8	5	2.3
52	Peerless	Cook,W A				2.6
53	Peterkin	Cook,W A	2.5	4.8	5	2.5
54	Peterkin	Peerless				
55	Petit gulf	Cook,W A	2.4	4 8	5	
56	Petit gulf	Peerless				2.4
57	Rust proof	Cook,W A	2.5	4.5		2 5
58	Rust proof	Peerless				
59	Rameses	Cook,W A	2 3	4 4		
60	Rameses	Cook,W A				
61	Rameses	Peerless				
62	Storm proof	Peerless				
64	Sea Island				4 3	
65	Southern hope	Peerless	2.6	4.8	5	2.0
66	Southern hope	Cook,W A				2 8
67	Southern hope	Cook,W A				2 4
68	Truitt	Peerless	2 4	4 8	5	2 5
69	Truitt	Peerless				2.5
70	Truitt	Peerless				
71	Truitt	Cook,W A				2 6
72	Welborn's pet	Cook,W A	2 1	4.5	5	2 4
73	Welborn's pet	Peerless				
74	Welborn's pet	Peerless				2 0
75	Wonderful	Peerless	2.5	4 3	5	2 0
76	Wonderful	Peerless				
77	Wonderful	Peerless				
78	Wonderful	Peerless				
79	Wonderful	Peerless				
80	Wonderful	Cook,W A				2 3
81	Zellner	Peerless	2 3	4 8	5	
82	Zellner	Peerless				2 0
83	Zellner	Cook,W A				2 5

TABLE IV—Continued.

Circumference of boll on crossed plant—inches.	Number of carpels to boll on crossed plants.	Number of seed to boll—original variety.	Number of seed to boll—crossed plants.	Weight of seed original plants per boll—grammes.*	Weight of seed per boll crossed plants—grammes.*	Weight of fiber per boll original plants—grammes*.	Weight of fiber per boll crossed plants—grammes.*	Per cent. of seed per boll original plants.	Per cent. of seed per boll crossed plants.	Per cent. fiber per boll—original plants.
4.8	4	31	37	2 852	4.933	1.857	2.630	60.6	65.3	39.4
......	5	43	44	4.860	6.443	2.322	2.784	67 6	69.9	32.4
......	5	......	41	......	5 939	......	2.297	......	72.1	......
......	4	......	39	......	4.988	......	2.216	......	69.2	......
4 9	5	......	40	......	6 382	......	2.252	......	73.9	......
4.4	4	42	33	3 217	4.607	1.751	1.941	64 8	70 4	35.2
4.8	5	......	41	......	5 245	......	2.765	......	65.5	......
4.4	4	45	39	3.826	4.944	2.499	2.159	60.3	69.7	39.7
......	5	......	43	......	4.945	......	2 630	......	65.3	......
......	5	42	43	5 897	4.216	2.751	2 507	68 2	62.7	31.8
4.8	5	......	44	......	4.276	......	3 214	......	57.1	......
5.1	4	41	33	5.340	5.026	2.706	2.076	66.3	70.8	32.7
......	4	......	33	......	4.608	......	2.396	......	65.8	......
......	5	34	43	2.417	4.910	1.029	2.460	70.2	66 6	29.8
......	5	......	44	......	5.610	......	2.755	......	67.1	......
......	4	......	32	......	4.129	......	1.802	......	69.6	......
......	5	45	48	5.8028	7 314	2.8880	3.237	68.9	69 3	31.1
......	......	15	......	2.023	......	0.658	......	......	......	29 3
4 4	4	40	36	4 975	4 068	2.239	1 838	68 9	73 4	31.1
5 2	4	......	37	......	4 070	......	1 612	......	71 6	......
4 8	5	......	44	......	6 149	......	2 842	......	68 4	......
4 3	4	33	36	5.029	5 439	2.419	2 258	67 6	70 7	32 4
4 1	4	......	35	......	5.183	......	2 3 5	......	68.8	......
......	5	......	37	......	5 197	......	2.580	......	68 1	......
4 6	5	......	43	......	5 670	......	2 454	......	68 9	......
5.0	4	34	35	1 312	5 193	0.890	1.926	59 6	73 1	40 4
......	5	......	43	......	5.238	......	2 316	......	68 5	......
4 4	4	......	38	......	4 123	......	1 394	......	74 7	......
4 2	4	42	33	5 415	5 624	2.423	2.320	69 0	71 8	31 4
......	4	......	34	......	5 010	......	2 575	......	64 7	......
......	4	......	38	......	5 344	......	2 660	......	66 8	......
......	4	......	34	......	5 397	......	2 338	......	68 6	......
......	5	......	40	......	5 154	......	2 490	......	67 4	......
5.0	4	......	33	......	4 574	......	2 118	......	68 3	......
......	5	33	42	5 015	5 349	1 837	1 900	73 8	73 8	26.8
4 3	5	......	47	......	5.294	......	2.610	......	66 4	......
5 1	5	......	41	......	4 916	......	1 653	......	74 8	......

TABLE IV—Continued.

Number.	Name of varieties containing male flowers supplying pollen.	Name of variety with female organ.	Per cent. fiber per boll—crossed plants.	Length fiber origi'al plants expressed in inches—4 tests.	Diameter of fiber original plants in millim's—av.6 str'nd†	Length of fiber cros'd plants in inches—av. 6 strand.
46	Okra leaf	Peerless	34.7	1.20	0 022	1 1
47	Peeler	Peerless	30 1	1.20	0.014	1.4
48	Peeler	Peerless	27.9	......	......	1.1
49	Peeler	Peerless	30 8	......	......	1.2
50	Peeler	Cook, W. A	26 1	......	......	1.4
51	Peerless.	Cook, W. A	29.6	0.87	0.020	1 4
52	Peerless.	Cook, W. A	34.5	......	......	1.3
53	Peterkin	Cook, W. A	30.3	1.00	0 020	1.4
54	Peterkin	Peerless	34.7	......	......	1.1
55	Petit gulf	Cook, W. A	37.3	1.00	0.020	0.9
56	Petit gulf	Peerless	42 9	......	......	0.9
57	Rust proof	Cook, W. A	29.2	......	0.014	1 1
58	Rust proof	Peerless	34.2	......	......	1.0
59	Rameses	Cook, W. A	33.4	0.87	0 025	1.2
60	Rameses	Cook, W. A	32.9	......	......	0.8
61	Rameses	Peerless	30 4	......	......	1.2
62	Storm proof	Peerless	30.7	1 00	0.020	1.4
64	Sea Island	......	......	1 50	0.017	......
65	Southern hope	Peerless	26 6	1.20	0 018	1 3
66	Southern hope	Cook, W. A	28 4	......	......	1 1
67	Southern hope	Cook, W. A	31 6	......	......	1 3
68	Truitt.	Peerless	29 3	0 90	0 014	1 0
69	Truitt.	Peerless	31 2	......	......	1 1
70	Truitt.	Peerless	31 9	......	......	1 1
71	Truitt.	Cook, W. A	31.1	......	......	1 2
72	Welborn's pet	Cook, W. A	26 9	0.90	0 014	1 4
73	Welborn's pet	Peerless	31 5	......	......	1 2
74	Welborn's pet	Peerless	25 3	......	......	0.9
75	Wonderful	Peerless	25.3	1 35	0 018	1.0
76	Wonderful	Peerless	35 3	......	......	1.2
77	Wonderful	Peerless	33.2	......	......	1 0
78	Wonderful	Peerless	31 4	......	......	1 2
79	Wonderful	Peerless	32 6	......	......	1 2
80	Wonderful	Cook, W. A	31 7	......	......	1.2
81	Zellner	Peerless	26.2	0.90	0.020	1 2
82	Zellner	Peerless	33 6	......	......	1 2
83	Zellner	Cook, W. A	25.2	......	......	1 4

TABLE IV—Continued.

Diameter of fiber crossed plants millim's–av.6 str'nd†	Condition of twist original plants.	Condition of twist crossed plants.	Strength of fiber original plants—grammes.‡	Strength of fiber crossed plants—grammes.‡	Degree of maturity of fiber—crossed variety.	Degree of maturity of fiber—original variety.
0.020	Very fair	Very good	7 12	11 32	Good	Fair
0.017	Fair	Very good	8 53	10.05	Good	Fair
0 017		Fair		8 43	Fair	
0.022		Good		10.97	Good	
0.018		Very good		10.06	Very good	
0.020	Very good	Good	10.42	11 56	Very good	Very good
0 017		Excellent		6 52	Very good	
0 020	Fair	Very good	7 33	9 24	Very good	Fair
0 022		Excellent		12.46	Excellent	
0 016	Very good	Good	7 77	11 96	Good	Very good
0.018		Good		13 04	Good	
0.020	Fair	Very good	11 02	7 90	Very good	Fair
0 022		Very good		12.58	Very good	
0 013	Fair	Fair	13 08	12 12	Fair	Good
0.018		Very fair		9.67	Very good	
0.016		Poor		6.96	Poor	
0.018	Very good	Very good	7.48	9 25	Very good	Good
	Very good		8 51	12.70‡		Very good
0.011	Very fair	Fair	10 26	12 05	Good	Good
0 017		Excellent		8 61	Excellent	
0 017		Very good		7.26	Good	
0.018	Poor	Fair	15.16	13 05	Fair	Poor
0 022		Fair		12.63	Fair	
0 021		Excellent		14 14	Very good	
0 014		Excellent		10 78	Excellent	
0 013	Good	Poor	7.34	7.03	Poor	Good
0 025		Fair		6 86	Fair	
0 037		Excellent		10.75	Excellent	
0 021	Very fair	Good		8 52	Good	Fair
0 020		Excellent	9.61	12.44	Excellent	
0.022		Excellent		11.28	Excellent	
0 014		Very good		9.31	Good	
0.017		Very good		10.79	Very good	
0 018		Good		8.26	Good	
0 016	Fair	Fair	12 43	16 12	Fair	Good
0 020		Good		9.65	Good	
0 021		Very good		11.56	Very good	

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* A gramme is equivolent to 15.4 grains.

† A millimeter is equivalent to 0.03937 of an inch.

‡ Results of cultivation at Auburn.

MICRO-PHOTOGRAPH, FIG. 10.

1. Afifi.
2. Bamieh.
3. Sea Island.
4. Nankin.
5. Bailey.
6. Okra Leaf.

These strands were taken at randum from the bolls, but rather indicate the average condition of the fiber in each instance. In the case of the Sea Island and Okra leaf, and the Bailey the character of the twist is excellent. The Afifi and Bamieh are not so well twisted, but the degree of strength to resist rupture compares very favorably with the others. With the exception of Nankin these are long staple cottons.

MICRO-PHOTOGRAPH, FIG. 11.

The figures in brackets () correspond to those found in first column in table on pages 30–37.

1. Hawkins' improved, *original form.*
2. Hawkins' improved crossed on W. A. Cook (32).
3. Hawkins' improved crossed on Peerless (33).
4. Hunnicutt, *original form.*
5. Hunnicutt crossed on W. A. Cook (34).
6. Hunnicutt crossed on Peerless (35).
7. Jones' improved, *original form.*
8. Jones' improved crossed on W. A. Cook (36).
9. Jones' improved crossed on Peerless (37).
10. Jones' long staple, *original form.*
11. Jones' long staple crossed on Peerless (38).
12. Jones' long staple crossed on Peerless (39).
13. Keith, *original form.*
14. Keith crossed on W. A. Cook (40).
15. Keith crossed on Peerless (42).
16. King, *original form.*
17. King crossed on W. A. Cook (43).
18. King crossed on Peerless (44).

Some of these strands have been untwisted to show more clearly the comparative widths and degree of maturity.

MICRO-PHOTOGRAPH, FIG. 12.

These figures in brackets () correspond to those found in first column in table on pages 30–37.

1. Herlong, *original.*
2. Herlong crossed on W. A. Cook (28).
3. Herlong crossed on Peerless (31).
4. Gold dust, *original.*
5. Gold dust crossed on W. A. Cook (23).
6. Gold dust crossed on Peerless (26).
7. Dixon, *original.*
8. Dixon crossed on W. A. Cook (21).
9. Dixon crossed on Peerless (22).
10. Cherry's cluster, *original.*
11. Cherry's cluster crossed on W. A. Cook (14).
12. Cherry's cluster crossed on Peerless (16).
13. Bailey, *original.*
14. Bailey crossed on W. A. Cook (7).
15. Bailey crossed on Peerless (8).
16. Allen's long staple, *original.*
17. Allen's long staple crossed on Peerless (3).
18. Allen's long staple crossed on W. A. Cook (4).

MICRO-PHOTOGRAPH, FIG. 13.

The figures in brackets () correspond to those found in first column in table on pages 30–37.

1. Southern hope, *original.*
2. Southern hope crossed on Peerless (65).
3. Southern hope crossed on W. A. Cook (67).
4. Truitt, *original.*
5. Truitt crossed on Peerless (68).
6. Truitt crossed on W. A. Cook (71).
7. Welborn's pet, *original.*
8. Welborn's pet crossed on W. A. Cook (72).
9. Welborn's pet crossed on Peerless (73).
10. Wonderful, *original.*
11. Wonderful crossed on Peerless (77).
12. Wonderful crossed on W. A. Cook (80).
13. Zellner, *original.*
14. Zellner crossed on Peerless (82).
15. Zellner crossed on W. A. Cook (83).

Fig. 14.

Size and shapes of bolls secured from the plants developed by the crossing experiments:

*1.	Afifi	1%
2.	Allen's long staple on W. A. Cook	4
3.	Allen's long staple on W. A. Cook	4
4.	Allen's long staple on Peerless	2
5.	Allen's long staple on Peerless	2
6.	Allen's long staple on W. A. Cook	5
7.	Allen's long staple on W. A. Cook	5
8.	Allen's long staple on Peerless	3
9.	Allen's long staple on Peerless	3
10.	Bailey on W. A. Cook	6
11.	Bailey on W. A. Cook	6
12.	Bailey on W. A. Cook	7
13.	Bailey on W. A. Cook	7
14.	Bailey on W. A. Cook	7
15.	Bailey on Peerless	8
16.	Bailey on Peerless	8
17.	Bailey on Peerless	9
18.	Bailey on Peerless	9
19.	Barnett on W. A. Cook	10
20.	Barnett on W. A. Cook	10
21.	Barnett on W. A. Cook	11
22.	Barnett on W. A. Cook	11
23.	Barnett on Peerless	12
24.	Barnett on Peerless	12
25.	Bamieh	13
26.	Bamieh	13
27.	Cherry's cluster on W. A. Cook	14
28.	Cherry's cluster on W. A. Cook	14
29.	Cherry's cluster on Peerless	16
30.	Cherry's cluster on Peerless	16
31.	Cherry's cluster on Peerless	16
32.	Cherry's cluster on Peerless	16
33.	Cherry's cluster on W. A. Cook	15
34.	Cherry's cluster on W. A. Cook	15
35.	J. C. Cook on Peerless	19
36.	J. C. Cook on Peerless	19
37.	J. C. Cook on W. A. Cook	18
38.	J. C. Cook on W. A. Cook	18
39.	J. C. Cook on W. A. Cook	17
40.	Dixon on W. A. Cook	20

129.	Truitt on Peerless	68
130.	Truitt on W. A. Cook	
131.	Truitt on W. A. Cook	
132.	Truitt on Peerless	69
133.	Truitt on Peerless	69
134.	Truitt on Peerless	70
135.	Truitt on Peerless	70
136.	Welborn's pet on W. A. Cook	72
137.	Welborn's pet on W. A. Cook	72
138.	Welborn's pet on Peerless	73
139.	Welborn's pet on Peerless	73
140.	Wonderful on Peerless	75
141.	Wonderful on Peerless	75
142.	Wonderful on W. A. Cook	80
143.	Wonderful on W. A. Cook	80
144.	Wonderful on Peerless	76
145.	Wonderful on Peerless	76
146.	Wonderful on Peerless	79
147.	Wonderful on Peerless	79
148.	Wonderful on Peerless	78
149.	Wonderful on Peerless	78
150.	Wonderful on Peerless	77
151.	Wonderful on Peerless	77
152.	Wonderful on Peerless	77
153.	Zellner on Peerless	81
154.	Zellner on Peerless	81
155.	Zellner on W. A. Cook	83
156.	Zellner on W. A. Cook	83
157.	Zellner on Peerless	82
158.	Zellner on Peerless	82

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* Numbers found on the plate.

% Numbers found on the table, pages 30–37, first column.

PLATE 15.

Open bolls with the fiber protruding in a condition to be picked for the gin. These bolls show distinctly the improvement resulting from crossing. In most instances the size has been perceptibly increased. The numbers over each boll correspond to those in column one in table on pages 30–37.

1. Afifi.
2. Allen's long staple on Peerless.

3. Allen's long staple on Peerless.
4. Allen's long staple on W. A. Cook.
5. Allen's long staple on W. A. Cook.
6. Bailey on W. A. Cook.
7. Bailey on W. A. Cook.
8. Bailey on Peerless.
9. Bailey on Peerless.
10. Barnett on W. A. Cook.
11. Barnett on W. A. Cook.
12. Barnett on Peerless.
13. Bamieh.
14. Cherry's cluster on W. A. Cook.
15. Cherry's cluster on W. A. Cook.
16. Cherry's cluster on Peerless.
17. J. C. Cook on W. A. Cook.
18. J. C. Cook on W. A. Cook.
19. J. C. Cook on Peerless.
20. Dixon on W. A. Cook.
21. Dixon on W. A. Cook.
22. Dixon on Peerless.
23. Gold dust on W. A. Cook.
24. Gold dust on W. A. Cook.
25. Gold dust on Peerless.
26. Gold dust on Peerless.
27. Green fiber.
28. Herlong on W. A. Cook.
29. Herlong on W. A. Cook.
30. Herlong on Peerless.
31. Herlong on Peerless.
32. Hawkins' improved on W. A. Cook.
33. Hawkins' improved on Peerless.
34. Hunnicutt on W. A. Cook.
35. Hunnicutt on Peerless.
36. Jones' improved on W. A. Cook.
37. Jones' improved on Peerless.
38. Jones' long staple on Peerless.
39. Jones' long staple on Peerless.
40. Keith on W. A. Cook.
41. Keith on W. A. Cook.
42. Keith on Peerless.
43. King on W. A. Cook.
44. King on Peerless.
45. Nankin.
46. Okra leaf on Peerless.
47. Peeler on Peerless.

48. Peeler on Peerless.
49. Peeler on Peerless.
50. Peeler on W. A. Cook.
51. Peerless on W. A. Cook.
52. Peerless on W. A. Cook.
53. Peterkin on W. A. Cook.
54. Peterkin on Peerless.
55. Petit gulf on W. A. Cook.
56. Petit gulf on Peerless.
57. Rust proof on W. A. Cook.
58. Rust proof on Peerless.
59. Rameses on W. A. Cook.
60. Rameses on W. A. Cook.
61. Rameses on Peerless.
62. Storm proof on Peerless.
63. "Scrub" on Peerless.
64. Sea Island.
65. Southern hope on Peerless.
66. Southern hope on W. A. Cook.
67. Southern hope on W. A. Cook.
68. Truitt on Peerless.
69. Truitt on Peerless.
70. Truitt on Peerless.
71. Truitt on W. A. Cook.
72. Welborn's pet on W. A. Cook.
73. Welborn's pet on Peerless.
74. Welborn's pet on Peerless.
75. Wonderful on Peerless.
76. Wonderful on Peerless.
77. Wonderful on Peerless.
78. Wonderful on Peerless.
79. Wonderful on Peerless.
80. Wonderful on W. A. Cook.
81. Zellner on Peerless.
82. Zellner on Peerless.
83. Zellner on W. A. Cook.

PLATE 16.

This plate represents a seed from each boll with its fiber adhering, but spread out so as to exhibit the relative length of each specimen. The figures correspond to those found in table on pages 30–37, first column:

1. Afifi.
2. Allen's long staple on Peerless.

3. Allen's long staple on Peerless.
4. Allen's long staple on W. A. Cook.
5. Allen's long staple on W. A. Cook.
6. Bailey on W. A. Cook.
7. Bailey on W. A. Cook.
8. Bailey on Peerless.
9. Bailey on Peerless.
10. Barnett on W. A. Cook.
11. Barnett on W. A. Cook.
12. Barnett on Peerless.
13. Bamieh.
14. Cherry's cluster on W. A. Cook.
15. Cherry's cluster on W. A. Cook.
16. Cherry's cluster on Peerless.
17. J. C. Cook on W. A. Cook.
18. J. C. Cook on W. A. Cook.
19. J. C. Cook on Peerless.
20. Dixon on W. A. Cook.
21. Dixon on W. A. Cook.
22. Dixon on Peerless.
23. Gold dust on W. A. Cook.
24. Gold dust on W. A. Cook.
25. Gold dust on Peerless.
26. Gold dust on Peerless.
27. Green fiber.
28. Herlong on W. A. Cook.
29. Herlong on W. A. Cook.
30. Herlong on Peerless.
31. Herlong on Peerless.
32. Hawkins' improved on W. A. Cook.
33. Hawkins' improved on Peerless.
34. Hunnicutt on W. A. Cook.
35. Hunnicutt on Peerless.
36. Jones' improved on W. A. Cook.
37. Jones' improved on Peerless.
38. Jones' long staple on Peerless.
39. Jones' long staple on Peerless.
40. Keith on W. A. Cook.
41. Keith on W. A. Cook.
42. Keith on Peerless.
43. King on W. A. Cook.
44. King on Peerless.
45. Nankin.
46. Okra leaf on Peerless.
47. Peeler on Peerless.

48. Peeler on Peerless.
49. Peeler on Peerless.
50. Peeler on W. A. Cook.
51. Peerless on W. A. Cook.
52. Peerless on W. A. Cook.
53. Peterkin on W. A. Cook.
54. Peterkin on Peerless.
55. Petit gulf on W. A. Cook.
56. Petit gulf on Peerless.
57. Rust proof on W. A. Cook.
58. Rust proof on Peerless.
59. Rameses on W. A. Cook.
60. Rameses on W. A. Cook.
61. Rameses on Peerless.
62. Storm proof on Peerless.
63. "Scrub" on Peerless.
64. Sea Island.
65. Southern hope on Peerless.
66. Southern hope on W. A. Cook.
67. Southern hope on W. A. Cook.
68. Truitt on Peerless.
69. Truitt on Peerless.
70. Truitt on Peerless.
71. Truitt on Peerless.
72. Welborn's pet on W. A. Cook.
73. Welborn's pet on Peerless.
74. Welborn's pet on Peerless.
75. Wonderful on Peerless.
76. Wonderful on Peerless.
77. Wonderful on Peerless.
78. Wonderful on Peerless.
79. Wonderful on Peerless.
80. Wonderful on W. A. Cook.
81. Zellner on Peerless.
82. Zellner on Peerless.
83. Zellner on W. A. Cook.
84. W. A. Cook.
85. Peerless.

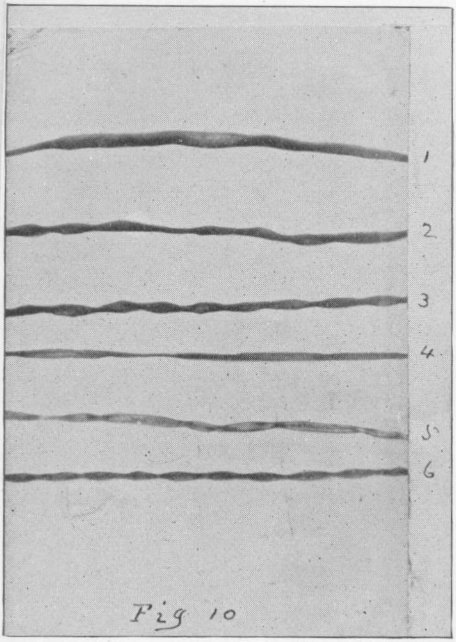

Fig 10

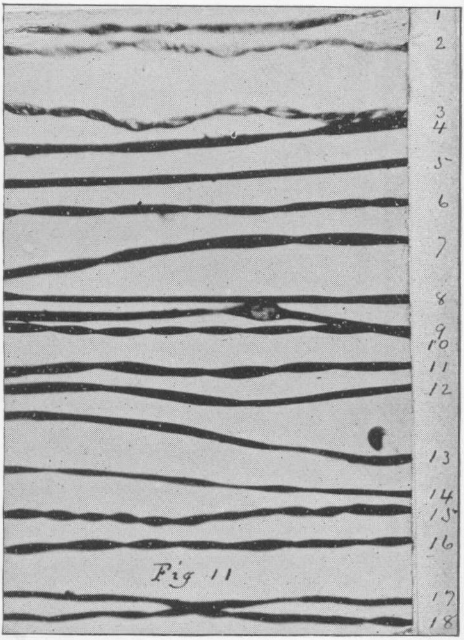

Fig 11

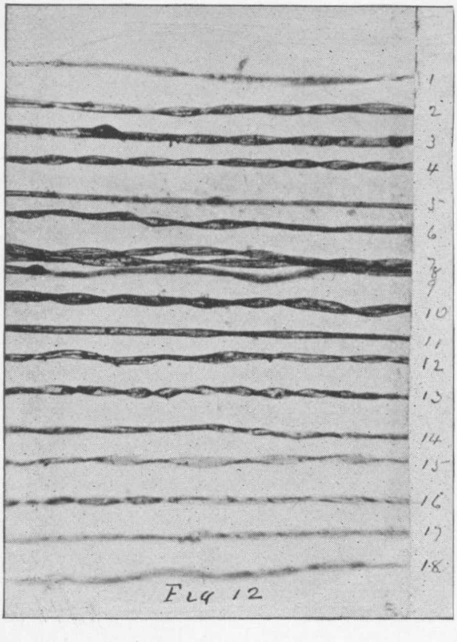

Fig 12

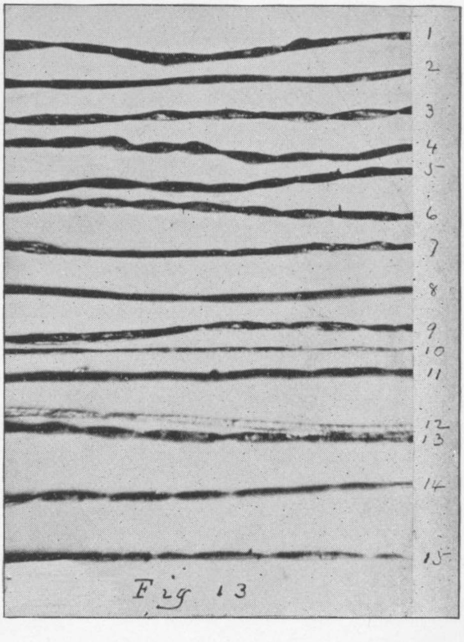

Fig 13

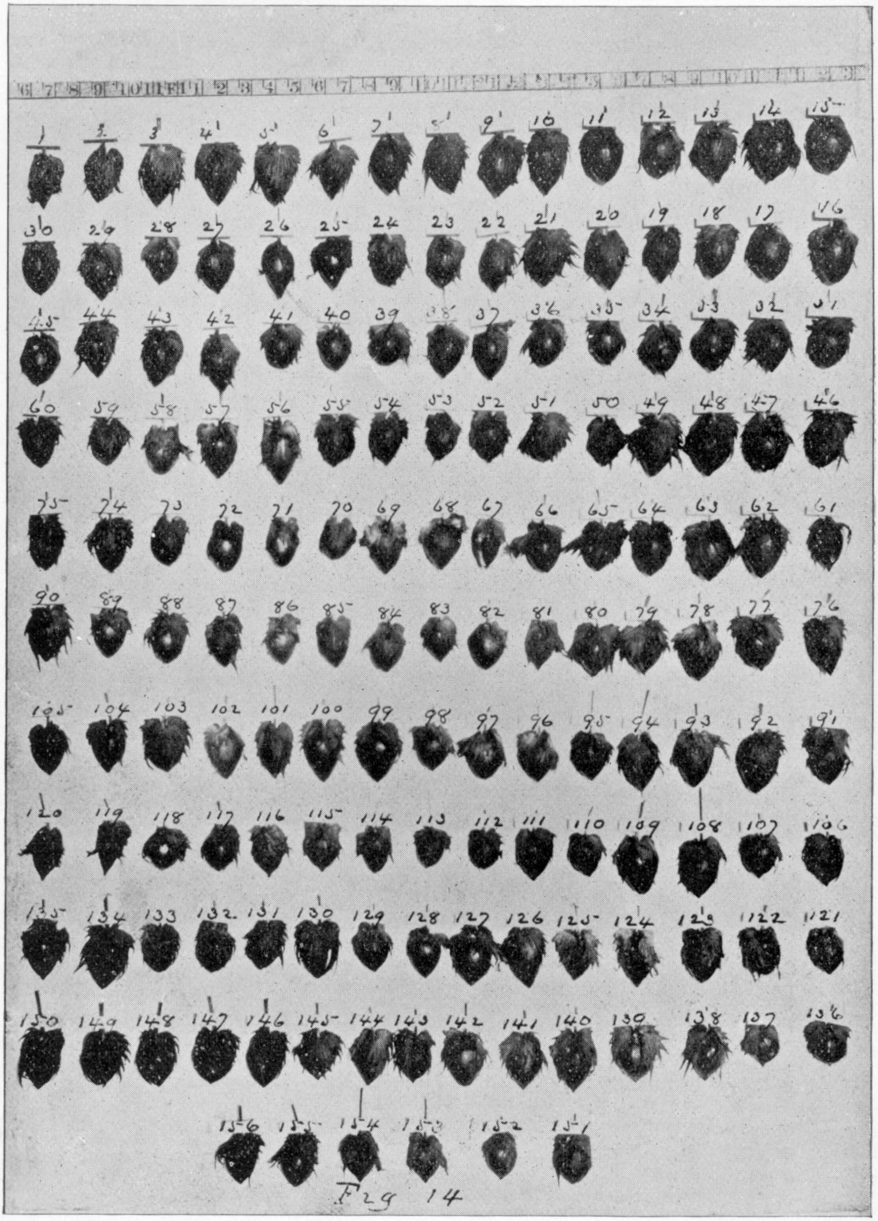
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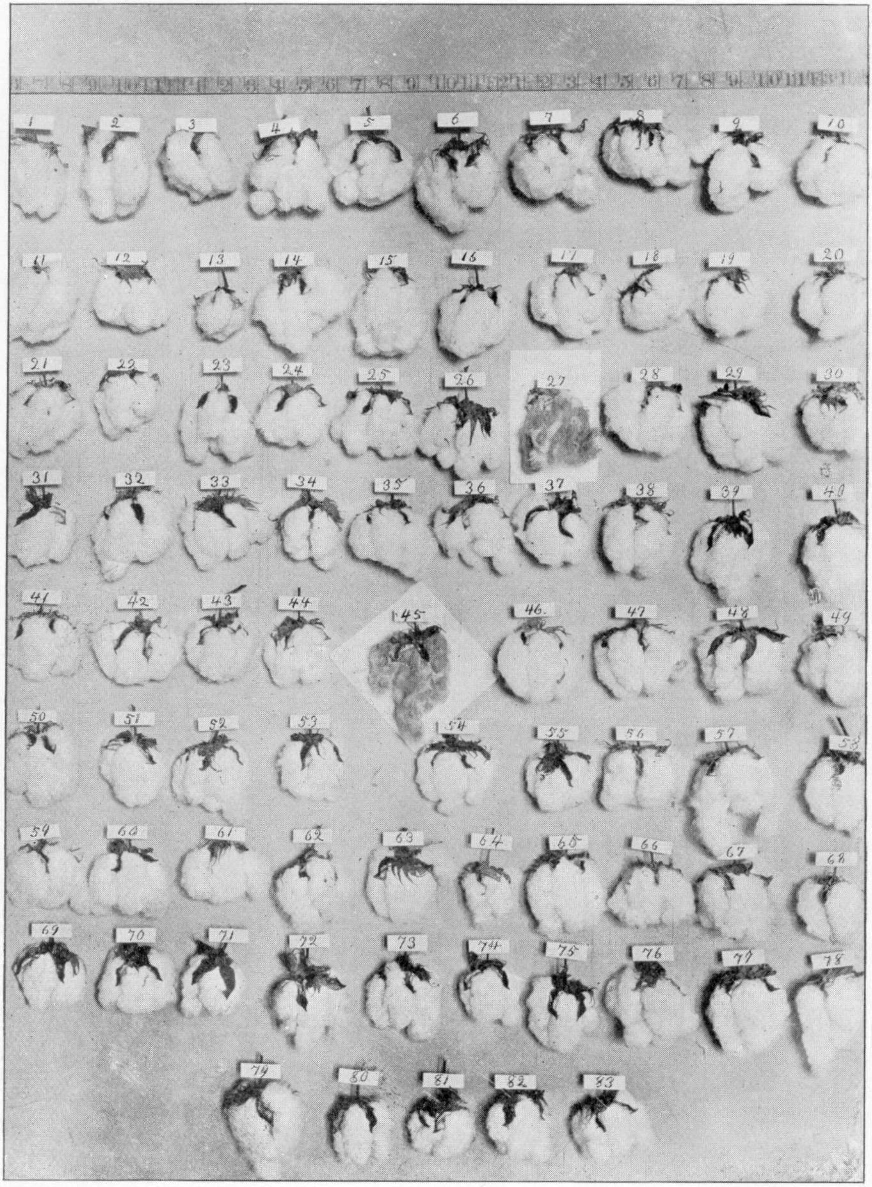
Fig 14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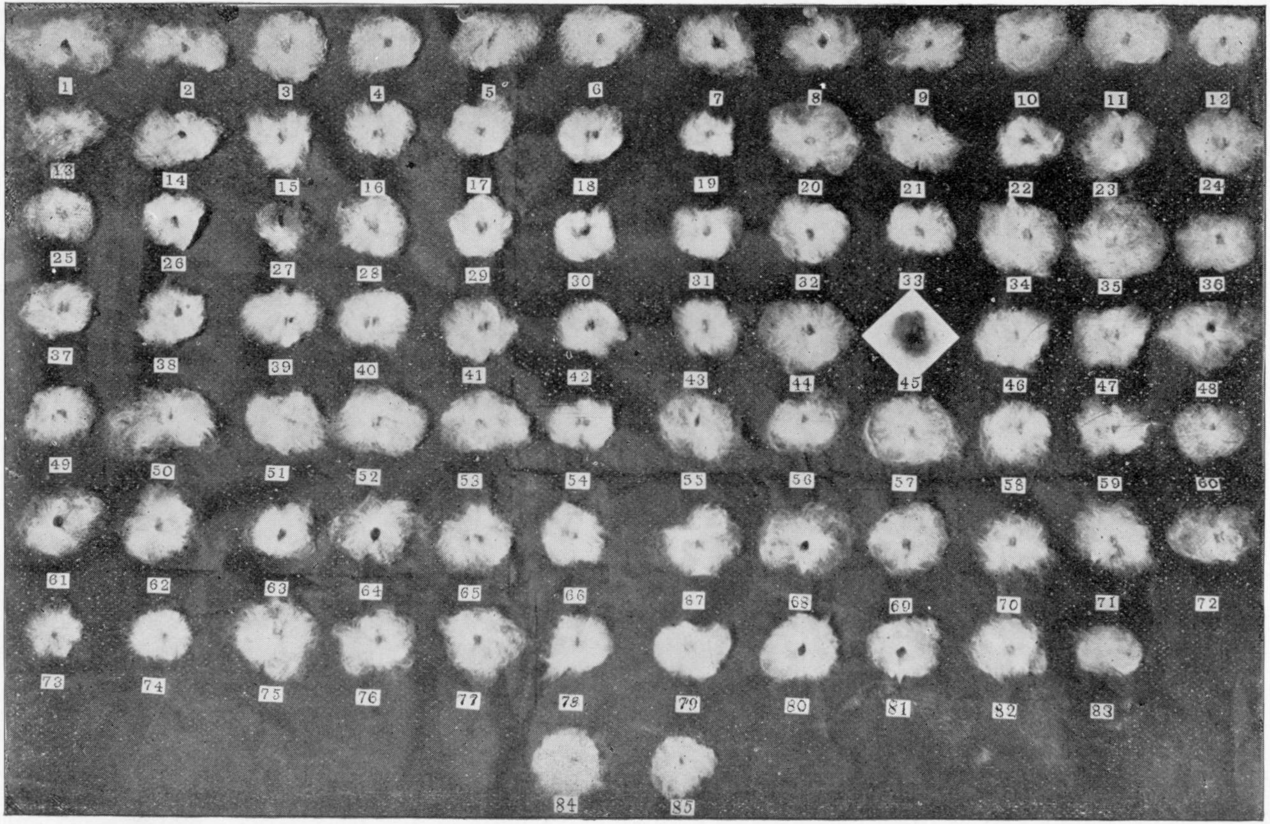
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Bulletin No. 57, : : May, 1894.

Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

Fertilizers Required by Cotton as Determined by the Analysis of the Plant.

J. T. ANDERSON.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

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ASSISTANTS:

FERTILIZER REQUIREMENTS OF COTTON.

AS DETERMINED BY THE ANALYSIS OF THE PLANT.

No question, perhaps, so nearly concerns the grower of cotton as that of fertilization. The small margin for profit in its cultivation makes it imperative that the southern farmer, who chooses to depend well nigh exclusively on the great staple for his livelihood, should cultivate it at the smallest possible cost. An indiscriminate and unintelligent use of fertilizers must be discarded, then, as early as possible, and the farmer should seek to inform himself as to what his soil needs in order to make it highly productive. Much that is valuable has been published on this subject, and many reliable experiments performed which seem to solve the question pretty effectually as far as the particular soils under consideration are concerned. By the application of various fertilizers in varying proportions the experimenter has been able to say that his soil needs this and that constituent in this and that amount, but he solves the question with any great degree of certainty *only* with reference to his own soil and those which resemble it in kind and climatic conditions. What is needed in South Carolina or Texas, for instance, may not be needed in Alabama, and what an east Alabama soil may be deficient in, may be found in sufficiency in a western Alabama soil. The great desideratum, therefore, is to find some method of determining soil requirements which admits of general application, or which may be readily and cheaply applied in individual cases. With the hope of being able, if possible, to make some small contribution toward the solution of this great problem, the work detailed in this bulletin was undertaken.

For the purposes of the experiments herein described two plots of ground were selected, whose soils are of the same general type, but are widely different in point of fertility. The soil of the Drake field is too poor for the profitable culture of cotton, while that of the Station garden has, by proper management, been brought into a high state of cultivation. The field plot stood idle the previous year, while the garden produced two crops. The last crop was a winter grass which was harvested just prior to breaking the soil for these experiments. In the preparation of this land all the stubble and roots, as far as possible, were removed by the rake after the ground was thoroughly broken up. Each piece of ground was divided into ten small plots, each 10x10 feet, and lying end to end. The garden strip was so located that there was a slight drainage in a transverse direction. In the Drake field, however, the peculiar conditions of the surface were such that, to secure uniformity of soil, the strip had to be so located that the drainage would be lengthwise, plot 1 being the higher. In all cases a space four feet wide was left between the plots. Three of the plots in each strip were left unfertilized, while to the other seven the three fertilizing constituents were applied, singly and in combination, as is set forth in Table I. In the final preparation of the soil and in the planting and cultivation of the cotton, all plots were treated alike.

The first set of samples for analysis were taken during the first week in June, when the plants were in the early flowering stage. The second set were drawn about the 1st of September, when the last blossoms were falling off, and the early bolls were beginning to open. The entire stalk above ground was taken, air dried, and prepared for analysis in the usual way.

It is proper to state here that all the field work for these experiments was done for the writer under the supervision of Mr. James Clayton, formerly assistant horticulturist of the station, to whom acknowledgments are due for valuable and painstaking services.

In Table I will be found the percentages of potash, phosphoric acid, and nitrogen in the plant in the flowering stage. The figures given are the means of a number of determinations, and are calculated to the dry substance, the moisture of each sample having been carefully determined in the usual way, by separated heatings and weighings until no further loss of weight occurred. In the same Table will be found the weight in ounces of the seed cotton gathered from each plot.

To make the results comparable the number of stalks in each plot were counted and the actual weights obtained were reduced to a uniform stand. It should be stated further that the stalks were not as thick in the plots as is usual, and none of them were located near the edge of the plots, the purpose being to allow the roots to have the full benefit of the fertilizers used.

TABLE I.

COTTON PLANT IN FLOWERING STAGE.

A glance at the figures in Table No. 1 will reveal several noteworthy facts. In the first place it will be observed that there is considerable divergence between the maximum and minimum percentages of two of the constituents. That the composition of the cotton plant, therefore, in relation to these ingredients at least, is subject to perceptible variation, cannot be doubted. For instance, the maximum percentage of potash in the Drake field is 50.8 % higher, and in the garden, 21.1 % higher, than the minimum in the same soil; while the maximum in the garden exceeds the minimum in the field by 98 %. The maximum of nitrogen in the field is 17 %, and in the garden 25.8%, higher than the minimum in the same soil; and the maximum in the garden, 28.2 %

Table I.

COTTON PLANT IN FLOWERING STAGE.

Plots.	FERTILIZERS USED.	Drake Field.				Station Garden.			
		Per cent. Potash.	Per cent. Phosphoric Acid.	Per cent. Nitrogen.	Oz. Seed Cotton.	Per cent. Potash.	Per cent. Phosphoric Acid.	Per cent. Nitrogen.	Oz. Seed Cotton.
1	None	2.154	0.839	3.390	3.75	3.444	0.861	3.455	35.63
2	Nitrate Soda		0.863	3.906	10.	3.287	0.829	3.976	73.43
3	Kainit	2.751		3.382	11.88	3.320	0.958	3.717	117.14
4	Acid Phosphate		0.781	3.837	34.	3.227	0.914	3.896	124.29
5	None	2.034	0.934	3.488	9.29	3.178	0.862	3.825	130.83
6	Nitrate Soda and Kainit	2.137	0.627	3.855	30.	2.981	0.805	3.831	120.
7	Nitrate Soda and Acid Phosphate	1.823	0.699	3.685	23.21	3.199	0.854	4.225	96.25
8	Kainit and Acid Phosphate	1.997	0.919	3.967	29.17	3.102	0.797	3.873	132.86
9	Nitrate Soda, Kainit, Acid Phosp.	2.547	0.830	3.645	37.50	3.611	0.860	4.347	145.34
10	None	2.238	0.886	3.645	12.50	3.106	0.805	4.149	141.25

higher than the minimum in the field. The *relative* variations between the extremes of phosphoric acid are greater than those in the case of nitrogen, but the absolute variations are small, and may possibly be traceable to accidental causes. It may not be amiss to state just here that a great deal of time and care were spent in the analytical work, that no errors might creep in to vitiate the results, and hence it can be confidently affirmed that the results given may be relied on. It is believed, however, that some individual stalks have exhibited peculiarities of composition, and such peculiarities might have been eliminated, perhaps, had a larger number of plants from each plot been available for analysis.

In the second place, we note that the character of the soil exercises a perceptible influence on the composition of the plant, at least as far as potash and nitrogen are concerned. Taking the means of the percentages of potash in the three unfertilized plots of each soil separately, we find that this mean in the garden soil is 51.4 % higher than the corresponding mean in the field soil. Making the same estimates for nitrogen, we find that the garden soil exceeds the field soil in this ingredient by 8.6 %. Here, as before, we cannot affirm any positive rule concerning phosphoric acid.

The original purpose of these investigations was to find out what effect, if any, the addition of fertilizing constituents to the soil would have on the relative proportions of these constituents in the plants themselves. With this purpose before us let us examine Table I in detail. In the results from the Drake field soil, we see that the highest percentage of potash is in plot 3, and the next highest in plot 9, to both of which plots potash was added. On the other hand, the second lowest percentage is in plot 8, which also was fertilized with potash. It will be noticed that this plot seems eccentric in another particular—in that it contains the highest percentage of nitrogen, when no nitrogen was applied to it. With this exception, the highest percentage of nitrogen is found in plot 3 which has nitrogen fertilization, and the lowest percentage where nitrogen was used, is higher than the average of those where no nitrogen was added, even when the high percentage of plot 8 is included in the estimate. As has already been noted, the variation in phosphoric acid seems to obey no rule, the percentages in the two soils being practically the same.

In the beginning of this discussion it was stated that the garden soil was in a high state of cultivation to begin with, and it was to be expected, that the influence of fertilizers here, both on the composition of the plant and on the yield of seed cotton, would be less strongly marked than in the poorer soil. While this is the case, it is, also, true that by fertilization with potash and nitrogen the percentages of these constituents even here are increased. This is notably true in plot 9, where all three fertilizers were applied and where are found the highest percentages of these ingredients.

The average effect of fertilization on the percentages of the fertilizing constituents in the plants may best be seen by reference to Table II. By the term "fertilization" in this table is to be understood the use of the particular ingredient in question, without reference to the other ingredients. Thus when percentages of potash are considered, fertilization with potash without reference to phosphoric acid or nitrogen is solely considered.

Table II.

GENERAL SUMMARY.

	Drake Field.			Station Garden.		
	Fertilization.			Fertilization.		
	With-out	With	% In-crease by	With-oui	With	% In-crease by
Potash............	2.062	2.356	14.25	3.240	3.254	0.43
Phosphoric Acid...	.828	.807	—2.53	.853	.856	0.35
Nitrogen..........	3.618	3.773	4.28	3.819	4.095	7.23

It will thus be seen that by fertilization with potash, the average percentage of that constituent in each soil is increased. This increase is large in the poor soil and small in the rich. Fertilization with nitrogen, also, has a well marked influence on the percentages of that constituent, as the above table shows.

The results that we have hitherto been considering were obtained from the analysis of the plant in the early flowering stage. It was deemed expedient to analyze the plant in a later stage, also, and so about three months after the first samples were taken, when the plant was full of unopened bolls, the second lot were drawn. One of the purposes of this investigation was to see if the percentages of potash, phosphoric acid, and nitrogen in the plant did not increase with the yield of cotton. This could hardly be otherwise, if the seed were ground up with the stalk, inasmuch as the seed are a reservoir, so to speak, in which these constituents accumulate. Hence it was thought best not to include the young, inmature seed in the sample for analysis, and they were accordingly rejected. The results of the analysis are given in Table III following, which is constructed after the model of Table I. Here, as in the other, the results are calculated to the dry substance.

Table III.

ANALYSIS OF PLANT IN THE BOLLING STAGE.

Plots.	FERTILIZERS USED.	DRAKE FIELD.				STATION GARDEN.			
		Per cent. Potash.	Per cent. Phosphoric Acid.	Per cent. Nitrogen.	Oz. Seed Cotton.	Per cent. Potash.	Per cent. Phosphoric Acid.	Per cent. Nitrogen.	Oz. Seed Cotton.
5	None........	1.256	.788	1.883	9.29	2.538	.758	2.352	130.83
6	Nitrate Soda and Kainit	2.123	.345	1.969	30.	2.026	.741	2.436	120.
7	Nitrate Soda and Phosphoric Acid.	1.051	.537	1.883	23.21	1.494	.688	2.064	96.25
8	Kainit and Phosphoric Acid......	2.119	.488	1.841	29.17	2.751	.900	2.442	132.86
9	Nitrate Soda,Kainit, Phosp. Acid..	2.562	.557	1.833	37.50	3.054	.696	2.339	145.34
10	None	....	......	......	12.50	2.683	.724	2.273	141.25

A conspicuous fact observable in the above table is that the figures here are smaller than the corresponding figures in the first table. This was to be expected. The plant at this stage of growth is nearing maturity, and the three important constituents are being rapidly stored up in the seed.

Studying the table in detail, we find that in the Drake field the lowest percentages of potash are in 5 and 7, where there was no potash fertilization, while the highest is in 9, where there is complete fertilization and where there is, also, the highest yield of cotton. As we shall see a little later, the average of the percentages of potash in plots in the field which have potash fertilization, is about the same as that in the richer soil of the garden. Singularly enough we have in 9 one of the lowest percentages of nitrogen, but the other two nitrogen-fertilized plots bring up the average, and with this constituent, as with potash, we have an increase of percentages due to fertilization. We must observe, however, the small variation between the maximum and minimum in this column.

Coming now to the garden plot we find that the average effect of potash fertilization is to increase the percentages of potash, while, on the other hand, nitrogen fertilization does not seem to have a like effect on the percentages of nitrogen. This would seem to indicate that the garden soil contains a deficiency of potash, but a sufficiency of nitrogen.

The results on phosphoric acid are worthy of special attention. With a single exception the percentages of this constituent in the Drake field in the bolling stage, are decidedly lower than the corresponding ones in the flowering stage, while no such marked change is observable in the garden percentages. It would seem, therefore, that there is a deficiency of available phosphoric acid in the Drake field, which was not shown by the analysis at the earlier stage, and further, that there is no such deficiency in the garden soil. The exceptional case referred to is in 5, where the percentage of phosphoric acid is only a little smaller than the average found in the earlier stage. This fact, taken in connection with that of a high percentage of nitrogen and a low yield of cotton, might suggest the possibility of a case of arrested development. It will be observed that with rare exceptions the percentages of all the constituents are higher in the garden than they are in the field, and from this the conclusion may be drawn that there is a deficiency of potash, phosphoric acid, and nitrogen in the field. The smaller yield of cotton in the field strengthens this conclusion.

Table IV following, gives the summary of results contained in Table III, and is submitted without comment.

Table IV.

GENERAL SUMMARY.

	DRAKE FIELD			STATION GARDEN.		
	FERTILIZATION.			FERTILIZATION.		
	With out	With	% Increase by	Without	With	% Increase by
Potash	1.154	2.268	96.53	2.238	2.610	16.62
Phosphoric Acid	5.66	.527	—6.89	.741	.761	2.70
Nitrogen	1.862	1.895	1.77	2.356	2.280	—3.22

For convenience of comparison and study, it has been thought advisable to present Table V following, which is a consolidation of Tables I and III.

It will be seen from this table that the percentages of the constituents in the bolling stage are smaller in most instances than the corresponding percentages in the flowering stage. It will be convenient to refer to this decrease in values in per cents of those of the earlier stage. In the Drake field we find the decrease in potash in No. 6 to be 0.7 %, and in Nos. 8 and 9, there is an increase of 6.1% and 0.6 % respectively; while in the other two plots the decrease is 38.2 % and 42.3 %. It will be observed, also, that the largest yields of cotton are in plots 6, 8, and 9. From this it would seem that in the potash-fertilized plots there is a sufficiency of that constituent under the circumstances here existing. On the other hand, comparing the field and garden, we find that while the latter has much higher percentages of potash to begin with, it has at the same time larger per cents of decrease than the potash-fertilized plots in the field, ranging from 11.3 % in plot 8 to 53 % in plot 7. In other words, with a larger supply there is a smaller excess of potash over the demands for that constituent. Little can be learned from the figures relating to phosphoric acid. The decrease ranges from 0.8 % in plot 6 in the garden to 46.9 % in plot 8 in the field. The decrease in the values of nitrogen is uniformly high, showing the great demand for that valuable constituent. In the field the range is from 46 % in plot 5 to 53.6 % in plot 8, while in the garden it runs from 36.4 % in 6 to 51.1 % in 7.

A few words with reference to the yield of cotton in passing. A reference to Table I will show that in the unfertilized plots 1, 5, and 10 in each soil the yield is not the same, but is lowest in 1 and highest in 10. This suggest that all the plots are not uniformly fertile, but increase in fertility from 1 to 10. This lack of uniformity in natural fertility, will, of course, effect the results obtained by artificial fertilization, but the effect of the latter on the yield is noticeable, just as it was on the composition of the plant. By a study of Table V we find that where we have high percentages of two or more constituents in the flowering stage, and a relatively low decrease of those percentages in passing to the bolling stage, we have, generally speaking, a large yield. On the other hand, low, or even average, percentages in the early, and a large decrease of the same in the later stage, showing an insufficient supply from the soil, means a relatively low yield. The application of this rule,

Table V.

Plot	FERTILIZERS USED.	DRAKE FIELD.							STATION GARDEN.						
		Potash		Phosphoric Acid		Nitrogen		Seed cott'n	Potash		Phosphoric Acid		Nitrogen		Seed cott'n
		Flower-ing	Bolling	Flower-ing	Bolling	Flower-ing	Bolling		Flower-ing	Bolling	Flower-ing	Bolling	Flower-ing	Bolling	
5	None......................	2.034	1.256	0.934	0.788	3.488	1.883	9.29	3.178	2.538	0.862	0.758	3.825	2.352	130.8
6	Nitrate and Kainit..........	2.137	2.123	0.627	0.345	3.855	1.969	30.	2.981	2.026	0.805	0.741	3.831	2.436	120.
7	Nitrate and Phos. Acid	1.823	1.051	0.699	0.537	3.685	1.883	23.21	3.199	1.494	0.854	0.688	4.225	2.064	96.3
8	Kainit and Phos. Acid......	1.997	2.119	0.919	0.488	3.967	1.841	29.17	3.102	2.751	0.797	0.900	3.873	2.442	132.9
9	Nitrate, Kainit, Phos. Acid..	2.547	2.562	0.830	0.557	3.645	1.833	37.50	3.611	3.054	0.860	0.696	4.347	2 339	145 3
10	None......................	......	......	......	......	......	......	......	3.106	2.683	0.805	0.724	4.149	2.273	141.3

if it be a rule, to plot 5 Drake field may explain the low yield of cotton there, a deficiency both of potash and of nitrogen being manifest. Likewise in plot 7, Station garden, we find a large decrease in the percentages of all three constituents, although two of them have been added to the soil, and here, also, we find a relatively low yield.

In connection with this work, it has been thought well to make a complete analysis of the two soils. In view of the fact of their similarity geologically, both being classed as light sandy soils, and the additional fact that one is very poor and the other rich, a comparison of their chemical composition will be interesting.

CHEMICAL ANALYSIS OF SOILS.

	DRAKE FIELD.	STATION GARDEN.
Moisture	.650	.825
Insoluble Silica	94.790	93.097
Soluble Silica	.532	.560
Alumina	1.153	1.873
Oxide Iron	.850	1.093
Lime	.185	.260
Magnesia	.158	.122
Soda	.268	.315
Potash	.098	.087
Phosphoric Acid	.087	.064
Nitrogen	.069	.086
Organic Matter	1.550	2.195
Humus	.580	.863
Available Inorg. Matter	.647	.946
Humus Silica	.253	.353
Humus Phosphoric Acid	.020	.035

As will be observed, both soils have a high percentage of insoluble silica, that of the field exceeding that of the garden nearly two per cent. Oxide of iron in the hydrated condition is believed by some to increase in soils the absorptive power of gases, and particularly, of moisture. Both of our soils are low in this constituent, with the advantage in favor of the garden. Estimated in terms of the poorer soil, the garden soil is 28.6 % higher in oxide of iron than the other. If the minimum limit assigned to lime in light sandy soils by writers on this subject be correct, both of these have a sufficiency of this valuable constituent, the garden having 40.5 % more than the field. In both potash and phosphoric acid; on the other hand, the garden soil is poorer, about 1 % in the former and 26.4 % in latter. What has just been said applies to *total* phosphoric acid. The humus phosphoric acid, all of which is believed to be readily available to the plant, is 75 % higher in the garden than in the field. In total available inorganic matter—that which dissolves out with the humus—the garden soil is 46 % richer than the field soil.

It will thus be seen that the garden soil in the main is richer in the important inorganic constituents than the other soil; but it is believed that its superior fertility is chiefly due to its larger proportion of organic matter. In total organic matter it is 41.6 %; in humus, 48.8 %; and in total nitrogen, 24.8 % richer than the other.

CONCLUSIONS.

It is not safe to base conclusions on a single series of experiments. Further investigations may make it necessary to alter some of the opinions suggested in this paper, and some of these conclusions here may have to be withdrawn, but it is believed that the broadest conservatism will sanction the following conclusions from the results herein presented:

1. That the composition of the cotton plant in respect to potash, phosphoric acid, and nitrogen, is subject to decided variations under varying conditions.
2. That the nature of the soil exerts a considerable influence on the composition of the plant, a rich soil giving higher percentages of the three important constituents than a poor soil.
3. By fertilizing with either of the three constituents in soils not already containing a sufficiency of the same, it is possible to increase the percentage of that constituent in the cotton plant which is grown on such soil.
4. That humus in the soil is of great value, not only in supplying organic constituents, but, also, in holding inorganic constituents in most available conditions.

It is not claimed that the results herein described *demonstrate* the utility of this method as a means of determining soil requirements for cotton, but it is claimed that they are highly suggestive. If the normal composition of the healthy, thrifty plant under given soil conditions be known, we believe it possible to determine when a deficiency of any of the three constituents exists in a given soil. Systematic determinations, therefore, of the composition of the cotton plant under normal healthy conditions, together with determinations of the chemical composition and the physical properties of the producing soil, will furnish a basis, it is believed, for the establishment of a plan of investigation which will prove of great value to the agricultural interests of the South.

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Agricultural Experiment Station

—OF THE—

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN, : : ALABAMA.

Paris Green; Composition and Adulterations.

B. B. ROSS, State Chemist.

☞The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Ala.

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INSECTICIDES.

COMPOSITION AND ADULTERATION.

The employment of insecticides in combating and checking the ravages of the cotton worm, has been generally practiced in the cotton growing sections of the South for many years, and where proper precautions have been observed, with undoubted success.

The materials which are almost exclusively utilized by the cotton planter as insect poisons are Paris Green, and London Purple, though the consumption of the former far exceeds that of the latter.

While these substances have been so generally employed for such a long period of time, but little attention has been paid to the quality and purity of the materials purchased for use as insecticides, and it is not at all surprising that frauds and adulterations are occasionally found upon the market.

With a view to determining whether or not such adulterations or falsifications had been practiced upon goods of this class for sale in this State, an attempt was made to secure samples of Paris Green and London Purple from all sections of the State. A large number of circular letters, calling for samples of these insecticides, were sent out to parties in all portions of the State, and it was expected that quite a number of specimens would be obtained in this way. But few replies, and still fewer samples were received, however, and the investigation has consequently been more limited in scope than was originally intended.

With one exception, the samples came from the "black belt," where the employment of Paris Green, has been much more extensive than on the hill lands; in fact in some of the hill counties, it has been found impossible to secure Paris Green in the market. Not a single sample of London Purple, could be obtained, a circumstance that indicated that this insecticide was even less in demand than was the case several years since.

Commissioner H. D. Lane, through Maj. T. J. Key, very kindly co-operated in securing additional samples of Paris Green, and these with the samples already on hand enabled the formation of a fair estimate of the character and quality of the insecticides on the market in Alabama.

The substance sold under the name "Paris Green" is, chemically considered, an aceto-arsenite of copper, and is known in the arts and to the trade under quite a variety of names, such as, "Emerald Green," "Mitis Green," "French Green," "Schweinfurt Green," etc.

The last named term (derived from the place of it's first manufacture) is the designation most frequently given to it in Europe, it being there used largely as a pigment on account of it's brightness of color.

Scheele's green, the simple arsenite of copper, is frequently confounded with Paris Green, but it is distinguished from the latter by its duller color and the entire absence of acetic acid, which is a characteristic constituent of a genuine Paris Green.

One of the methods formerly employed in the preparation of Paris or Schweinfurt Green involved the simple treatment of the crude and freshly precipitated Scheele's green (copper arsenite) with wood vinegar, from which source the acetic acid of the final product was derived.

The process as first devised by Russ & Sattler in 1814, was kept secret for a long period, but after the investigation of its composition by Liebig, its manufacture became more extended.

In the method generally adopted for the preparation of this substance, arsenious acid (white arsenic) and acetate of copper (verdigris) are employed; both are dissolved separately in hot water, and the boiling solutions are mixed together, the precipitated coloring matter being allowed to settle.

Paris Green is normally a bright crystalline powder, insoluble in water, but changing in color when boiled with water for some time. According to Ehrmann, the composition of pure Paris Green is as follows:

Copper oxide	31.29
Arsenious acid	58.65
Acetic acid	10.06

The purest grades of Paris Green, however, show at least slight variations from the proportions given above, and it is quite difficult to fix an absolute standard for the composition of products of this character.

Paris Green, which is intended for use as an insecticide, however, should contain at least 50 per cent. of combined arsenious acid, and any purchasers of this article who are in doubt as to its purity or quality can have the same tested by forwarding a sample to this Laboratory.

The following is the result of the examination of the samples of Paris Green received at this Laboratory:

		Arsenious acid.
No. 1.	From Hale Co., forwarded by Mr. B. L. Garber	55.42
No. 2.	From Wilcox Co., forwarded by Mr. S. M. Cathcart	55.01
No. 3.	From Montgomery, forwarded by Dept. of Agriculture	59.71
No. 4.	From Montgomery, forwarded by Dept. of Agriculture	53.13
No. 5.	From Montgomery, forwarded by Dept. of Agriculture	57.38
No. 6.	From Eimer & Amend, New York	54.15
No. 7.	From Tallapoosa county	none.

Samples one to six inclusive, possessed the bright green color characteristic of a genuine Paris Green, and their mechanical condition was all that could be desired.

The proportions of arsenious acid are also well above the limit previously referred to (50%), and no traces of adulteration or attempts at adulteration were detected.

Sample No. 7, although of nearly the same shade of color as a normal Paris Green, was nevertheless so lacking in the brightness of tint which characterizes the genuine article that it was at once regarded with suspicion. A qualitative examination, carefully conducted, showed an entire absence of both copper and arsenic, not the least trace of the latter being discoverable by the employment of the most delicate tests. Quite a number of tests were next made for all the green coloring agents of importance, but with negative results, and it was then decided that the color of the material was due to a combination of blue and yellow coloring matters.

A further examination revealed the presence of Prussian Blue and chrome yellow, intimately mixed with each other, and well incorporated with a large quantity of inert materials, such as clay, chalk, etc.

On taking a small portion each of Prussian Blue and Chrome Yellow and mixing with a large quantity of clay or chalk, it was found that a product corresponding almost precisely in color to the material examined, could be produced, and it was found quite easy to imitate the normal shade of color of Paris Green, though, as before stated, the brightness of tint, would be lacking. It was estimated that a material of this character could be manufactured at a cost not exceeding one cent per pound, while a high grade Paris Green frequently costs above twenty cents per pound, the fraudulent manufacturer being thus able to dispose of his product at an enormous profit.

Of course, such a preparation as this is entirely worthless as an insecticide, and planters using such an article, and not being aware of its character, would probably be thereafter prejudiced against the use of insect poisons in any shape or form.

As before stated, the true character and quality of an insecticide can be readily ascertained by analysis, and the

Station Laboratory will cheerfully test any samples forwarded for examination by planters from any section of the State.

Any fraudulent goods of this character can thus be readily driven from the market, and the planter can then be assured as to the absolute purity of the insecticides which he may purchase.

METHOD OF ANALYSIS.

The following is the process adopted in the Laboratory for the determination of arsenious acid in Paris Green:

Weigh one gram of the material, and place in a medium size beaker or flask; add about 30 cubic centimetres of strong hydrochloric acid and digest on a water bath, at a temperature somewhat below the boiling point, adding at frequent intervals, small quantities of finely powdered potassium chlorate. Continue the heating until the odor of free chlorine has almost disappeared; dilute with water, and filter, if necessary. Add ammonia in slight excess, cool and add magnesia mixture gradually, stirring vigorously all the while. Allow to stand 12 hours, filter and wash precipitate with ammonia water.

Dry filter and contents: detach precipitate from filter as completely as possible; ignite filter, using ammonium nitrate solution to facilitate ignition. Transfer the precipitate to a porcelain crucible, and heat for a while on an iron plate, and finally with the direct flame. Add filter ash to the precipitate and weigh as magnesium pyro-arsenate.

(NOTE.—Of course, this method is only applicable in the absence of phosphates and arsenates.)