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Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN

EXPERIMENTS WITH COTTON

VARIETIES
BOLL ROT
WILT
PHOSPHATES

By

J. F. DUGGAR, Director,

and

E. F. CAUTHEN, Farm Supt. and Recorder.

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EXPERIMENTS WITH COTTON

BY

J. F. DUGGAR, Director,

AND

E. F. CAUTHEN, Farm Superintendent and Recorder.

SUMMARY.

Of the many varieties of cotton tested in plots in 1910, Cook, Dillon, Hardin and Triumph made the largest yields; of those tested in observation rows, Bate Early Victor, New Triumph, Excelsior Wilt-Resistant, Triumph from Alabama, and Franklin, all yielded well.

The earliest varieties of cotton were Early Mammoth, Broadwell, Bank Account, Trice, Sugar Loaf King and Shelley; medium early were the Cooks, Triumph, Covington-Toole, Cleveland, Hite, Money Maker, Berry and Franklin; and among the latest varieties were Hardin, Dillon, Poulnot, Russell, etc.

Acid phosphate afforded larger yields than either ground rock phosphate or basic slag.

Anthracnose damaged all the varieties of cotton to some extent, but more especially the Cooks, Brown No. 1, Hardin, Trice, Gold Coin, and Early Mammoth. Some of those only slightly damaged were Rowden, Cleveland, Dixie, Simpkins, Dillon, and Poulnot.

Varieties differed greatly in the amount of boll-rot.

The amount of boll-rot or anthracnose was perceptibly reduced by treating the seed before planting them. Seed immersed in water at 170 degrees Fahrenheit for ten minutes produced a crop having only 4.9 per cent. of diseased bolls, while untreated seed had 11.3 per cent.; seed treated for twenty-two minutes in water at a temperature of 150 degrees Fahrenheit had 2.4 per cent. of boll-rot, while the adjacent plot of untreated seed had 9.9 per cent. of affected bolls. Charring the seed coat with concentrated sulphuric acid reduced the percentage of diseased bolls from 11.3 to 5.9.

Varieties of cotton were tested on soil at Loachapoka, Alabama, badly infected by wilt, or black root, and some of them showed

remarkable resistance to the disease. Cook, No. 307-6, yielded 269 per cent. more lint per acre than the nearest plot of common cotton; Covington-Toole yielded 227 per cent. more lint than the check; Cook from Hall afforded 185 per cent. more lint; Excelsior Wilt-Resistant 164 per cent. more, and a hybrid cotton 115 per cent. more lint than the check plot.

For wilt-infected lands it is recommended that the crop be changed from cotton to some other crop, as corn, grain, etc.; but in case it is found necessary to grow cotton, that some wilt-resisting variety be planted.

WEATHER CONDITIONS.

The growing season of both 1909 and 1910 was marked by extremes. In 1909 there was an excess of rain throughout May and June and an abundance during July and August. In 1910 a rainy season began in June and continued through most of the month of August.

The effect of the wet weather prevailing during the greater part of each summer was to cause the development, on the Station Farm and in many other localities throughout Alabama, of an abnormally large amount of boll rot, in such fields as had become contaminated with the germs of this disease.

The latter part of the summer of 1909 was also distinctly unfavorable to the cotton crop, through the occurrence of a period of extreme heat, causing the shedding of a large proportion of the squares and young bolls.

In 1910 a killing frost occurred at Auburn and throughout most of the State on October 29, an unusually early date. However, on the fields where the tests here recorded were made, no variety was materially reduced in yield by frost.

The harvesting season in both years was highly favorable, as indicated by the slight rainfall in September and October.

On the whole, both 1909 and 1910 must be regarded as years highly unfavorable to cotton in this part of Alabama, and indeed throughout a large proportion of the Cotton Belt. The table below gives the rainfall at Auburn for the growing season of each of the past three years.

Rainfall at Auburn in the growing season in 1908, 1909, and 1910.

MONTH	RAINFALL IN INCHES		
	1908	1909	1910
	In.	*In.*	*In.*
May	2.74	7 40	3.04
June	2.48	8 64	5 63
July	4.65	5.01	4 41
August	3.71	4 07	6 07
September	1.50	.86	2 97
October	1.61	1.42	1.97

VARIETIES OF COTTON.

Soils and fertilization for the variety test.—The number of varieties and strains of cotton compared in 1910 on the farm of the Alabama Experiment Station at Auburn was fifty. There was available only enough suitable land to accommodate twenty-two varieties on plots of sufficient size to determine accurately the yield per acre. The other twenty-eight varieties were necessarily confined each to a single row, not to determine their yields, but to make observations on their peculiarities and apparent good qualities, so that the most promising of them might be tested on a larger scale the following year.

The land used for the twenty-two varieties of cotton, grown on plots in 1910, is a poor, dry, upland, sandy loam, but fairly uniform in fertility. The preceding crop was drilled soy beans, the mature soy bean plants having been cut and removed from the land for threshing. About the middle of March, the land was plowed eight to ten inches deep, turning under the soy bean stubble and fallen leaves. The rows for cotton were marked off three and one-half feet wide, the fertilizer drilled in, and low beds formed. The cotton seed were dropped in checks, so that each row would have the same number of hills, and each plant the same space, namely, twenty-one inches by three and one-half feet. The stand of single plants spaced twenty-one inches apart was very uniform.

The first planting was made April 15. Owing to cold weather and heavy rains, germination was so imperfect that a second planting became necessary. On May 2 the cotton

beds were freshened with a spring tooth harrow and a second planting made.

A complete fertilizer was applied before planting. It was a home-mixture, consisting of 240 pounds acid phosphate, forty pounds muriate of potash, and 120 pounds nitrate of soda per acre. The fertilizer was mixed with the soil by means of a small shovel-plow before the beds or ridges were formed. Frequent rains in June and July caused a postponement of an intended application of nitrate of soda until July 22. At this date, which was doubtless too late, the nitrate of soda was so damp that it became necessary, in order to absorb its moisture and permit its easy distribution, to mix thirteen and one-third pounds of cotton seed meal with the sixty-six and two-thirds pounds of nitrate of soda. These amounts per acre were drilled on one side of each row, July 22.

Clean, shallow cultivation was given the cotton at such frequent intervals as to prevent injury from grass or from the crusting of the soil. Cultivation was continued until August 1.

The most common form of boll rot, anthracnose, reduced the yield of all varieties of cotton grown on the Station farm in 1910. Some of the varieties were severely injured by this disease, while others were only slightly hurt. None was entirely free from it. Some strains, grown from seed picked in fields where this disease was very destructive the previous year, were injured more severely than plants of the same variety grown from seed from healthier fields. It is believed that cotton seed from fields where boll rot prevails is one means of scattering this disease; therefore, the Station prefers not to send out seed grown on the Station farm until further selection has been made with the special aim of decreasing the amount of boll rot. However, the disease is quite widely prevalent over the Cotton Belt, but, as a rule, its effects are conspicuous only in wet seasons.

Varieties of cotton in 1910, ranked according to total value of seed and lint per acre.

VARIETIES	Actual yield per acre (stand variable)		Corrected to uniform stand	
	Lint	Percentage of Lint	Lint per acre	Total value per acre: lint 14c.; seed $26.00 per ton
	Lbs.		*Lbs.*	
Cook (from J. E. Stone)	496	40.3	497	$79 05
Dillon	443	39.5	463	73 95
Hardin	438	39.2	446	71 33
Cook (from M. R. Hall)	422	38 8	432	69 29
Triumph	412	38 0	426	68 62
Russell	384	33 4	407	67 49
Dixie	395	34 5	409	67 32
Cleveland	406	36.4	413	67 14
Poulnot	401	36 5	406	65 99
Ruralist	374	33.9	384	64 74
Covington-Toole	396	40.6	404	64 21
Cook No. 304	360	38.3	366	58 84
Cook No. 313	360	42.7	373	58 68
Broadwell	343	35.9	350	57 06
Early Mammoth	349	36.7	351	56 97
Bank Account	338	36.7	344	55 77
King Big Boll	322	37.0	325	52 62
Sugar Loaf King	323	38.5	323	51 88
Cook No. 354	301	39.2	318	50 73
Cook No. 307	308	40 4	318	50 55
Cook No. 333	308	42.0	310	48 95
Trice	228	30 7	232	39 25

From this table it may be seen that Cook, grown from seed obtained from J. E. Stone, Sylacauga, Alabama, afforded the largest yield of lint, 497 pounds, and the highest value of total product, $79.05 per acre. Dillon was second; Hardin, third; Cook from M. R. Hall, James, Alabama, fourth; and Triumph, fifth in total value per acre and in yield of lint per acre.

The varieties of cotton which ranked among the five most productive in each of the tests of the last five years are mentioned below in order of productiveness each year.

Most productive varieties of cotton in last 5 variety tests.

Rank in productiveness	1910	1909	1908	1906	1905
1	Cook (S.)	Cook (206)	Dillon	Cook	Toole
2	Dillon	Cook (221)	Gold Coin	Cleveland	Cook
3	Hardin	Dixie	Dixie	Layton	Cleveland
4	Cook (H.)	Hardin	Cook	Toole	Bancroft
5	Triumph	Poulnot	Hart	Poulnot	Christopher

Rank in productiveness of five most productive varieties of each year.

	1910 Rank	1909 Rank	1908 Rank	1906 Rank	1905 Rank	Total number tests	Number times among 5 best
Cook	1, 4	1, 2	4	1	1	5+	5+
Dillon	2	..	2	..	abs.	4	2
Toole	..	..	abs.	4	1	4	2
Cleveland	..	..	..	2	3	5	2
Dixie	..	3	3	..	abs.	4	2
Hardin	3	4	abs.	abs.	abs.	2	2
Poulnot	..	5	..	5	..	5	2

From the last two tables it may be seen that the list of varieties standing first to fifth in productiveness in some one or more of the last five tests at Auburn contains thirteen different names. Of these, Cook occurs five times among the winners; while Dillon, Toole, Cleveland, Dixie, Hardin, and Poulnot each occurs twice among the five most productive varieties.

Brief descriptions of varieties tested in 1910.—Cook Improved, whether from the originator, J. R. Cook, Ellaville, Ga., from J. E. Stone, Sylacauga, Ala., from M. R. Hall, James, Ala., or from the Alabama Experiment Station, is a productive, well-limbed variety of medium earliness. Its chief faults are special liability to boll-rot (anthracnose) and a tendency for the seed cotton to fall from the burs. The bolls are of medium to large size and the percentage of lint is very high.

Cleveland is somewhat similar to Cook in form of plant, large size of bolls, and in being early for a big boll variety. It has proved here to be less liable to boll-rot than has Cook. Its chief fault lies in the falling of the seed cotton from the burs; hence, picking should be done promptly.

Toole is well supplied with limbs and bolls. The per cent of lint is high. Its chief fault is the small size of bolls.

Hardin is a variety with medium-sized bolls and a rather high per cent of lint.

Poulnot is a semi-cluster variety with rather large bolls.

King (here received as Sugar Loaf King) is a variety with small plants and small bolls. King and its equivalents, or

varieties apparently selected from it, Simpkins and Broadwell, are the earliest varieties tested at Auburn. Reference to the long table below shows that King and similar early varieties have usually been somewhat less productive than the varieties described in the paragraphs above. However, the results may be reversed in regions where the boll weevil is present. The seed cotton of the King group of varieties easily drops from the burs.

Dixie is a variety well supplied with fruiting limbs and with bolls of small size. Its special value lies in having been selected by the United States Department of Agriculture as being largely resistant to cotton wilt. Its failure to show decided resistance in our tests in 1910 is not understood.

Dillon is a tall cluster variety, similar to the Jackson, from which it is a selection. It is strongly wilt-resistant.

Where to obtain seed.—The Alabama Experiment Station can not supply seed of any variety; it is believed that seed from a crop as badly damaged by anthracnose, or boll rot, as was all the cotton on the Station farm in 1910 may serve to increase this disease, although it is already present in most or all parts of the State. The Station obtained its seed from the following:

Cook (Stone), J. E. Stone, Sylacauga, Alabama.
Dillon, U. S. Department of Agriculture, Washington, D. C.
Hardin, W. P. Letson, Glen Allen, Alabama.
Cook (Hall), M. R. Hall, James, Alabama.
Triumph, Wade Brothers, Alexander City, Alabama.
Russell, J. M. Chappell, Jr., Route 6, Louisville, Miss.
Dixie, U. S. Department of Agriculture, Washington, D. C.
Cleveland, Alabama Experiment Station.
Poulnot, J. E. Bradberry, Athens, Georgia.
Ruralist, F. J. Merriam, Atlanta, Georgia.
Covington-Toole, W. F. Covington, Headland, Alabama.
Cook No. 304, Alabama Experiment Station.
Cook No. 313, Alabama Experiment Station.
Broadwell, J. B. Broadwell, Alpharetta, Georgia.
Early Mammoth, I. W. Mitchell, Youngsville, N. C.
Bank Account, H. G. Hastings & Co., Atlanta, Georgia.
King Big Boll, J. E. Butts, Ethelville, Alabama.
Sugar Loaf King, I. W. Mitchell, Youngsville, N. C.
Cook No. 354, Alabama Experiment Station.
Cook No. 307, Alabama Experiment Station.
Cook No. 303, Alabama Experiment Station.
Trice, M. N. McFadden, Warren, Tennessee.

SUMMARY OF ALL VARIETY TESTS OF COTTON ON THE FARM OF THE ALABAMA EXPERIMENT STATION.

In the following summary, showing the rank in productiveness in lint, are listed all the varieties grown on *plots* at Auburn. This does not include a large number of other varieties grown on single rows merely for observation and not to determine their yields. This table is intended for reference rather than for reading. The figure 1 after a variety indicates that in a given year it stood first among the varieties tested that year.

Rank in productiveness of varieties of cotton tested by Alabama Experiment Station

	'89	'90	'91	'91	'92	'93	'96	'97	'98	'99	'04	'05	'06	'08	'09	'10
Alex. Allen	--	--	--	--	--	--	--	--	--	--	4	10	8	16	--	--
Allen Hybrid	--	--	--	--	--	--	11	16	--	--	--	--	--	--	--	--
Allen Long Staple	2	--	8	--	21	--	--	14	--	--	14	--	--	31	28	--
Bailey	--	--	--	12	18	--	--	--	--	--	--	--	--	--	--	--
Bancroft	--	--	--	--	--	--	--	--	--	--	--	4	17	26	--	--
Bank Account	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	16
Barnett	4	--	3	--	--	--	--	--	--	--	--	--	--	--	--	--
Berry	--	--	--	--	--	--	--	--	--	--	--	21	--	--	--	--
Blue Ribbon Long Staple	--	--	--	--	--	--	--	--	--	--	34	16	--	25	19	--
Broadwell	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12	14
Brown No. 1	--	--	--	--	--	--	--	--	--	--	--	--	--	6	11	--
Cameron	--	--	--	--	--	--	--	--	--	--	7	14	--	--	--	--
Cherry Cluster	6	--	4	--	17	--	--	--	--	--	--	--	--	--	--	--
Christopher	--	--	--	--	--	--	--	--	--	--	--	5	12	33	--	--
Cleveland	--	--	--	--	--	--	--	--	--	--	--	3	3	12	7	8
Colthorp Eureka	--	--	--	--	14	4	--	--	--	--	--	--	--	--	--	--
Colthorp Pride	--	--	--	--	11	7	--	--	--	--	--	--	--	--	--	--
Columbia (L. S.)	--	--	--	--	--	--	--	--	--	--	--	--	13	32	--	--
Common	--	--	--	10	--	--	--	--	--	--	--	--	--	--	--	--
Cook (from Stone)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1
Cook Improved	--	--	--	--	--	--	--	--	--	--	6	2	1	4	9	--
Cook, W. A. (L. S.)	--	--	4	--	24	1	--	--	--	--	--	--	--	--	--	--
Cook, J. C	--	--	--	12	--	--	--	--	--	--	--	--	--	--	--	--
Cook No. 206	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Cook No. 221	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2	--
Cook No. 232	--	--	--	--	--	--	--	--	--	--	--	--	--	--	14	--
Cook No. 239	--	--	--	--	--	--	--	--	--	--	--	--	--	--	18	--
Cook No. 304	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12
Cook No. 313	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	13
Cook No. 354	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	19
Cook No. 307	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	20
Cook No. 333	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	21
Corley	--	--	--	--	--	--	--	--	--	--	--	--	--	7	--	--
Crossland	--	--	--	--	9	--	--	--	--	--	--	8	--	--	--	--
Culpepper	--	--	--	--	--	--	--	--	--	--	11	16	9	--	--	--
Dalkeith Eureka	--	--	--	--	15	10	--	--	--	--	--	--	--	--	--	--
Dearing	--	--	--	--	--	--	--	4	2	14	--	--	--	--	--	--

Rank in productiveness of varieties of cotton tested by Alabama Experiment Station—Continued

	'89	'90	'91	'91	'92	'93	'96	'97	'98	'99	'04	'05	'06	'08	'09	'10
Defiance (Drake's)														22	24	
Dickson			2		20		3	12				24				
Dillon															20	2
Dixie (Wilt-Resistant)												20	18	3	3	7
Doughty											10					
Drake (Cluster)											20			22	24	
Duncan							9	6		13						
Double Header														27		
Early Mammoth																15
"Excelsior"? (King)														8		
Edgeworth											27					
Ellsworth	12															
Florodora											33		16			
Garrard											27					
Georgia Best															13	
Gold Coin														2	21	
Gold Dust			7		22											
Grier's King											25					
Griffin's Drought Proof								2								
Hagaman												12				
Hart														5		
Hardin															4	3
Hawkins	9		9		16		8	3		3	15	8	7			
Herlong			6		23	6	13									
Huey's (Big Boll)														20		
Hunnicutt, J. B			1		14		12	13								
Hutchinson							1	7	7							
Jackson										1	3	17				
Johnson Excelsior											28					
Jones Improved	5		10				10	5	8	7	24					
Jones No. 1					17											
Jones' Long Staple			11		19	5	14									
Keenan															29	
Keith			5		11											
King	10			6	8		5			10	17	18	5		26	
King Big Boll																17
Langford														15		
Layton											2	5	2		8	
Lealand											38					
Lewis Prize											16					
Lowry										12						
Mascot											18					
Mathews (Long Staple)					7	11										
Meredith											30					
Mortgage Lifter											31			14		
Nancy Hanks											19					
Neeley Early														19		
Okra	9			13	12	8										
Parker											33					
Peeler				7	8											
Peerless	7	1		4	6		4	11								
Peterkin		2		5	1		7	8	3	4	1	12	6		6	
Poulnot											8	5	4	11	5	9

Rank in productiveness of varieties of cotton tested by Alabama Experiment Station—Continued

	'89	'90	'91	'91	'92	'93	'96	'97	'98	'99	'04	'05	'06	'08	'09	'10
Petit Gulf				3	3		17									
Pride of Georgia											29		10			
Red Leaf											12	9	11			
Rameses	8			9												
Ruralist														24		10
Russell									1	8	20	6	15	28	17	6
Rogers											23					
Rowden											5				22	
Schley											25	5		23		
Shine											22	20				
Simms Long Staple											9					
Simpkins															25	
Sistrunk														9		
Smith Improved									4							
Southern Hope		5		8	5											
Southern Wonder												15				
Strickland										11		7		13	23	
Storm Proof		4		15	2											
Sugar Loaf King																18
Sunflower											34		15			
Texas Bur											13	13		10	10	
Texas Oak								1	6	6						
Toole												1	3		15	11
Trice															30	22
Triumph														29		27
Truitt	1	3		2	4		2	9	5	2	24	16	14	17	16	
Tyler							6	15		9						
Welborn Pet	3			11	13	2	15			5		22				
Whatley Improved						9	16	10								
Wise											5					
Wonderful				14	16	1										
Woodfin Prolific											23	19				
Woods														18		
Wyche														30		
Zellner	11			1	10											
No. varieties in each test	13	5	13	15	29	11	17	16	8	14	40	30	20	33	30	22

RELATIVE EARLINESS OF VARIETIES.

The matter of earliness is now becoming a desirable quality of any variety of cotton. The first picking of all varieties in 1910 was made September 19. On that date more than 80 per cent. of the total seed cotton of Sugar Loaf King, Trice, Broadwell, and Bank Account was open, and more than 70 per cent. of Triumph, Early Mammoth, and Cook (No. 354). On the other hand, Dillon, Hardin, and Cleveland were among the productive varieties on which less than 60 per cent. of the total crop had opened at the time of the first picking, September 19.

Relative earliness of varieties of cotton as shown by percentages of total yield that opened by October 4, 1909, and by September 19, 1910.

[An x indicates that the corresponding variety was grown only in a row test, and on a part of the field slightly removed from the regular variety tests.]

	1909 Per cent. open Oct. 4-5	1910 Per cent. open Sept. 19-20
King (Sugar Loaf)	69.	92.x
Trice	69.	86.
Broadwell	71.	86.
Bank Account	59.	84.
Shelley	--	84.x
King (from Sims)	--	83.
Triumph	65.	78.
Blue Ribbon	55.	78.x
Bohlus	--	77.x
Rosser No. 1	--	76.x
Toole	--	76.x
Uncle Sam	--	76.x
Mortgage Lifter	76.x	--
Early Mammoth	60.	75.
Franklin	--	75.x
Berry	--	74.x
Brown No. 1	74.	--
Cook No. 354	--	74.
Pride of Georgia	--	74.x
Sistrunk	72.x	--
Triumph (from S. C.)	--	73.x
Money Maker	--	72.x
Cleveland (Stone)	--	72.x
Cleveland (from Georgia)	--	71.x
Gold Coin	53.	71.
Willet Red Leaf	38.	70.x

Peterkin	44.	70.x
Simpkins	69.	70.x
Bailey	--	70.x
Russell	50.	69.
Cook No. 304	--	69.
Covington-Toole	69.	--
Cook Wilt Resistant	--	68.
Hawkins	68.	--
Excelsior	68.	68.x
Edgeworth	68.x	--
Hite	--	68.x
Edgeworth	--	67.
Cook No. 307	--	66.
New Triumph	--	66 x
Truitt	65.	--
Ruralist	--	65.
Drake's Defiance	64.	--
Cook (from Stone)	--	64.
Huey, B, B	60.x	--
Keenan	61.	--
Poulnot	47.	59.
Dixie	42.	59.
Cook (Improved)	57.	--
Cook No. 313	--	57.
Mexican B. B.	57.x	--
Dillon	38.	57.
Cleveland (from Ala. Sta.)	59.	55.
Columbia	58.	--
Texas Bur	58.	--
Georgia Best	58.	--
Bates	--	55.x
Rowden	53.	--
Allen Long Staple	52.	--
Layton	52.	--
Hardin	55.	50.
Strickland	44.	--

VARIETIES ADAPTED TO BOLL WEEVIL CONDITIONS.

As the boll weevil spreads, the demand for earlier cottons increases. The varieties that set the largest number of bolls early in the season give the largest yield because the weevils become more numerous as the season advances and destroy all the late maturing portion of the crop.

If earliness can be coupled with largeness of boll and fairly high per cent. of lint in any variety, that variety becomes more

desirable. The station is endeavoring to breed that type of cotton and has some promise of success; but seed are not yet available.'

In the boll weevil sections, Triumph has generally given satisfaction. It has large bolls, is fairly early, yields a good per cent. of lint, and is storm-resistant. The plant is vigorous and grows to a medium size. Its foliage is heavy.

Cleveland and other big boll varieties have also proved satisfactory on many farms in the boll weevil region.

Some strains of Cook will probably suit boll weevil conditions fairly well. It is an early variety, has medium sized bolls, and picks easily. The per cent. of lint is high. The plant grows fairly large, puts on long fruit limbs and makes an open top, which admits sunlight among the branches and fruit.

King, Simpkins, and Broadwell all belong to one group and are the earliest kinds tested by this Station. The plants are not large; the bolls are small; the locks drop badly from the burs; the per cent. of lint is medium.

Toole is a productive variety having sufficient earliness for boll weevil conditions, though not so early as the King group. It should be tried where its small size of boll is not objectionable.

Some of the large-yielding varieties, like Dillon and Hardin are late in putting on a crop of fruit, and in consequence of the lateness may fail to produce a large crop under boll weevil conditions. Another popular variety is Russell, which, however, is too late for best results in the presence of the boll weevil.

FIELD NOTES ON ANTHRACNOSE, THE MOST COMMON FORM OF BOLL-ROT.

Description.—This disease appears in tiny spots on the bolls. At first the spots look dark-green or brownish and make slight depressions on the surface of the boll; later they take on a darker tinge and make a black spot. The center of this spot may become grayish and finally pinkish. The pink color is caused by the numerous spores, or tiny bodies that serve the purpose of seed, and these may spread this disease to other bolls.

When the boll is cut through the diseased portion, the lint and seed are often found to be dark and decayed. If there is much damp weather, the boll may be soft; if there is not

much dampness, the lint and seed are likely to be dry and hard.

When the disease attacks very young bolls, it often kills them. It may damage only one or two locks in a boll and make the picking of the remaining locks difficult. The stained lint cotton from the diseased locks lowers the market value of the entire sample of cotton. Boll rot is widespread and in wet years causes a great loss in yield in most of the cotton-growing states, especially east of the Mississippi River.

Conditions favoring anthracnose.—The amount of boll rot on the Station Farm was excessive in 1909 and again in 1910. Some varieties lost heavily from its ravages. No variety has yet been found to be entirely and continuously free from anthracnose.

Wet weather during June, July and August favors the development of boll-rot, while dry weather checks its spread. The dampness makes anthracnose more severe by affording favorable conditions for the development of the fungus that produces this disease. Moreover, wet weather increases the size of cotton plants and thus keeps the bolls largely shaded and damp, and may possibly make the bur more tender, and hence more easily entered by the anthracnose fungus.

For the same reason, cotton planted on low land, where it grows rank, suffers more from anthracnose than that grown on uplands.

Likewise, cotton heavily fertilized with nitgrogenous fertilizer, as excessive amounts of nitrate of soda and cotton seed meal, is apt to suffer severely from anthracnose, if the seed be from a diseased crop and if the summer be wet. Where boll rot is expected, the proportion of nitrogen in the fertilizer should not be very high and the rows should be wide, so as to permit an abundance of sunlight.

A. C. Lewis (Georgia Board of Entomology, Bul. No. 24, p. 58) has shown that merely rubbing a diseased boll against an uninjured one results in communicating anthracnose to the latter. However, it is highly probable that insects may yet be found to play a part in conveying the disease, either by merely spreading the spores or by introducing them into wounds made by the insects.

Susceptibility to anthracnose.—Varieties differ greatly in the extent to which they are damaged by boll rot. Whether these differences in susceptibility are due to some inherent weakness of certain varieties, for example, to the possession of a softer or thinner bur, is not fully known. However, our observations through a number of years seem to indicate that the wide variation in the damage wrought on different varieties grown side by side is at least partly due to the fact that some seed planted were from fields free from anthracnose, while the seed of other varieties or strains were badly infected with anthracnose, having been picked from fields where this disease was severe. At least one of the most important means of spreading boll-rot is by means of seed from a diseased crop.

Among the fifteen strains of Cook cotton that have been separated in the cotton breeding work on the Experiment Station Farm (all from a single lot of seed obtained from the originator of this variety), there is one strain that has a much larger percentage of boll-rot than any of the other strains. This fact and other data seem to indicate that it may be possible to decrease the amount of boll-rot by selection of the most resistant plants.

SUSCEPTIBILITY OF DIFFERENT VARIETIES TO ANTHRACNOSE.

Counts of bolls attacked by boll-rot, whether severely, or slightly, were made after opening began. The results are recorded in the following table:

Percentage of diseased bolls (almost all attacked by anthracnose, slightly or severely), in varieties of cotton tested at Auburn in 1909 and 1910.

	1909 Per cent. of diseased bolls	1910 Per cent. of diseased bolls
Allen Long Staple	11.	....
Blue Ribbon	3.0	....
Bailey ..... x.....	....	.9
Broadwell	8.4	2.6
Berry Big Boll.....x.....	....	2.3
Brown No. 1....	33.2	....

Bates	x	....	.9
Bank Account		...	3.3
Bohlus Triple Joint	x	....	.7
Cook (Stone)		....	5 8
Cleveland		4.6	3.4
Cleveland (Stone)	x	....	1 5
Cook Improved		23.1	....
Cook No. 206		8.	....
Cook No. 221		28.	....
Cook No. 239		33.	....
Cook No. 232		35.3	....
Cook (Hall)		....	9 4
Cook No. 304		....	17.7
Cook No. 313		....	23.2
Cook No. 354		....	28.3
Cook No. 307		....	28.6
Cook No. 333		....	25 2
Covington Toole		9.4	1.7
Dillon		11.5	3.3
Drake's Defiance		7.	....
Dixie		5.	3.2
Edgeworth	x	....	.7
Early Mammoth		....	9.3
Excelsior, from Georgia	x	....	.7
Excelsior, from South Carolina	x	....	2.2
Franklin	x	....	.5
Gold Coin		7.7	....
Georgia's Best		15.4	....
Hite		....	.4
Hardin		16,9	3.7
King Big Boll		....	4 3
Keenan		10.7	....
Layton Improved		11.2	....
Poulnot		9.7	2.8
Peterkin		8.9	....
Pride of Georgia	x	....	1.2
Rowden		4.7	....
Russell		....	3.4
Ruralist		....	3.9
Rosser No. 1	x	....	.6
Strickland		6.3	....
Sugar Loaf King		7.	5.8
Simpkins		5.2	1.1
Shelley	x	....	1.6
Texas Bur		7.8	....
Trice		3.9	15.4
Toole (Ga.)	x	....	1.

Truitt		7.2	
Triumph		8.7	3.3
Triumph (S. C.)	x		2.3
Triumph (Ga.)	x		.8
Trook	x		1 4
Uncle Sam	x		2.3

x Varieties marked (x) were grown in rows in a different part of the same field where boll-rot was less prevalent than on the plots on which the usual variety test was made.

From the above table, giving the percentages of diseased bolls for fifty-nine varieties and strains, it may be seen that in the last two years, when anthracnose was especially prevalent on the Station Farm, the varieties having the largest percentages of diseased bolls were the following:

1909.

Brown No. 1.
Various strains of Cook.
Hardin.
} (All having 17 per cent. or more of diseased bolls.)

1910 (Plots).	1910 (Observation Rows)
Various strains of Cook.	Gold Coin.
Trice.	Triumph (from South Carolina).
Early Mammoth.	Excelsior (from South Carolina).
Georgia Best.	Uncle Sam.
	Berry Big Boll.
	Blue Ribbon.

In the same tests, the varieties having the least boll-rot were the following:

1909.

Rowden.	Dixie.
Cleveland.	Simpkins.

1910 (Plots).	1910 (Observation Rows).
Covington-Toole.	Hite.
Broadwell.	Franklin.
Poulnot.	King.
Bank Account.	Rosser No. 1.
Dixie.	Edgeworth.
Dillon.	Excelsior from Georgia.
Triumph.	Bohlus.
Russell.	

Methods of picking cotton for seed, to reduce boll rot.—When practicable, avoid planting cotton in fields where there is much anthracnose. However, if seed must be saved from such fields, it is believed that the following method of picking, adopted by the Alabama Experiment Station in 1910, will greatly lessen the disease in the next year's crop.

In making that picking from which seed is to be saved, only healthy bolls are picked; no boll with a single diseased lock and no boll with a single lock that has failed to expand is picked. Future experience may show that it may be necessary to supplement this with disinfection of the seed to destroy spores of anthracnose that may be lodged on the outside of the seed while being ginned.

Treatment of cotton seed for boll-rot.—In 1910 an experiment was made at Auburn in treating cotton seed to ascertain whether any treatment would reduce the amount of anthracnose in the resulting crop. On account of the nature of the infection of the seed, it was not expected that a treatment of the seed by disinfectants would entirely destroy the fungus, but that the amount of boll-rot might be reduced by destroying the spores that might be on the outside of the seed.

The seed used were chosen as representing a strain of Cook cotton that had been one of the most severely damaged by boll-rot in 1909.

There were only two rows per plot, each row three and one-half feet wide, and all plots were adjacent. The plants made rather luxuriant growth, the limbs lapping slightly across the middles.

The treatments compared were scalding at two temperatures, the use of commercial sulphuric acid, copper sulphate solution, and two strengths of formalin solution.

Treatment of cotton seed for boll-rot (anthracnose).

Plot	TREATMENT OF SEED	Percentage of total bolls attacked by boll rot; counted Sept. 22, 1910	Treatment ranked according to freedom of crop from boll rot
		Per cent.	
1	Hot water, 170 degrees Fah.; 10 min.....	4.9	2
2	Formalin, 4 per cent solution; 30 min.....	7.2	5
3	Untreated	11.3	9
4	Charred seed coat with pure sulphuric acid	5.9	3
5	Copper sulphate, 10 per cent solution; 1 hour	7.3	6
6	Fumigated with carbon bisulphide.....	7.4	7
7	Formalin solution, 5 per cent; 30 min	6.4	4
8	Untreated	9.9	8
9	Hot water, 150 degrees Fah.; 22 min.....	2.4	1

All treatments seem to have had at least some slight value.

The results show that when the seed were scalded twenty-two minutes with water at 150 degrees Fahrenheit, the percentage of bolls attacked by anthracnose was reduced from 9.9 to 2.4; and when scalded for ten minutes at 170 degrees Fahrenheit, the reduction of diseased bolls was from 11.3 down to 4.9 per cent.

The hope in scalding the seed was that some temperature and length of treatment might be found which would destroy that part of the fungus which had penetrated the seed coat. The results justify the hope that such a result may here have been attained, and that laboratory experiments may determine definitely the temperature and time of scalding necessary to effect the destruction of that part of the fungus, without impairing the germination of the seed.

No definite recommendations for farm practice can be based on the result of one year's test. The field experiments here described will be continued and amplified in 1911.

Field Notes on Cotton Wilt, or Black-Root.

Description.—When a plant is attacked by cotton wilt, or black-root, all the leaves may suddenly wilt, beginning with the tender leaves at the tip of the main stem or branches. Or the disease may come on more slowly, revealing itself by causing that part of the cotton leaf between the large veins to turn yellowish and the edges of the leaf to shrivel. The plant usually dies, or a part of it may die and the remaining part take on a new growth, giving the plant a dwarfed, or one-sided appearance.

The disease develops in spots in the field and re-appears in the same spots from year to year. The infected area is irregular in shape and grows larger each year. All the plants in an infected area may not die; sometime in the same hill, one plant dies and another remains healthy.

Wilt may appear about the time that cotton plants reach the squaring stage and it may continue to kill them throughout the growing season. In 1910, wilt was more injurious during June and July, which were wet months.

Cause.—The cause of wilt is a fungus, which enters the cotton plant through the root, and blocks up the channels that convey food and water from the soil to the leaves. The plant then wilts and may die.

If a cross section through a dying stem is made near the ground, the woody portion shows dark specks or becomes brown or black. This dark color is due to the wilt fungus, which has blocked up the water-carrying vessels. (Fig. 3).

Cotton wilt appears most frequently in sandy soil. Cotton on clay soil is less apt to be attacked. In Alabama black root is most prevalent in the southeastern part of the state.

Means of spreading.—The germs of wilt are in the soil of infected fields. Anything that carries even a little of the soil from one part of the diseased field to another, or from one diseased field to another, scatters the disease; for example, plows or the feet of livestock. Regions in which some field contains the germs of wilt may expect in time to have black-root spread to almost every cotton field, if livestock are permitted to range over the fields in winter. During the time of heavy rains, the overflow

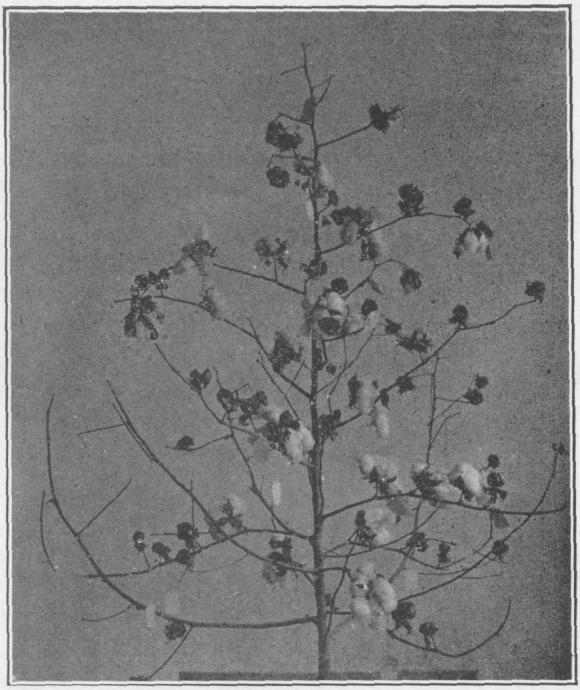

Fig. 1.--A cotton plant badly attacked by boll-rot or anthracnose.

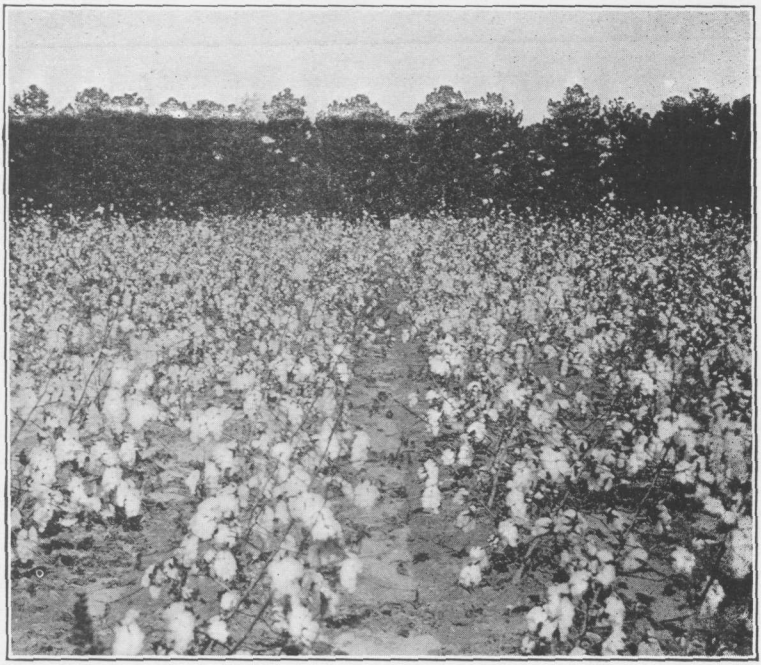

Fig. 2.—On right Cook cotton badly injured by boll rot; on left, a different strain of the same variety having only a medium amount of boll rot.

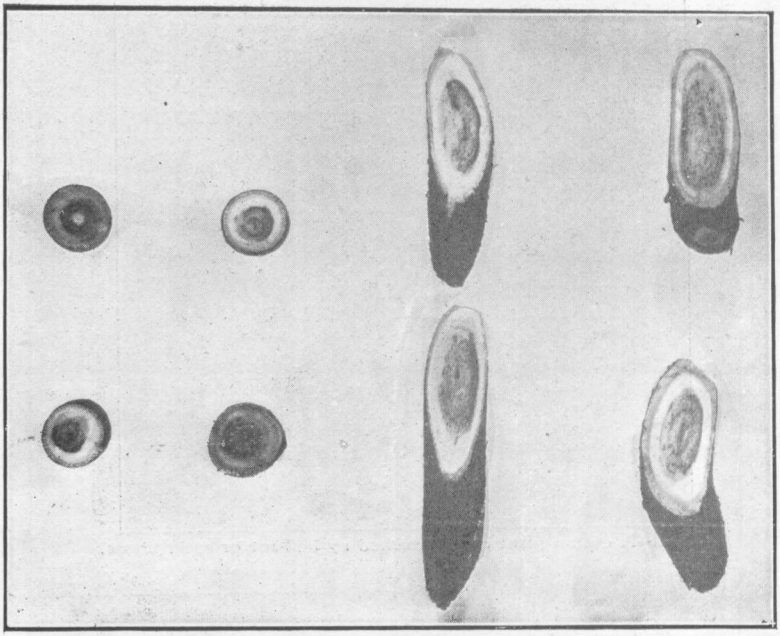

Fig. 3.---Cross-section through cotton stalks injured by wilt. (U. S. Dept. Agr.)

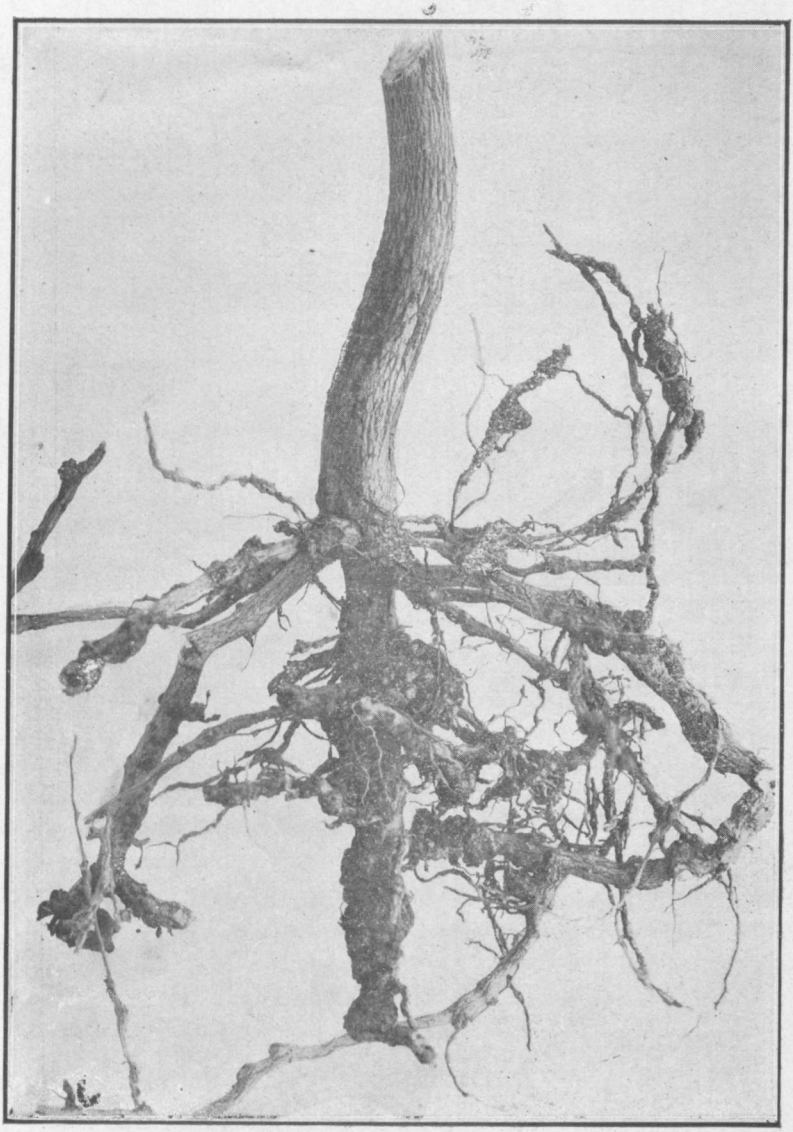

Fig. 4.---Cotton root injured by root-knot or mematodes. (U. S. Dept. Agr.)

Fig. 5.—Rows of Cook cotton from Alabama Experiment Station tested on wilt land; middle row proved immune to wilt, while another strain of Cook in rows on either side was largely killed by wilt.

Fig. 6.—Wilt resistant Cook cotton (from Hall) on the right; common cotton on left.

water may carry the disease to lower parts of the field. The disease may spread from small spots to entire fields, if cotton continues to be grown on the diseased areas. Once in the soil, the germs of wilt may remain for many years, even though no cotton be grown.

Treatment for wilt.—The continuation of cotton on wilt-infected soil means the continuation of the disease. When wilt appears in a field, that part of the field having wilt should be devoted to some other crop, or abandoned.

In 1906, the Station found two places in the fields used for variety tests where a few plants died. The wilted plants were carefully dug and every particle of each burned; the soil for several feet around was thoroughly saturated with a solution of four ounces of formalin to one gallon of water. This disease was not again noted in this part of the field. It is not certain that such treatment of the soil is thoroughly effective, though it is considered advisable when only a few plants are affected.

The germs of the cotton wilt fungus more readily enter wounded cotton roots than those that are sound. The wounds made in cotton roots by the minute nematode worms, (which cause knots or enlargements (Fig. 4) on the roots of cotton, tomatoes, cabbages, etc.), permit the ready entrance of the wilt fungus and the consequent loss through black-root. Fortunately those tiny but very injurious nematode worms can be starved.

When these nematode worms are once introduced (and they are present in most old garden spots in sandy soils), they increase in the soil from year to year. Fortunately, these worms can not live on the fibrous roots of corn, oats, grasses, etc., nor do they generally multiply on peanuts nor on the Iron variety of cowpeas. They can be starved by keeping from growing on the field any plant with tender or fleshy roots, such as cotton and many varieties of cowpeas, most vegetables, morning-glories, and certain other weeds. The warfare against cotton black-root is best conducted by getting rid of the root-knot disease, caused by the nematode worms.

Where wilt has become common on a farm, rotation of crops

becomes doubly important. If practicable, keep cotton out of that field for a number of years. In case it is considered necessary to grow an occasional crop of cotton, let cotton occupy the diseased field not oftener than once in three years, and then, if possible, plant wilt-resistant varieties. The following is one of several rotations suitable for fields infected with wilt. First year, oats, followed by the Iron variety of cowpeas; second year, corn with either Iron cowpeas or peanuts between the rows; third year, a wilt-resistant variety of cotton. Every third year the field may be planted in some one of the wilt-resistant varieties of cotton, which should then be but slightly attacked by black-root.

Wilt-resistant varieties.—Varieties of cotton differ in their susceptibility to the cotton wilt. There is a difference even in different strains of the same variety. For example, Cook, as a variety, is not at all immune, yet at least two strains of Cook have shown up to this time considerable resistance to black-root. It should be stated, however, that there is no variety that has yet been made entirely proof against wilt, as may be seen from the figures in the next table.

In order to test the resistance of a number of varieties and strains which had previously showed more or less promise in this line, these varieties were tested on a field known to be severely infected by cotton wilt. The field selected was one owned by Mr. Wright, Loachapoka, Ala. The counting of diseased plants, the ginning, etc., were all done by a representative of the Experiment Station. The table shows the results.

Tests of wilt-resistant varieties of cotton on infected soil at Loachapoka, Alabama.

VARIETY	Per cent. of plants wilted		Yield per acre		Per cent. of lint.	Per cent. yield of lint over common cotton	Value per acre of Lint at 14c per lb.; Seed at $26.00 per ton.
	Counted July 6	Counted Sept. 1	Seed cotton	Lint			
	Per ct.	*Per ct.*	*Lbs.*	*Lbs.*			
Dixie	39.2	15.9	372	126.0	34	2	$20 89
Dillon	15.2	2.3	885	327.0	37	163	53 08
Common	36 1	46.4	362	185.0	34	.....	20 33
Cook (Hall)	21.8	12.1	965	354.	36 7	166	57 52
Cook 307-6	.....	17.9	928	380.	41	269	61 37
Common	31 4	37.3	303	103.0	34	.....	17 01
Covington-Toole W.R	20.7	10.5	864	337 0	39	227	57 02
Excelsior W. R.	9.5	4.2	736	272.	37	164	44 14
Hybrid	7.9	3.6	618	222.0	36	115	36 58

Dillon, Excelsior Wilt-Resistant, and the hybrid lost very few plants from wilt. Two strains of Cook and Covington-Toole Wilt-Resistant lost more plants than Dillon, but far fewer than did the common cotton. The increased yield of lint of the wilt-resistant strains, Dillon, Covington-Toole, Excelsior, and two strains of Cook, ranged between 163 and 269 per cent. more than that afforded by common cotton.

The value of lint and seed per acre was, for Cook 307-6, $61.37; for Cook (from Hall), $57.52; for Toole, $57.02; Dillon, $53.08; the average for common or mixed cotton was only $18.67. Here is an extreme difference of $42.70 per acre merely as the result of planting wilt-resistant, highly bred seed instead of common seed.

Dillon is the oldest wilt-resistant variety and has been improved by the Bureau of Plant Industry of the United States Department of Agriculture. Its parent variety was Jackson Limbless and it closely resembles its parent.

Dixie is a variety bred for wilt-resistance by the Bureau of Plant Industry of the United States Department of Agriculture. In the tests made at Loachapoka by the Alabama Experiment Station, Dixie, from seed obtained from the United States Department of Agriculture, showed no notable resistance to

wilt. The plant is well supplied with fruit limbs and with bolls of medium size. The percentage of lint is low to medium.

The strains of Cook, Toole, and Excelsior that here proved largely resistant to wilt, closely resemble their respective parent varieties. The station has no seed of these wilt-resistant varieties for sale or distribution this year.

The Dillon and Dixie varieties have been described before.

Cook, selected for wilt-resistance by M. R. Hall, James Bullock County, Alabama, is similar in appearance to other strains of Cook. Cook 307-6, a strain bred by the Alabama Experiment Station, has been selected only one year for wilt-resistance and can not yet be regarded as having fully established its claim to resistance.

Every seed of any kind of this wilt-resistant cotton grown will be needed in the Station's experiments in 1911.

This Experiment Station can not supply seed of any of the above varieties. Limited amounts of seed of Dillon and Dixie may be purchased at the time this is written through W. W. Gilbert, Department of Agriculture, Washington, D. C.

Readers are requested not to apply to this station for either free or purchased cotton seed this year; but on application, the Station will gladly furnish to inquirers the addresses of growers or dealers of standard varieties, if such addresses are not given among those on page 21 of this bulletin.

Excelsior and Hybrid, were obtained from the Georgia State Board of Entomology, Atlanta, Ga.

GROUND ROCK PHOSPHATE COMPARED WITH ACID PHOSPHATE AND BASIC SLAG PHOSPHATE.

Three experiments were made on the Station farm and a fourth in Bullock County to compare these three different phosphates.

On rocky, red, clay-loam soil at Auburn, all three phosphates were used in 1909 in combination with stable manure, supplemented by a complete commercial fertilizer mixture. None of the phosphates notably increased the yield, probably because the large amount of nitrogen and the abundant rainfall in the early summer caused the plants to run too largely to stalk or "weed."

On gray, sandy upland at Auburn (Norfolk sandy loam) the same three phosphates were compared in both 1909 and 1910, the same fertilizer on each plot in 1910 as on that plot in the preceding year.

The tests of ground rock, or raw phosphate, versus acid phosphate and basic slag showed that these different phosphates increased the yields to a profitable extent; yet, owing to the inequality in fertility of the land on which these phosphate experiments at Auburn were conducted, no definite conclusion can be drawn.

However, this experiment was also made for this Station on more uniform land in Bullock county, Alabama; the results follow:

Raw or ground rock phosphate versus acid phosphate and versus basic slag as fertilizer for cotton at James, Bullock County, Ala., in 1909

Plot	Fertilizer per acre		Seed cotton per acre	
	Amount	Kind	Yield	Increase from phosphate
			Lbs.	*Lbs.*
1	240 Lbs. 24	Slag phosphate Bu. stable manure	408	64
2	240 Lbs. 24	Acid phosphate Bu. stable manure	544	200
3	240 Lbs. 24	Raw phosphate Bu. stable manure	368	24
4	200 Lbs. 100	Cotton seed meal Kainit	344	....
5	.....	.....	256	88
6	240 Lbs. 200 " 100 "	Rock phosphate Cotton seed meal Kainit	424	80
7	240 " 200 " 100 "	Acid phosphate Cotton seed meal Kainit	504	160
8	240 " 200 " 100 "	Slag Cotton seed meal Kainit	392	48

Average from Acid Phosphate 180
Average from Slag Phosphate 56
Average from Raw Phosphate 52

In this experiment, carefully conducted by W. R. Hall, on gray sandy land, near James, Bullock County, acid phosphate afforded a much larger increase in yield than did either raw phosphate or basic slag phosphate.

The stable manure was drilled in the same furrow with the phosphates, in the hope that the decay of the latter might serve to make the raw phosphate more soluble. Probably this result would have been more completely attained if the raw phosphate had been composted with the stable manure.