
BULLETIN NO. 12.

NEW SERIES.


Agricultural Experiment Station,

OF THE

Agricultural and Mechanical College,

AUBURN, AEA. - - - FEBRUARY, 1890.

CO-OPERATIVE SOIL TESTS.

 The Bulletins of this Station will be sent Free to any citizen of the State who desires them.

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CO-OPERATIVE SOIL TESTS---1889.

[BY THE DIRECTOR.]

For the purpose of studying the needs of the different soils of the State, nine intelligent farmers, who owned different typical soils, were selected to co-operate with the director of this station in studying, through experiment, the chemical deficiencies of their soils. The substances furnishing nitrogeon, phosphoric acid and potash were weighed and mixed in the quantities and proportions in which they were to be used and delivered to the experimenters so labeled as to prevent mistakes in their use. Sulphate of ammonia and cotton seed meal were used as sources of ammonia. Dissolved bone black supplied the phosphoric acid and kainit the potash. The localities selected were in the following counties : Clarke, Conecuh, Colbert, Etowah, Madison, Pike, Talladega, Tallapoosa and Tuscaloosa.

The following instructions were mailed to each experimenter as his guide in conducting the inquiry :

Directions for Conducting Soil Tests.

SELECTION OF GROUND.

The area for conducting the experiments should be level or nearly so. The soil should, if practicable, be of the character which generally prevails in the section intended to be represented. Select, by preference, that which has received no fertilizer for several years, or better still, that which has not been fertilized at all, but not freshly cleared.

ARRANGEMENT OF PLOTS.

If cotton is the plant experimented with measure plots seventy yards long and fourteen feet wide. This will make

one-fifteenth of an acre and will accommodate four rows three and one-half feet wide and seventy yards long. Number the plots 0, 1, 2, etc. To that marked 0, apply no manure; apply the contents of the bags to the plats to which their numbers correspond and apply no manure to the next and mark it 00. To the next apply early, in the drill, sixty-four pounds of green cotton seed. To the next apply sixty-four pounds of green cotton seed and thirteen and one-third pounds of acid phosphate. To the next apply 200 pounds of stable manure. On the next plant a variety of field peas which produces much vine; gather the peas when ripe and let the vines rot on the land.

If the experiment is made with corn make the same arrangement of plats, except that they shall be twenty feet wide, instead of fourteen, to accommodate four rows of corn five feet wide. Distribute the fertilizers as evenly as possible in the four rows in each case, and when the crop matures weigh the product of the two middle rows of each plat as the test of the effects of the different fertilizers. Weigh separately the product of each outside row on each plot to ascertain to what extent they were affected by the manure applied to the adjacent plots.

Note in a book, kept for the purpose, the date and manner of the preparation of the land; date of applying the fertilizers and preparing the seed-bed and date and manner of planting. Keep a record of rainfall and temperature, if practicable; if not, note the seasons in terms usually employed by farmers. Make a record of the character of the soil and subsoil, depth of soil, condition as to wetness or dryness every time it is plowed. Record the crops grown upon the land for three years past and quantity and kind of manure, if any, applied to each crop. Note the kind of implements used in preparing, planting and cultivating. Note date of securing a stand on each plot and the appearance of the plants. Note the time and manner of every operation performed in the cultivation of the crop, and every two weeks during its growth make notes of the comparative size and appearance of the plants upon the different plots.

Note difference, if any, in effects of excessive rainfall or

drouth upon the plants to which different manures are applied.

Before the crops mature, blanks on which to record results will be furnished, accompanied with detailed instructions for accurately interpreting the answers given in the products.

In all operations upon the plots the manner and time of treatment of all of the plots must be as nearly as possible the same, the only difference between them resting in the fertilizers applied.

As was to be expected with inexperienced experimenters, mistakes and omissions were made by some, which rendered their work valueless. The results of experiments made in some sections, however, are valuable indications of the needs of those particular soils.

Tallapoosa County—J. P. Oliver, experimenter.—Soil, sandy—loam, with clay subsoil. The land had been cleared and in cultivation seven years.

Preparation—The land was broken April 18th, with three inch scooter; rows opened three and one-half feet apart and fertilizers applied April 19th, and land bedded with Johnson combination plow. Seed planted April 20th.

Cultivation—This was done with heel scrape and hoe, very shallow, so that the land was laid by nearly level. Seasons favorable, except slight drouth in latter part of July.

The following statement of results shows effects of fertilizers in hastening maturity and increasing the yield :

Report of Results of Experiments with Fertilizers.

TALLAPOOSA COUNTY.

TWO INSIDE ROWS—YIELD IN SEED COTTON PER PLOT.

No. Plot....	POUNDS FERTILIZERS PER ACRE.	1st Picking.	2nd Picking	Pounds seed cotton per acre.
0	Manure.....	9	11	600
1	Sulphate of amonia, 80.....	12	11	690
2	Nitrate of soda, 100.....	24½	13	1125
3	Dissolved bone black, 200.....	23½	13	1095
4	Kainit, 100.....	13½	13	795
5	Cotton seed meal, 200.....	16	12	840
6	{ Sulphate of ammonia, 80	26	14	1200
	{ Dissolved bone black, 200			
7	{ Sulphate of ammonia, 80	15½	13	855
	{ Kainit, 100			
8	{ Cotton seed meal, 200	22¼	12	1027½
	{ Dissolved bone black, 200			
9	{ Dissolved bone black, 200	24	15	1170
	{ Kainit, 100			
10	{ Sulphate of ammonia, 80	24½	10	1035
	{ Dissolved bone black, 200			
	{ Kainit, 100			
00	No manure.....	14	12	780
11	{ Green cotton seed, 960	24½	13	1125
	{ Dissolved bone black, 200			
12	Green cotton seed, 960.....	18	12	900
13	Stable manure, 3,000.....	20	14	1020

Mr. Oliver had pursued a judicious rotation of crops upon this land which secured a liberal supply of vegetable matter, which preserved a favorable mechanical condition of the soil and, decomposing during the growth of the crop, furnished the needed supply of nitrogen.

In consequence of these conditions, we find but little increase from the application of substances furnishing nitrogen except in the case of nitrate of soda, the yield from which so far exceeds those from sulphate of ammonia and cotton seed meal, as to suggest that some undiscovered cause affected the yield upon plot No. 2.

The effect of phosphoric acid, supplied in the Dissolved Bone Black (acid phosphate furnishes the same) is marked and uniform, showing very plainly that this particular soil not only needed phosphoric acid, but that it needs little else. Its effect is made especially conspicuous in compari-

son with an application of 30 bushels of green cotton seed per acre on plot No. 12, and 3,000 lbs. of stable manure per acre on plot No. 13.

Mr. Oliver's lands lie northwest of Dadeville, one and a half miles from the town, in what is geologically known as the metamorphic region.

These lands are so rolling that neither a supply of vegetable matter nor the surface-soil can be retained without terracing.

The contrast between the condition of his lands which were terraced soon after they were cleared and those near by, which were not, is most striking.

ETOWAH COUNTY, J. J. NORRIS, EXPERIMENTER.

Mr. Norris describes the land selected, as follows: "Land selected was an old sedge field with a growth of small pines on it. Had not been in cultivation for eight or ten years. Soil sandy—land slopes gently to the south. Soil three to four inches deep—subsoil varies from white sandy to yellow (sandy) clay."

The preparation was very thorough. After breaking with turn plow it was harrowed four times before applying the fertilizer.

On account of failure to secure a stand of plants from the first planting, a second was made on the 9th of May, which resulted in a good stand on the 23rd.

A frost occurred June 1st but did not seriously injure the cotton. The cultivation was shallow and very thorough, the season too wet for cotton.

It proved too wet for plots ten to fourteen, inclusive, injuring the stand and dwarfing the plants which survived. Plot No. 6 was also affected by poor stand. The stand in the remaining plots was reasonably uniform and the comparison of the effects of the different fertilizers reliable.

Mr. Norris reports that as early as July 1st the appearance of the plants on the plots to which the Dissolved Bone Black was applied gave promise of better results than those to which none were applied. He says: "July 1st; a difference has begun to show very decidedly in favor of plots

Nos. 2, 5, 7, 8 and 9, the plants on which are a good deal stronger and healthier looking than the rest.

The weights of the first picking show that the phosphoric acid of the Dissolved Bone Black both hastened maturity and increased the yield.

The results of the two inside rows of each plot are given. Those of the two outside rows were gathered and reported separately, but the difference is too slight to render necessary the publication of both.

Phosphoric acid seems to have been the principal element of plant food needed by Mr. Norris' soil, after a rest of ten years.

The effects of nitrogen would have been, perhaps, more marked upon soil under continued cultivation. The season and subsoil were unfavorable for results from nitrogenous manures. The frequent heavy rains probably carried much of the nitrogen through the porous subsoil, while the phosphoric acid remained in reach of the roots of the plants.

Mr. Norris reports the following results :

Report of Results of Experiments with Fertilizers.

ETOWAH COUNTY.

INSIDE ROWS—YIELD OF SEED COTTON PER PLOT.

Plot Number.	LBS. FERTILIZERS PER ACRE.	1st	2nd	3rd	4th	Seed Cotton per acre—lbs.
		picking.	picking.	picking.	picking.	
		Date, Sept 25.	Date, Oct. 18.	Date, Nov. 5.	Date, Dec. 5.	
0	No Manure		1	2	2½	165
1	Sulphate Ammonia 80		½	1	1	75
2	Dis. Bone Black 200	5½	5	7	2	585
3	Kainit 100		2	2½	1½	180
4	Cotton Seed Meal 200	1½	1	3½	1½	225
5	{ Sulphate Ammonia 80	7½	4½	6½	2	615
	{ Dissolved Bone Black 200					
6	{ Sulphate Ammonia, 80		3½	3½	2½	285
	{ Kainit 100					
7	{ Cotton Seed Meal 200	9½	5	5	1	615
	{ Dissolved Bone Black 200					
8	{ Dissolved Bone Black 200	5	3½	5	1½	450
	{ Kainit 100					
9	{ Sulphate Ammonia 80	10½	5½	6½	2	705
	{ Dissolved Bone Black 200					
10	{ Kainit 100	5	2½	3½	1	360
11	Dissolved Bone Black 200		2	2	1	150
12	960 lbs. Green Cotton Seed					
13	{ 960 lbs. Green Cotton Seed		5	4½	2½	360
	{ 150 lbs. Am. Sup. Raw Bone					
14	3,000 lbs. Stable Manure		3½	2½	3	270
14	200 lbs. Am. Raw Bone Sup.		5	4	2½	345

TUSCALOOSA COUNTY, A. V. ALBRIGHT, EXPERIMENTER.

Soil—Brown loam with red clay subsoil ; the latter resting upon pebble. Land prepared and cotton planted in the usual way—cultivated shallow with hoe and wide sweeps. After the May drouth of four weeks, rains were excessive and frequently accompanied by severe wind. Last frost 31st May.

As in the experiments of Messrs. Oliver and Norris the difference between the yield of the two inside rows, and that of the two outside rows, of the plots of four rows, is very slight, indicating that the plants in the outside rows were not benefitted by the manures applied to the adjacent plots.

The soil, as in Etowah and Tallapoosa, seems to have been deficient in phosphoric acid. An examination of the

weights in the first pickings shows that phosphoric acid hastened the maturity of the fruit, an important consideration in localities subject to ravages by the caterpillar.

Report of Results of Experiment with Fertilizers.

TUSCALOOSA COUNTY.

INSIDE ROWS—YIELD IN SEED COTTON PER PLOT.

Plot No.	LBS. FERTILIZERS PER ACRE.	1st.	2nd	3rd	4th	Seed Cotton per acre—lbs.
		picking.	picking.	picking.	picking.	
		Date.	Date.	Date,	Date,	
		Aug. 29	Sept. 14.	Sept. 25.	Oct. 8.	
0	No Manure	10	13	1	2	780
1	Sulphate Ammonia..... 80	10	13	2	3	840
2	Dis. Bone Black..... 200	13	18	3	2	1080
3	Kainit..... 100	10	13	2	1	780
4	Cotton Seed Meal..... 100	10	12	2	1	750
5	{ Sul. Ammonia..... 80	12	15	3	2	960
	{ Dis. Bone Black..... 200					
6	{ Sul. of Ammonia..... 80	11	16	1	3	930
	{ Kainit..... 100					
7	{ Cotton Seed Meal..... 200	14	13	1	2	900
	{ Dis. Bone Black..... 200					
8	{ Bone Black..... 200	14	15	2	1	960
	{ Kainit..... 100					
9	{ Sul. of Ammonia..... 80	15	14	4	3	1080
	{ Dis. Bone Black..... 200					
10	{ Kainit..... 100	7	10	1	2	600
11	{ No Manure.....	15	16	1	2	1020
	{ Green Cotton Seed..... 960					
12	{ Acid Phosphate..... 150	6	9	2	2	570
	{ Green Cotton Seed..... 960					
	{ Stable Manure..... 3,000	16	18	1	1	1080

Seed of eleven varieties of cotton were sent to all of the experimenters, but Mr. Albright is the only one who made a successful comparison of their productiveness.

The following tabulated statement shows comparative earliness and productiveness of eleven varieties.

The Peerless leads in early maturing and is equaled only by Jones' improved, in yield, closely followed by Welborn's Pet and Zellner.

There is remarkable uniformity in both time of maturing and yield in varieties so distinctive, in characteristic as are most of them.

Report of Results of Experiments with Varieties of Cotton.

TUSCALOOSA COUNTY.

YIELD IN SEED COTTON PER PLOT.

Plot Number.	NAME OF VARIETY.	1st	2nd	3rd	4th	Seed cotton per acre in lbs.
		picking.	picking.	picking.	picking.	
		Date,	Date,	Date,	Date.	
		Sept. 5.	Sept. 20.	Oct. 11.	Nov. 1.	
1	Allan's Long Staple.....	17	8	4	2	930
2	Barnett.....	15	7	3	2	810
3	Cherry's Cluster.....	18	7	4	2	930
4	Hawkins' Improved.....	18	9	3	3	990
5	Jones' Improved.....	19	10	5	2	1020
6	King's Improved Prolific.....	14	14	1	1	900
7	Peerless.....	20	10	5	1	1080
8	Rameses.....	16	9	4	2	930
9	Truitt.....	14	10	4	2	900
10	Welborn's Pet.....	17	9	5	3	1020
11	Zellner.....	17	10	5	3	1050

SUMMARY.

1. On the three soils, in Etowah, Tallapoosa and Tuscaloosa the experiments *indicate* that phosphoric acid is the principal ingredient deficient.

Phosphoric acid hastened maturity.

DIRECTIONS FOR CONDUCTING SOIL TESTS WITH FERTILIZERS, 1890.

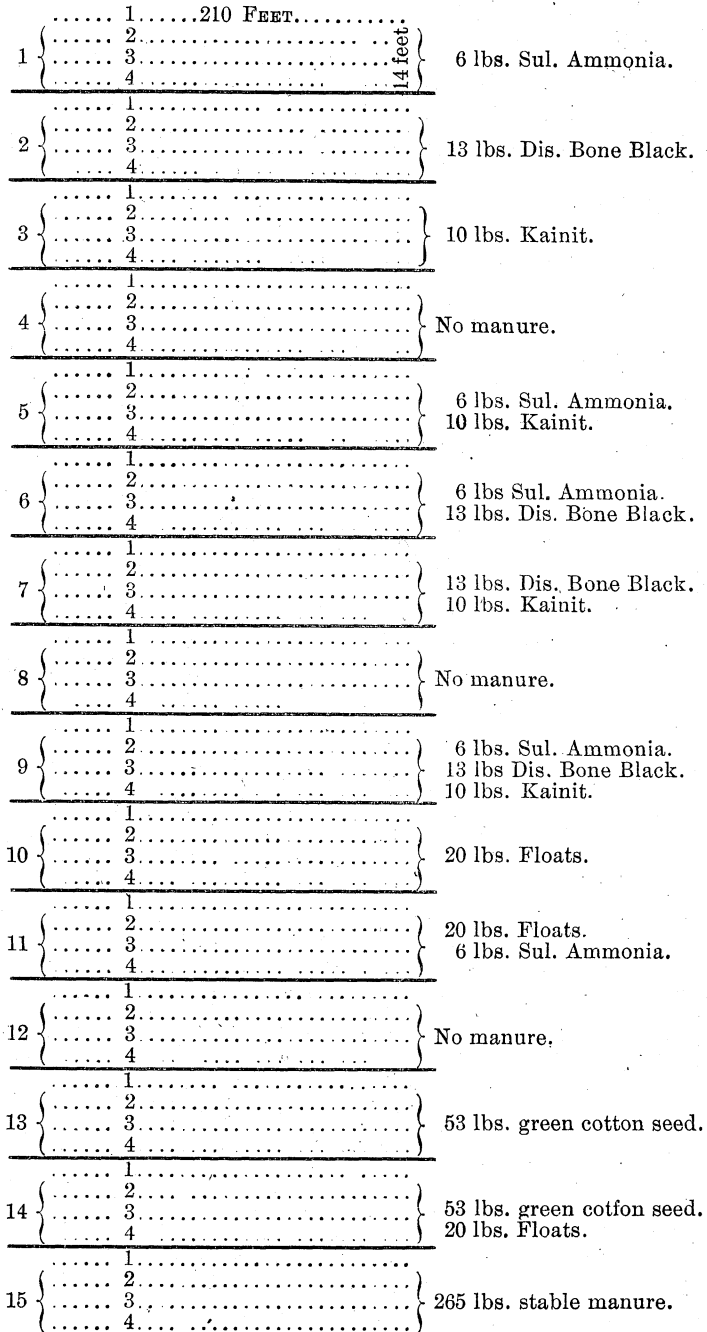
SELECTION OF LAND.

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 $3\frac{1}{2}$ feet apart. All of the experiments will be made with cotton this year.

DIAGRAM OF EXPERIMENT PLOTS:



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* $3\frac{1}{2}$ 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 should 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 re-

liable, 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 the 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 rainfall 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 after-

noon, 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 1 and 4 as they being only $3\frac{1}{2}$ 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 2 and 3 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 2 and 3 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 benefit the farmers who cultivate the character of land upon which the experiment is made.

