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**Wilt Resistant Varieties of Cotton**

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By

**E. E. CAUTHEN, Associate Agriculturist**

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# WILT RESISTANT VARIETIES OF COTTON

By

E. F. CAUTHEN, Associate Agriculturist.

## SUMMARY.

Cotton wilt and root-knot occur more frequently in the southern third than in any other part of Alabama. However, these diseases are also to be found in the central third, and on small widely separated areas in certain other counties still farther north. Cotton wilt is found most frequently in loose sandy land; it rarely occurs in heavy clay soil.

In total money value of lint and seed per acre a non-resistant strain of Cook, used for comparison, averaged in fifteen experiments \$26.78 per acre; while the wilt-resistant varieties averaged as follows: Modella \$28.96; Wood \$33.19; Dixie \$33.22; Cook No. 307-6 \$34.17; Covington-Toole \$34.42; Tri-Cook \$40.53 per acre. The range of gains from resistant varieties extends from 8.1 percent with Modella to 51.3 percent with Tri-Cook.

An average of the percentages of yearly loss of cotton plants in each variety from wilt is as follows: Cook (check), a non-resistant strain, 40.3 percent; Wood 15.1 percent; Modella 14.7 percent; Covington-Toole 10.5 percent; Cook 307-6 9.3 percent; Dixie 8.5 percent; Tri-Cook 7.3 percent; Dillon 5.4 percent. In the two experiments in which Dix-Afifi was planted, it lost no plants.

The wilt-resistant varieties of cotton used in these experiments differ slightly in their relative earliness.

In comparison with standard varieties like Cleveland, Cook and Triumph, most of them must be regarded as somewhat later in time of opening.

Among the resistant varieties tested, those ranking highest in total money value of seed and lint per acre are the earliest and turn out about 40 percent of lint.

This Station recommends to farmers who have cotton wilt and root-knot in their land that they employ, as a means of controlling these diseases, a simple rotation of crops (see page 88) in which are excluded those crops that have a tendency to increase these diseases. In this rotation, which includes cotton, only wilt-resistant varieties should be planted.

## THE NATURE OF COTTON WILT.

Cotton wilt sometimes called "black-root" or "blight" is a diseased condition of the stem, or roots of the plant. It makes its appearance frequently about the middle of May, and may continue through the remainder of the growing season. After a few days of hot rainy weather, the effects of the disease are most noticeable. The loss is greatest in wet years.

The disease is due to a fungus (*Fusarium vasinfectum*, Atk), which can live in the soil for a long time on decaying vegetable matter. It is propagated by means of tiny spores and other forms of fruiting bodies. This particular fungus seems to attack only the cotton plant.

In 1892 Prof. George F. Atkinson, while working at this Station described this disease. In 1898 Prof. S. F. Earle of this Station was called to investigate an outbreak of cotton wilt on the farm of Mr. James Hall at Midway, Bullock County. (1)

### SYMPTOMS OF COTTON WILT.

The fungus enters the roots and stems of the cotton plant and its threads (mycelia) fill or block up the water-carrying tubes, thereby cutting off or interfering with the supply of food elements and water from the soil. The interference with the water and food supply soon causes the cotton plant to wilt.

When a cotton plant is severely attacked by this fungus, its leaves may suddenly wilt without any apparent cause and fall off, leaving only a dead stem standing. Sometimes only a small part of the plant dies. The remaining part may put on a new growth, but it will always remain dwarfed in appearance.

### EXTENT OF COTTON WILT IN ALABAMA.

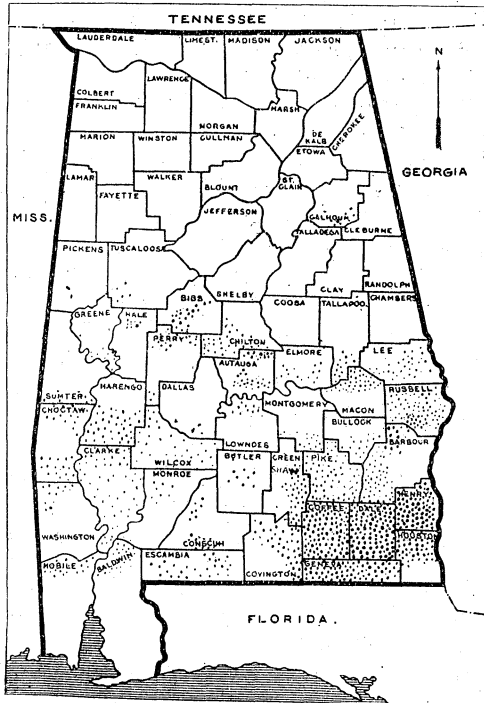
Cotton wilt occurs in two-thirds of the counties of the State. It is spreading rapidly, and it seems a matter of a short time when it will have extended to all sandy soils on which cotton is continuously grown.

The disease seems severest on loose sandy soils, but it may occur on any sandy soil even though it has a clay subsoil. It rarely occurs on heavy clays. The worst infection is usually found where the sand has washed in and formed a very deep loose sandy soil.

Wilt and root-knot are severest in that part of Ala-

(1) Bul. 107, Alabama Experiment Station, p. 299.

bama lying south of a line drawn westward from Lee County to Sumter County. It is also found in small widely distributed areas in other counties.



The numerous dots on the map indicate that portion of the State where cotton wilt is severest.

## METHODS OF CONTROLLING COTTON WILT AND ROOT-KNOT.

### WILT-RESISTANT VARIETIES OF COTTON.

Wherever cotton wilt occurs, nematodes, which cause root-knot, are usually found. These worms enter the cotton roots, and cause abnormal growths, thus making it easy for wilt to gain an entrance into the cotton roots.

Most varieties of cowpeas, such as Whippoowill, New Era, Red Ripper, and Clay are susceptible to root-knot, and when they are grown on infested land, the number of nematode worms or gall worms increases. Sweet potatoes, sugar cane, and many garden vege-

tables also serve to increase the number of gallworms. Such crops should not be grown on wilt-infected land, because they increase the number of nematodes in the soil and consequently increase the loss from wilt whenever cotton is planted on such land.

The common varieties of cotton differ widely in their resistance to wilt and root-knot. In those sections of the Cotton Belt badly infected with these diseases have originated varieties more or less resistant. Some of them have proven very profitable, even when grown on badly wilt-infected land. However, not all of the wilt-resistant varieties have desirable qualities, as earliness, easy harvesting, etc.

In 1911, this Station began a series of experiments in which many of the wilt-resistant or "anti-blight" varieties were planted side by side and carefully studied. The experiments were located on badly infected lands in different parts of the state, and their results, along with some recommendations, are published in this bulletin.

On the Alabama Experiment Station farm at Auburn there was then no badly infected wilt-land. Therefore, the experiments had to be located away from Auburn, where suitable lands and farmers willing to co-operate were available. Such men and locations were found in Butler, Lowndes, Lee, Macon, Pike, and Tallapoosa Counties. This experimental work has been supported by the appropriation made by the Legislature of Alabama in the "Local Experiment Law."

#### PLAN OF EXPERIMENTS.

A representative of the Station always selected the land, and laid off the plots. The preparation of the land and its cultivation were left to the farmer conducting the experiment.

The same kind of commercial fertilizer was used on most experiments. It was mixed at the Experiment Station, sacked and shipped to the experimenter. It usually consisted of 320 pounds of acid phosphate per acre, 160 pounds of kainit and 200 pounds of cottonseed meal. Some years 100 pounds of nitrate of soda was applied as a side dressing about the second or third cultivation.

The cotton seed of the different varieties were obtained from the originator or some reliable grower each year. The planting was usually done under the

supervision of a Station representative. An equal amount of seed was planted on each plot.

The experimenter was requested to thin the cotton in the usual way, leaving as nearly as possible a perfect stand and the same number of plants on each row. After the second cultivation or "dirting the cotton", no more plants were to be destroyed by hoeing or plowing—a request not carefully complied with in every experiment.

About the middle of June a representative from the Station visited each experiment and made a careful count of all plants, both diseased and healthy, and pulled up all dead or nearly dead plants. On subsequent visits only the dead or nearly dead plants were pulled up and counted. The counts were made about 30 days apart throughout the growing season.

The plants that were not badly attacked or that had partly recovered are not included in the number of dead or nearly dead plants. The wide difference between the number of plants indicated by 100 percent of a stand of one variety taken as a standard and the small number of some other varieties is accounted for by the fact that many plants died either from wilt or from "sore shin" (*Rhizoctonia*) between the time of thinning and of the first counting. However, the percentage of dead or nearly dead plants represents the relative loss of the different varieties from wilt. The loss of plants from "sore shin" and cultivation is not taken into the calculation in making up the table of losses.

The picking and weighing of the cotton from each plot was done in most cases under the supervision of a representative of the Station.

All calculations of the yield and percentage of seed and lint are based on the ginning results obtained from those same varieties when they were included in the variety tests at the Experiment Station.

The percent of lint of most varieties is an average obtained from several ginnings, and is as follows: Cook 583, 42.8 percent; Cook 307-6, 39.5 percent; Covington-Toole, 39.1 percent; Dillon, 39.1 percent; Dix-Affi, 30.6 percent (a long staple variety); Dixie, 35.3 percent; Modella, 35.6 percent; Tri-Cook, 41.5 percent; Wood, 35.1 percent.

The prices of seed and lint used in the table are those:

that were employed in calculating the value of seed and lint in the variety tests at the Experiment Station during the years of the wilt experiments and are given in the following table:

Year -----	1911	1912	1913	1914	1915
Lint per pound -	9c.	12c.	13c.	6¼c.	12c.
Seed per ton ----	\$16.00	\$16.00	\$20.00	\$16.00	\$30.00

### COMPARISON OF DIFFERENT WILT-RESISTANT VARIETIES OF COTTON ON BASIS OF MONEY VALUE PER ACRE.

In the extensive wilt-variety test for the past five years we have compared the leading wilt-resistant varieties of cotton. These different varieties show some difference in yield and a wide variation in their resistance to wilt and root-knot. None of them are entirely immune to these diseases, but several of them are sufficiently resistant to make profitable crops of cotton even on the worst infected land.

In studying the table of "Total Values of Seed and Lint per acre" it should continually be borne in mind that it is practically impossible to find areas which are uniformly infected with these diseases and large enough to accommodate eight or ten different varieties in one-tenth acre plots. Therefore, one experiment is not sufficient for conclusions on the resistance of any one variety; but an average of several experiments, as recorded in the table below, is more valuable. A variety may lose a larger number of plants and produce less cotton in one experiment than in another. This larger loss in money value does not necessarily mean that this variety is less resistant than some other, but it may mean that it was planted on a worse infected area. However, when one variety in many tests falls below some other variety, it is doubtless due to its lack of resistance and productiveness.

#### WILT-RESISTANT VARIETIES MEASURED BY THEIR MONEY VALUE.

The comparative value of the different wilt-resistant varieties of cotton in these experiments is shown in a table of total money value of seed and lint for each.



The money values are based on the actual yield of seed and lint cotton per acre. No corrections are made for the difference in stand found at the first count, which was usually about the middle of June, and none for the difference in stand at the time of picking. However, it should be borne in mind that at the time of thinning in nearly every experiment the stand was reported good or perfect.

The total value of each variety in the sixteen experiments recorded in the following table shows, in a fairly satisfactory way, its relative merit:

Table I.—Total Value of Seed and Lint Per Acre

Name of Experimenter	Location	Year	Names of varieties tested									
			Dillon	Mo- della	Cook (Check)	Wood	Coving- ton Toole	Tri- Cook	Cook 307.6	Cook (Check)	Dixie	Dix- Affi
E. T. Peddy -----	Loachapoka -----	1911	\$60.75	\$39.20	\$38.50	\$46.42	\$47.96	\$57.02	\$53.57	\$46.13	\$38.33	\$
S. T. Slaton -----	Loachapoka -----	1912	30.42	25.24	28.18	39.15	36.63	41.68	45.03	28.18	35.35	
Jas. T. Ramage -----	Brundidge -----	1912	52.74	35.56	20.14	38.54	50.27	46.56	41.94	39.54	44.42	
W. J. Bridges -----	Notasulga -----	1913	54.40	46.10	43.29	56.21	58.86	66.25	42.72		47.20	
T. J. Burk -----	Tuskegee -----	1913	54.50	41.54	14.74	33.34	50.57	24.95	45.26	43.51	55.96	
Jas. T. Ramage -----	Brundidge -----	1913	34.54	27.79	6.81	29.14	27.28	39.16	22.92	8.82	30.10	
Jim Whatley -----	Auburn -----	1914		12.94	13.89	16.07	21.13	19.32	14.72	15.99	14.64	
David Richardson -----	Notasulga -----	1914			22.46	23.63	18.97	26.73	40.25			
W. W. Thompson -----	Liverpool -----	1914		29.68	29.25	30.44	35.90	29.00	30.54	28.08	31.56	29.07
Jas. T. Ramage -----	Brundidge -----	1914		20.64	13.03	34.41	29.94	31.49	36.36	14.24	29.31	
Joe Russell -----	Lowndesboro -----	1914		55.50	40.87	55.80	57.90	70.33	58.31	47.43	39.90	39.58
J. R. Stough -----	Notasulga -----	1914		14.89	9.60	19.36	14.99	18.81	20.13	14.98	14.83	
David Richardson -----	Notasulga -----	1915		20.40	31.34	29.31	29.18	40.68	18.39	37.73	38.39	
J. J. McGuire -----	Notasulga -----	1915		24.50	33.66	27.56	18.45	42.38	26.39	33.66	28.82	
J. H. Reynolds -----	Greenville -----	1915		11.43	20.96	16.94	18.30	22.67	15.98	20.25	16.32	
Average acre value of each variety				28.96	24.45	33.09	34.42	40.53	34.17	29.12	33.22	
Percentage of increase in acre value over average of checks				8.1		23.5	28.5	51.3	27.6		24.0	

*Mr. E. T. Peddy:* The experiment conducted by Mr. Peddy was located on a dark sandy soil with a yellow sandy subsoil. The land was not badly infected with wilt.

The average value of seed and lint of the two check plots was \$42.31 per acre; the average value of the wilt-resistant varieties was \$49.03, making an average difference of \$6.72 per acre in favor of wilt-resistant varieties. The four largest yielding varieties named in order are Dillon, Tri-Cook, Cook 307-6 and Covington-Toole.

*Mr. S. T. Slaton:* This experiment was located near the one conducted by Mr. Peddy, and on very much the same kind of land.

The total value of seed and lint per acre for Cook 307-6 was \$45.03; for Tri-Cook \$41.68; for Wood \$39.15; and for Cook (check) \$28.18. The gain from planting wilt-resistant varieties is measured by \$16.85 per acre from Cook 307-6, \$13.50 from Tri-Cook and \$10.97 from Wood.

*Mr. J. T. Ramage:* The experimental plots for 1912 and 1913 were located about one mile north of Brundidge on a sandy plateau-like elevation. The surface sloped slightly but not sufficient to wash; the fertility of all plots seemed about equal.

In 1912 the value of lint and seed per acre was \$52.74 for Dillon, \$46.56 for Tri-Cook and \$44.42 for Dixie. The average of the Cook (check) plots was \$29.84; this leaves a difference of \$22.90 in favor of Dillon; \$16.72 and \$14.58 in favor of Tri-Cook and Dixie respectively. A difference of \$32.60, or a gain of 162 percent is noted between Dillon and the check that suffered the greatest loss. In the 1913 experiment the advantage of the resistant varieties over the non-resistant variety is still greater.

In 1914 the experiments were transferred to a new location in the southern part of Brundidge. The land sloped considerably and was inclined to wash; its soil was dark sand, with reddish yellow sandy subsoil; the plots lay between two terraces and were fairly uniform in fertility.

The average money value per acre of Cook (check) was \$13.65, while the average of the resistant varieties was \$30.71 per acre, an increase of 125 per cent. in favor of the latter varieties. Among the wilt-resistant

varieties themselves there is the broad difference of \$15.72 by which Cook 307-6 exceeded that of Modella. The three largest yielding varieties named in order were Cook 307-6, Wood and Covington-Toole.

*Mr. W. J. Bridges:* This experiment is located on a dark sandy soil in Notasulga; the surface of the plots is almost level, with the exception of a shallow sag that runs across all of the plots. The field has been in cultivation many years.

The total value of the lint and seed of the Cook (check) was \$43.29 per acre, while the average of the wilt-resistant varieties was \$53.11, making an average difference of \$9.82 in favor of the latter varieties. The four largest yielding varieties, named in the order of their value, were Tri-Cook, Covington-Toole, Wood and Dillon.

*Mr. T. J. Burk:* This experiment is located on badly infected land in Tuskegee; the surface is almost level; the soil is a fine sand, or silt, and has been in cultivation for a half century or more; its fertility is above that of the average farm land.

The total value of seed and lint per acre shows a range in value from \$14.74 on the lowest check to \$55.96 on Dixie the highest wilt-resistant variety in this experiment. The second check was on land not badly infected with wilt. The average gain of all the wilt-resistant varieties over the average value of the checks is \$18.90 per acre.

*Mr. Jim Whatley:* This experiment is located about a mile and a half from Auburn on light sandy soil with a yellow subsoil. During the past ten years cotton has been grown on this piece of land alternately with corn and cowpeas and with corn and grain; the land has been fertilized liberally with commercial fertilizers, lot manure and leguminous crops.

The total value of lint and seed per acre from the first picking September 4th (the weights of the late pickings were lost) was \$21.13 for Covington-Toole, \$19.32 for Tri-Cook and an average of \$14.94 for the Cook (checks). Covington-Toole gained \$6.19 and Tri-Cook \$5.13 per acre over the average of the checks.

*Mr. W. W. Thompson:* This experiment is located at Liverpool, Macon County; the soil is a fine sand with a fine yellow sandy subsoil and has been cultivat-

ed in cotton many years. The 1913 experiment was located on badly infected land, while the 1914 experiment located on a different area showed very little wilt.

The yield of the 1913 experiment was lost through a mistake in picking. The advantage of one variety over the others in the 1914 experiment is not great.

*Mr. Joe Russell:* This experiment was located about a mile north of Lowndesboro on a dark fine sandy soil. It is typical of a badly infected section of Lowndes County. The fertility of this soil is above that of the average farm land.

Of the wilt-resistant varieties Dix-Affi made the least gain in money value over the non-resistant variety, while Tri-Cook made the largest gain, a difference of \$30.75 in favor of the latter variety. The average gain of the wilt-resistant varieties over the non-resistant is \$9.75 per acre. It is to be noticed that the money value per acre of the wilt-resistant varieties is sufficiently great to justify the growing of cotton on land highly fertilized, or naturally fertile, even if it is badly infected with wilt.

*Mr. J. R. Stough:* This experiment was located on badly infected soil about four miles from Notasulga. The land has been in cultivation many years and slopes gradually from one side of the field to the other. At the time of thinning the stand of plants was almost perfect, but at the time of the first count a considerable number of plants had died.

The money value of Cook 307-6 was \$20.13 per acre, while the average value of the non-resistant Cook (check) was \$12.29 per acre. An average difference of \$5.05 per acre in favor of the wilt-resistant varieties is shown in this experiment.

*Mr. David Richardson:* The experiments conducted by Mr. Richardson were located on a coarse sandy soil that had been in cultivation many years. The 1915 experiment which was in a different location was not badly infected with wilt.

In the 1914 experiment Cook 307-6 made a total value of \$40.25 per acre, while the Cook (check) adjacent made only \$22.46. This shows the advantage of planting a wilt-resistant variety.

In the 1915 experiment it is noticed that the difference between the non-resistant and the wilt-resistant

varieties is not wide. The greatest money value per acre came from Tri-Cook, which made \$40.68 worth of seed cotton per acre. The three best yielding varieties, named in their order, were Tri-Cook, Dixie and Cook (check).

*Mr. J. J. McGuire:* Mr. McGuire's experiment was located near that of Mr. Richardson's. The soil is light sandy with a yellow subsoil. The amount of infection was not very great, as is shown from the number of plants that died on the Cook (check) plots.

The money value of Cook (check) per acre is greater than that of the wilt-resistant varieties. This comes from the fact that the best yielding strain of Cook from the Experiment Station breeding test was used as a check in this experiment and that it possessed some immunity to black-root, as was found out later.

*Mr. J. H. Reynolds:* This experiment was located on a light sandy soil with a reddish subsoil about five miles west of Greenville. The land was badly infected with wilt.

The record of the first picking was the only one obtained. Almost all the late crop was destroyed by the boll weevil.

It is again noticed that the variety used as a check yielded a greater money value than most of the wilt-resistant varieties. This Cook (check) variety was the same as mentioned in the preceding experiment.

#### AVERAGE OF ALL EXPERIMENTS ON BASIS OF ACRE VALUES.

In an average of fifteen tests or more, the percentage of increase in crop value over the average of the check varieties indicates a difference in money value of 8.1 percent for Modella, 23.5 percent for Wood, 24 percent for Dixie, 27.6 percent for Cook 307-6, 29.5 percent for Covington-Toole and 51.3 percent for Tri-Cook. In total value of seed and lint per acre Dillon ranked high, and was probably the least susceptible of the wilt-resistant varieties to this disease.

Tri-Cook, Covington-Toole and Cook 307-6 in the fifteen experiments made an average acre money value of \$40.53, \$34.42 and \$34.17 respectively.

#### COMPARATIVE RESISTANCE OF DIFFERENT VARIETIES OF COTTON.

The table of "Percentage of Plants Dead or Nearly Dead" shows the relative resistance of the different

varieties of cotton in sixteen experiments, covering a period of five years. It is practically impossible to find areas that are uniformly infected with wilt and nematodes and that are large enough to accommodate eight or ten different varieties in one-tenth acre plots.

The following table shows the percentage of plants that died during the season. The first count was made about the 15th of June; the subsequent counts followed about thirty days apart during the growing season. All the dead or nearly dead plants were pulled up at each count so that they would not interfere with the next count. When a plant looked as if it might recover sufficiently well to produce fruit, it was not pulled up.

Table II.— Percentage of Plants Dead or Nearly Dead up to the Last Count of the Season

Name of Experimenter	Location	Year	Names of Varieties Tested									
			Dillon	Mo- della	Cook (Check)	Wood	Coving- ton Toole	Tri- Cook	Cook 307_6	Cook (Check)	Dixie	Dix- # Affi
E. T. Peddy	Loachapoka	1911	1.4	2.9	22.1	10.5	5.2	6.0	3.7	15.1	3.7	
S. T. Slaton	Loachapoka	1912	3.0	28.0	35.2	17.2	25.1	12.9	12.4	39.4	4.9	
Jas. T. Ramage	Brundidge	1912	3.7	10.2	68.2	11.6	10.8	6.6	10.2	33.7	3.2	
W. W. Thompson	Liverpool	1913	7.4	29.2	68.0	27.5	9.6	19.0	28.4			
W. J. Bridges	Notasulga	1913	3.5	21.3	43.9	19.5	7.4	12.0	14.3		18.7	
T. J. Burk	Tuskegee	1913	3.0	6.2	43.5	7.7	3.5	5.2	5.1	24.5	2.9	
Jas. T. Ramage	Brundidge	1913	15.5	35.4	56.3	20.1	34.8	9.5	10.1	33.2	20.0	
Jim Whatley	Auburn	1914		7.0	21.6	14.6	4.6	0.9	6.1	3.0	2.7	
David Richardson	Notasulga	1914		13.8	42.4	14.4	4.9	2.4	1.2	46.5	14.4	
W. W. Thompson	Liverpool	1914		1.6	8.0	1.4	1.1	0.6	0.0	4.9	7.7	0.0
Jas. T. Ramage	Brundidge	1914		34.3	82.5	21.8	8.6	12.5	10.2	71.2	26.1	
Joe Russell	Lowndesboro	1914		2.9	53.3	11.1	7.6	3.5	5.4	15.1	6.8	0.0
J. R. Stough	Notasulga	1914		10.1	45.2	21.5	16.8	7.0	10.4	26.6	4.5	
David Richardson	Notasulga	1915		14.8	3.0	8.3	6.3	10.1	1.8	46.5	1.2	
J. J. McGuire	Notasulga	1915		9.8	18.9	13.2	15.7	3.7	16.3	18.9	7.1	
J. H. Reynolds	Greenville	1915		8.3	33.1	20.5	5.4	4.8	13.5	29.9	3.9	
Average Percentage of Loss			5.4	14.7	40.3	15.1	10.5	7.3	9.3	29.2	8.5	



*Dillon*: In the above table Dillon occurred in seven experiments during three years, and lost on an average of 5.4 per cent. of its plants. In comparing it with its Cook (check), which is very susceptible to wilt, it is noticed that the losses in the check are about twelve times as numerous as in the case of Dillon.

In 1913 Dillon sustained a loss of 7.4 percent at Liverpool, and 15.5 percent at Brundidge.

*Modella*: Modella was tested sixteen times and lost on an average 14.7 percent, its loss covering a range from 1.6 percent in 1914 at Liverpool to 35.4 percent at Brundidge in 1913. It is noted that 1913 was a year during which all varieties suffered badly from wilt and nematodes.

*Cook (check)*: The first check in the above table shows that the loss of cotton plants due to wilt and nematode injuries was severe in every experiment. A wide range of losses from 3 percent at Notasulga in 1915, to 82.5 percent at Brundidge in 1914 is observed. The average loss in the sixteen experiments is 40.3 percent.

*Wood*: This variety closely resembles Dillon in some of its characteristics, and is almost as immune to wilt as Dillon. Its loss ranged from 1.4 percent in 1914 to 27.5 percent in 1913. Its average loss for sixteen experiments was 15.1 percent.

*Covington-Toole*: In comparing this variety with its nearest Cook (check) it is observed that its average loss was only 10.5 percent, while the average loss of the check was 40.3 percent. The loss from wilt was not sufficient to seriously interfere with the stand any year. During the sixteen tests it lost an average of only 10.5 percent.

*Tri-Cook*: This new variety shows that it resisted the attacks of wilt and nematodes remarkably well. In no experiment during the five years did it lose over 19. percent of its plants. Its average loss was only 7.3 percent.

*Cook 307-6*: This variety originated at the Alabama Experiment Station. In the above table it is noted that its greatest loss was in 1913 at Liverpool, when 28.4 percent of its plants died during the growing season. Its range of loss for sixteen experiments varies from no loss to about 28 percent. Its average loss for five years was 9.3 percent.

*Dixie*: This variety occurs in fifteen experiments and sustained an average loss of 8.5 percent.

*Dix-Afti*: This long staple hybrid was planted in two experiments in 1914. In these two experiments it was not subjected to as severe a test as some of the other varieties. It was found that it did not suffer any loss in either of these experiments.

#### AVERAGE LOSSES.

By a study of averages in the above table it is observed that the two check plots lost respectively 40.3 percent and 29.2 percent. Tri-Cook lost the smallest number of plants, the average being only 7.3 percent for the five years, while Cook 307-6 followed very closely with a loss of only 9.3 percent.

It is noted that no variety is entirely immune to root-knot and cotton wilt. In the experiments in which Dillon was included it lost the least number of plants. Of the so-called wilt-resistant varieties, Wood lost the largest number of plants in the sixteen experiments. Enough plants of any of the wilt-resistant varieties withstood the diseases, even under the severest conditions, to make a fairly good stand and to produce crops above the average in value.

#### RELATIVE EARLINESS OF THE WILT-RESISTANT VARIETIES OF COTTON.

A late variety of cotton is not suited to boll weevil conditions. Only the early or medium early varieties seem to give satisfactory yields under heavy weevil infestation. A wilt-resistant variety may be profitable when it is grown on badly infected soil, but may prove a failure after that territory becomes infested with boll weevils.

The Experiment Station is selecting strains from wilt-resistant varieties for earliness and longer fiber, but it has no seed ready for distribution. Addresses of growers of wilt-resistant varieties will be furnished on application to Experiment Station.

Most wilt-resistant varieties tested in these experiments are somewhat late. Below is given a table which shows their relative earliness, as obtained from some of the wilt experiments in different parts of the State.

Table III.—Relative Earliness of Different Varieties.

Varieties	Location and Percentage of Total Crop Picked						
	Loachapoka Sept. 12 1912	Brundidge Sept. 2 1914	Liverpool Sept. 15 1914	Lowndesboro Sept. 22 1914	Notasulga		Auburn Sept. 3 1915
					(McGuire) Sept. 12 1914	(Richardson) Aug. 31 1915	
Modella .....	56.8	66.2	75.3	85.6	27.3	22.2	16.9
Cook (check) .....	75.0	73.8	83.9	89.9	47.4	58.3	
Wood .....	60.9	50.5	70.4	84.3	44.0	38.5	27.7
Covington-Toole .....	59.4	64.4	60.4	87.9	35.9	40.0	24.0
Tri-Cook .....	66.7	58.0	75.7	82.3	50.0	45.5	
Cook 307-6 .....	59.7	70.5	72.0	86.2	31.5	26.7	23.4
Dixie .....	58.1	43.2	57.1	81.0	30.8	42.1	25.4
Dix-Afifi .....			77.4	77.4			
King .....							69.2
Triumph .....							35.6
Cleveland .....							44.0

The above table shows that in the 1912 experiment Cook (check) was the earliest and Modella the latest. By September 12th over half the seed cotton of all varieties was picked.

The Brundidge test in 1914 shows that half of all varieties except Dixie was picked by September 2nd. Their earliness as measured by the percentage of total cotton picked by this date ranged from Cook 73.8 percent to Dixie 43.2 percent.

The Liverpool experiment showed that Dix-Affi was there the earliest of the wilt-resistant varieties and Covington-Toole the latest, the difference between them being about 20 percent.

The experiment at Lowndesboro was picked September 22nd for the first time. The difference between the earliest and latest variety as shown by the first picking is only about 10 percent.

This small difference shows that when the first picking is late, the difference between the earliest and the latest varieties is not wide.

In the 1915 test by Mr. McGuire at Notasulga, the earliest variety was Tri-Cook. In the same year a test conducted by Mr. Richardson in Notasulga and picked August 31st, showed Tri-Cook again the earliest. In the Richardson experiment 27.3 percent of Modella was gathered at the first picking and 50 percent of Tri-Cook.

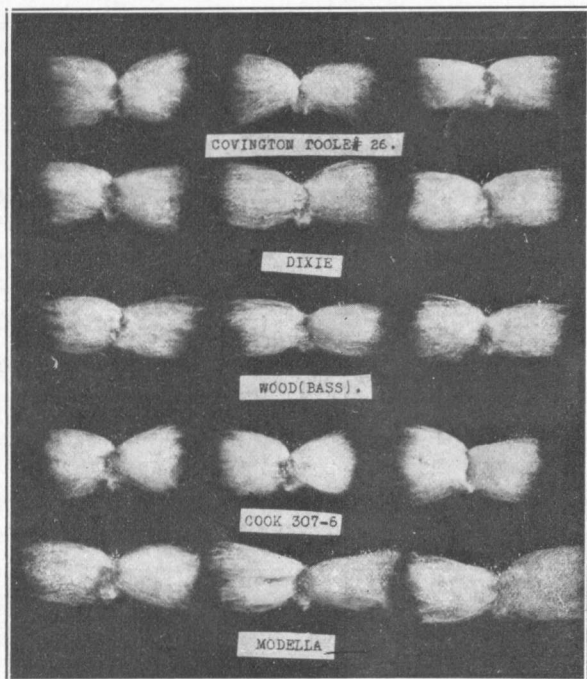
In the ordinary cotton variety test at Auburn in 1915 the first picking was made September the 3rd. At this time, 16.9 percent of Modella was picked; and 60.2 percent of Wood (this is an early strain of Wood); 35.6 percent of Triumph; 44 percent of Cleveland; and 69.2 percent of King. It must be borne in mind that the last three varieties are not wilt-resistant; they are placed in this table in order that the relative earliness of the wilt-resistant varieties may be compared with some well known early and medium early non-resistant varieties.

The above table shows that among the different wilt-resistant varieties there is not a wide difference in their relative earliness. In comparison with such standard varieties as Triumph, Cook and Cleveland, most of the wilt-resistant kinds must be regarded as somewhat later in maturing.

A study of yields of varieties of cotton, as reported



In the centre are the three rows of the original Cook plants tested on severely infested wilt land at Loachapoka. Notice the resistance of the middle row. The plants on this row constitute the beginning of Cook 307-6, a wilt-resistant strain.



The comparative length of fiber of some of the most important varieties described.



by experiment stations in boll weevil territory, seems to show that some of the medium early varieties often produce a greater money value per acre than the extremely early varieties like King or Simpkins. Certainly where boll weevils are absent or few in numbers, as at Auburn in 1915, certain medium early varieties have surpassed in yield the extremely early varieties.

#### BRIEF DESCRIPTION OF WILT-RESISTANT VARIETIES OF COTTON USED IN EXPERIMENTS.

##### DILLON.

In 1900 some wilt-resistant plants were selected by a representative of the U. S. Department of Agriculture from a badly infected field of Jackson Limbless cotton growing near Dillon, South Carolina. This selection was later named Dillon to distinguish it from Jackson Limbless, its parent. Small quantities of seed of this new variety were widely distributed over the wilt-infected sections of the Cotton Belt, but this variety did not prove very satisfactory because of its cluster habit, lateness in maturing and difficulty in picking. It is the most resistant variety to wilt and nematodes thus far tested by the Alabama Experiment Station.

The Dillon plant grows tall on fertile soil and usually has one, two or three large base limbs. Its fruiting limbs are short and its bolls grow in clusters. The bolls are small, slender, somewhat pointed and difficult to pick. The seed are small and fuzzy. Its fiber is about 7-8 inch long; its percentage of lint is about 37.

##### MODELLA.

This variety originated in Georgia some years ago. It was selected from Excelsior by Mr. A. C. Lewis of the Georgia State Board of Entomology and resembles the old Peterkin variety. The plants are medium size and have many small straight limbs with three or four base limbs. The bolls are medium size and about 80 to 85 of them make a pound of seed cotton. The seed are small and many of them are smooth and black. The percent of lint is about 35; its fiber is from 3-4 to 7-8 inch long. This variety is late and lacks storm resistance.

##### COOK.

Cook variety, which was used as a check in most variety tests, came from the breeding experiment at the Alabama Experiment Station, and represents one of the most productive strains of this variety. The plants are intermediate in type and have two or three base limbs with many long fruiting limbs. The bolls are medium large, open wide and are easily picked. This variety is medium early, but is lacking in storm-proof qualities. The seed are small and very fuzzy; the fiber is short and strong. It turns out at the gin 42 to 43 percent of lint. This variety is very susceptible to wilt and nematodes, and for this reason it was used as a check in the variety tests.

##### WOOD.

The Wood variety was developed by Judge Sam Wood of

Abbeville, Alabama. Its plants are tall and semi-cluster in habit. It is not easy to pick, has medium size bolls, matures late, and has heavy foliage, but it shows considerable wilt-resistance and is productive. The seed are medium size and fuzzy; its fiber is short; it turns out about 35 percent of lint.

A strain of Wood bred by Mr. A. G. Bass, Headland, Alabama, produces a more open type plant and seems a little earlier than ordinary Wood.

#### COVINGTON-TOOLE WILT-RESISTANT.

This variety was developed by Mr. W. F. Covington of Headland, Alabama. It is a selection from the Toole variety, which somewhat resembles Peterkin. The plants are small and have light foliage and are productive. The bolls are ovate, early and easily picked. The seed are small and very fuzzy. The average percentage of lint in seven tests was 39.1; its fiber is short; it shows decided resistance to wilt. This variety is being recommended by the originator for boll weevil conditions.

#### TRI-COOK.

In the fall of 1910, Mr. M. R. Hall of James, Alabama, mixed a small lot of improved Cook and pure Triumph seed cotton and ginned them together. From this mixture he selected the basis of his Tri-Cook variety, which still shows that after five years of selection the type of plant is not yet uniform.

Most plants resemble Cook in type, shape, size of boll, and percentage of lint. The seed are uniform in size, somewhat longer than ordinary Cook. The percentage of lint in a three-year test averages 41.

Tri-Cook ranked well in resistance to root-knot and wilt, as is seen in the table of comparative losses. It ranked second in the average money value of seed and lint per acre in the four years tested.

#### COOK 307-6.

This variety originated at the Alabama Experiment Station. In 1909 three plants that had withstood the wilt were found in the breeding block of the Cook-row-test. They were harvested separately and the seed of each plant was planted on a separate row the next year on badly infested land at Loachapoka. The progeny of one plant showed considerable immunity to wilt, and from this one plant originated the strain of Cook 307-6.

Cook 307-6 resembles the ordinary Cook variety. The plants when grown on fertile land, are inclined to develop a number of vegetative or "wood" limbs. Its bolls are easily picked and about 70 make a pound of seed cotton. They show some storm resistance and seem not so susceptible to boll-rot as the ordinary Cook. Its seed are small and fuzzy; the percentage of lint averages 39.5.

The resistance of Cook 307-6 to wilt and nematode injury is strong. Whether it is early enough for boll weevil conditions remains to be proved.

#### DIXIE.

Dixie was developed by the United States Department of



Agriculture. It belongs to the Peterkin group, and has long basal limbs and long slender fruit limbs. Its bolls are medium size, and it requires about 70 to make a pound of seed cotton. They are easily picked. The seed are small and fuzzy; the percentage of lint to seed is 35; its fiber is about 7-8 an inch long. Dixie is thought to be rather late for boll weevil conditions. It is a resistant variety and produces well under ordinary conditions.

#### DIX-AFIFI.

Dix-Afifi is a hybrid made by Mr. A. C. Lewis, of the Georgia State Board of Entomology, by crossing Dixie on Mit-Afifi. The last named variety is an Egyptian cotton found to be very resistant to nematodes. This hybrid resembles Dixie type of plant. The bolls are medium size, easy to pick, but mature late. The fiber is long and silky; the percentage of lint to seed is about 30.

*This Station has no seed for sale of any of the above varieties, but can furnish, on application, lists of growers of most resistant varieties.*

#### RECOMMENDATIONS FOR CONTROLLING COTTON WILT AND ROOT-KNOT.

The cotton wilt fungus seems to attack only the cotton plant, and fortunately it may be starved out by a judicious rotation of crops.

The choice of crops for a rotation is important where the land is infested with nematodes and wilt. No crop or variety that encourages the multiplication of nematodes or wilt should be introduced into the rotation. A few of the crops that increase the number of nematodes are most varieties of cowpeas, (except Iron and Brabham), sweet potatoes, soybeans, vetches, clovers, sugar cane, melons, and most garden vegetables. Some crops that tend to starve out nematodes and wilt are corn, oats and other grains, grasses, sorghums, velvet beans, peanuts, beggar weed, and Iron and Brabham cowpeas. For infected land the following three-year rotation is suggested:

1st year—Plant corn and between the corn rows or hills plant Iron or Brabham cowpeas. Where early autumn pasture for cattle is desired, velvet beans may be planted with the corn and grazed while green and in time to sow a fall grain crop.

2nd year—Plant oats; after the grain is cut for hay or seed, plant the stubble in Iron or Brabham cowpeas for hay or seed. Follow this with some winter grain for a cover crop.

3rd year—In the spring plow under the cover crop and plant some wilt-resistant variety of cotton.

*Use Wilt-Resistant Varieties:* It is earnestly recommended that only wilt-resistant varieties of cotton be planted on wilt infected land, if such lands must be planted in cotton. The importance of this suggestion is emphasized by a careful comparison of the results of the wilt-resistant and the non-resistant varieties of cotton tabulated in this bulletin.

The farmer may develop a wilt-resistant strain of cotton from his favorite variety if he will carefully follow a few well established principles of plant breeding. However, to breed a good variety of cotton requires a great deal of care and time extending through a number of years. If he is not willing to give the time necessary, he will make more rapid progress by buying pure wilt-resistant seed from some reputable grower, who is engaged in systematic seed improvement.