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OF

AGRICULTURAL EXPERIMENT STATION,

Agricultural and Mechanical College,

AUBURN, ALA.

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A New Root Rot Disease of Cotton.

Report of Alabama Weather Service.

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A New Root Rot Disease of Cotton.

GEO. F. ATKINSON.

In response to a circular letter issued from the Alabama Agricultural Experiment Station during the early part of the summer of 1890, requesting specimens of cotton affected with the so-called "black rust," "red rust," "root rot," etc., I received specimens of rotted roots of cotton from Saville, Ala. The specimens were sent by Mr. G. W. Rhodes of that place on whose farm they were collected.

The disease was called by him "root rot." and the roots were certainly in quite an advanced stage of decay. The two roots sent were tap roots and were probably pulled up so that the decayed lateral roots were broken away.

I expected to find the *Ozonium* described by L. H. Pammel as being the cause of a root rot disease of cotton in Texas (Bulletins Nos. 4 and 7, Tex. Ag. Ex. St.). There were no external signs of the mycelium of a fungus visible to the unaided eye, and examination was made by taking cross-sections. In all the preparations fungus threads were present, having penetrated the dead tissue. I supposed these were probably connected with the *Ozonium*, though we would expect to find various saprophytic fungi attacking such tissues. In one preparation, however, peculiar fat globules were present in quanity in enlarged cavities. Upon close examination I found also peices of a thin membrane marked with irregular rugosities and striæ.

This at once suggested to me the presence of the female cysts of *Heterodera radicicola* (Greef) Müll., a root-gall nematode, which was made the subject of a special study* by myself one year ago, and is known to be very injurious to many plants.

The subject now possessed a new interest and I made a special trip to Saville the early part of September to thoroughly investigate the disease and to make careful collections of plants in various stages. Although I possessed the faint suggestions of the presence of *Heterodera* in the material sent me, I was quite surprised to find that this worm was the cause of the disease.

There were perhaps two or three acres in the field that were more or less affected. In some places there were spots several square rods in extent on which the cotton was entirely dead.

These spots were often connected by areas more or less affected, and in some places an apparently healthy plant was surrounded by dead ones. The plants I examined were carefully dug up with a shovel. At first I selected those entirely dead. Only a portion of the tap root remained attached to the stem, the lower portion having rotted away. To the plants which had recently died portions of the lateral roots remained in connection, the majority, however, easily breaking away.

In a few cases, even though the roots were well rotted, the characteristic galls could be seen on some of the lateral roots, being oval and somewhat one-sided enlargements. On the decayed tap roots no galls could be found since the tissues were well broken down. A few plants which had been badly diseased showed evidence of partial recovery, young branches growing from the lower part of the stem. Such plants yielded unmistakable evidence of the work of *Heterodera*. While the lower end of the tap root had rotted away, the plant had succeeded in putting out a number of roots near the surface of the ground which had given it the fresh impetus for growth. These lateral roots possessed an abundance of the galls, and the peculiar cracked

* Science Contrbutions from the Agricultural Experiment Station, Alabama Polytechnic Institute, Vol. I. No. I., Dec. 1890. An abstract prepared by the author was published in the March and April (1890) numbers of the Southern Cultivator, Atlanta, Ga., uuder the title, "Nematode Root-Galls."

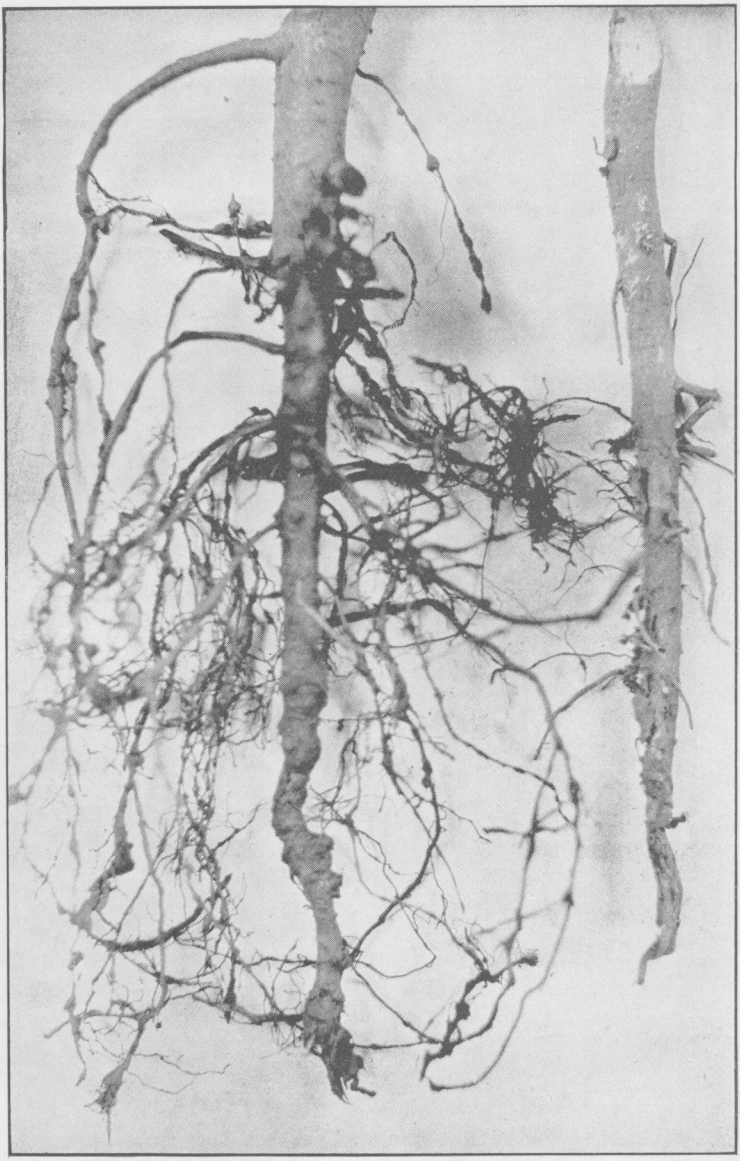

PLATE I.—ATKINSON, A NEW ROOT ROT DISEASE OF COTTON.

and scabby lateral galls on the upper portion of the tap root showed how thoroughly infected the plant had been.

But the richest specimens were found in plants which showed the first external signs of the disease. In these specimens not only was there a profuse development of the galls on the lateral roots, but nearly the entire lower portion of the tap root was affected, having large lateral galls, which from age were cracked and scabby in appearance. Plate I. is from a photograph of specimens collected by myself. This is the appearance of the old larger galls on all plants, and lays these parts under contribution to various putrefactive bacteria and saprophytic fungi so that the roots of many plants literally rot off. The presence of the worm has this effect in the case of the tomato plants that are badly diseased. The tap root is always very freely attacked and rots off below. Tomato plants seldom die outright as a result of the decay of the lower part of the tap root, for they are capable of quickly sending out numerous lateral roots above the point of injury and thus tide the plant along. Cotton plants do not have the power of sending out lateral roots so readily near the surface of the ground when the stem becomes rather old and are therefore more liable to serious injury when badly diseased.

Mr. Rhodes was not acquainted with the characteristics of nematode root-galls and was not aware that any plants in his neighborhood were affected by such a disease. I noticed one old peach tree still in the cotton field, and was informed that a peach orchard occupied the grounds about twenty years ago. At my request we visited the garden and upon pulling up tomato and okra plants found them very badly diseased. This was sufficient evidence that portions of the grounds there were very badly infected.

The external manifestations of the disease in cotton are strikingly similar to those of the root rot disease caused by *Ozonium* as described by Pammel; the irregular distribution of the spots as well as the tendency to increase in extent and sometimes the changing of the spots. Also as in the case of *Ozonium* the first external sign of the disease is the sudden wilting of a plant on a hot sunshiny day, especially after rain. This similarity in exter-

nal appearance is easily accounted for from the nature of the disease, since the condition of the roots prevents the absorption of water in quantities equal to that transpired by the leaves, though there may be an abundance of water in the soil. From this time the plant rapidly declines.

The diseased plants begin to die about the time of "chopping out" the cotton in May, when the plants are quite small, and the disease continues throughout the season.

In my studies last autumn I found cotton affected at Auburn, but not seriously. Some cotton planted in September of the present year for experimental purposes was, in some cases, seriously attacked while yet only one or two leaves above the cotyledons were developed.

The worms are able to live and develop in the roots of a great variety of plants, though some plants are more subject to serious attack. There are indications that they may become somewhat provincialized in their tastes, in some localities attacking more seriously plants which in other localities are not much injured.

If deprived for some time of the food plant they prefer they will affect more seriously the ones which formerly nearly escaped their injuries.

That the worm can produce a serious disease of cotton, and is more widely and thoroughly distributed than is generally known, increases the gravity of an already serious question.

It may be of interest for the readers of this article to have a short account of this worm. *

Other examples of nematode worms are found in the *trichina* of pork, which produces in man the disease known as *trichinosis*; in the "*vinegar eel*" or "*paste worm*;" and in the so-called "*hair worm*," one of the *Gordidæ*, popularly supposed to be a metamorphosed horse hair.

The eggs are bean-shaped, and 250 of them placed end to end would make a line one inch long. The young worm, or larva, hatches from the egg in about a week's time in favorable weather.

* This account of the worm is quoted from an article by myself in the *Agricultural Journal*, Montgomery, Ala., Nov. 1890, entitled "Danger from the continued Distribution of the Root-Gall Nematode."

It is "thread like" or "eel like," from which the family of worms to which this one belongs gets its name of *Anguillulidæ*. It is blunt at the head end and narrowly pointed at the tail. The mouth is in the center of the blunt head. In the œsophagus is a short, slender spear which the worm can thrust forward partly out of the mouth and then draw it back. By thrusting this spear forward the worms puncture holes in the roots which enables them to enter. Once in the root the worm moves around, sucks the juice, and, by its presence, stimulates the tissues of the root to abnormal growth, and thus the galls are formed. The worm now becomes stationary in the tissues of the gall, moults its skin the second time, having moulted once just about the time of hatching; it distends by growth into a vesicular body resembling a small gourd. Before it is fully grown important differences appear in the males and females. The males instead of distending farther shrink away from their skin, leaving it as an "empty shell," exactly the shape of their body when they resembled a small gourd. As they shrink in diameter they increase in length until when fully developed they are coiled three or four times inside their distended cast off skin. The distended cast off skin makes the third moult. While they are elongating they moult again, which makes four times for the males. The males have returned to the eel form of the worm. but are much longer than the larva and have blunt tails instead of narrowly pointed ones. They now break through their cystic wall (the distended cast off skin) and seek the female to fertilize her. Twenty or twenty-five males placed end to end would make a line one inch long.

The female continues to distend so that she closely resembles a stout gourd, the head being at the small end. Of course she is not so large as a gourd, since it takes about five millions of the females to make a mass so large as a common sized gourd. Each female contains from 200 to 300 eggs. The larvæ hatch while yet within her body because she is imprisoned in the roots, unless some accident happens to the gall which breaks it.

In favorable weather the worm will develop from the egg to the mature female, to eggs again in about one month. So it will be seen that they develop very rapidly.

Remedies.

There are many nurseries, market gardens, propagating houses and less pretentious places for growing such plants as the peach, grape, cabbage, tomato, Irish potato, etc., for sale, or even to give away, to be transplanted, that are infected with this worm. When soil is once infected it is very difficult to get rid of the worm. The most important action is to prevent the farther distribution. Irish potatos are one of the most prolific sources of infection and the only way to tell certainly when they are infected is to know whether or not the soil where they were grown is free from the worm, and the seed potatos from which the crop was raised were also free.

The purpose of this bulletin is to warn farmers and horticulturists to be very cautious as to the source from which they get rooted plants or tubers for planting in their fields or gardens.

Where land is already infested, though no remedy is known, there are some practical suggestions to be made, which if followed will keep the worms somewhat in check.

Rotation of Crops.—By growing for a few years on badly infected soil, plants which are known to be insusceptible to the attacks of the worm, the numbers can be greatly reduced. It should be some crop that can be cultivated, or else weeds should be pulled from the ground. If a crop susceptible to the attacks of the worm were grown every third year probably it would suffer much less harm.

*Clean Cultivation.—The absence of clean cultivation is one of the most fruitful scources of the thorough impregnation of the soil with the worms. It was of course impossible to make an application of this principle to the enemy in question before that enemy was known, and especially before the time required for its complete development from the egg had been determined. Now that these facts are known and since we know many of the plants subject to the disease it is to be hoped this method will be employed by those desirous of subduing the worms. Not

* The remaining suggestions are taken from my article in Science Contributions from the Agricultural Experiment Station, Alabama Polytechnic Institute, Dec. 1889, pp. 47-50, Vol. I., No. I.

only should an effort be made to prevent the growth on arable land of all plants growing wild which are liable to serious infection, but so soon as a crop has been gathered, or it is found that the crop will not be worth gathering, from any cultivated plant liable to serious infection the farther growth of the plants should be stopped, or what is better the roots of the plants should be gathered and burned when possible. In gardens this would not be a serious task compared with the benefit to be derived. I have noticed cabbages, tomatoes and potatoes, all of which are seriously susceptible to the disease, growing in an abandoned condition for two months in the latter part of the season, all the while providing for the rapid development and multiplication of the parasites. During this time two successive generations of the worms are developed. Each female egg would on the average, making no allowance for fatalities, produce in the first generation 200 young. Allowing 50 per cent. of these for males there would be 100 to start the second generation for every one at the beginning of the first. These would then on the basis of a similar computation produce 20,000 young or 10,000 females to be the producers of the third generation. Then during the time of the abandoned growth of these diseased plants every productive parasite has produced 10,000 productive parasites.

TREATMENT OF PERENNIALS.—The greatest care should be exercised in the cultivation of perennials like the grape, peach, fig, etc. The young plants should be obtained from sources where it is known they have been grown in non-infected soil. The orchard or grapery should be selected and by a system of cultivation of insusceptible plants be rendered sterile by starving out the worms. Then the practice of cultivating either for forage or as a fertilizer plants liable to the disease in the orchard should be discontinued. Where orchards or graperies are so seriously injured as to interfere with the productiveness of the trees or vines, they might be preserved for a few years while the orchard is renewed in soil freed from the worms, when they should be destroyed.

The peach trees and grape vines which I have examined in the vicinity of Auburn, while slightly affected do not appear yet to

suffer any serious consequences. Young trees and seedlings are more seriously affected. The most badly diseased grape cuttings I have seen were those grown very near diseased cabbages and tomatoes. Care should also be used in the cultivation of seed potatoes which are not infected.

TRAPPING THE WORMS.—In Germany cultivators of the sugar beet have resorted with a degree of success to trapping the worms of a related species (*H. Schachtii*)* from badly infected soils by the cultivation of plants very susceptible to the disease, and then gathering the roots before the worms are fully developed and destroying them. Such plants they call "catch plants" ("Fangpflanzen").

COMPOSTS.—If roots are ever used in the making of composts great caution should be used since there is danger of infecting soils hitherto free from the worms by fertilizing such land with compost material containing diseased roots. Kühn‡ has shown that such infection does take place in the case of a related species, *Heterodera Schachtii* Schmidt, and also states that the material may be rendered innocuous by placing unslacked lime in layers with the infected refuse of plants which may be used in compost.

PLANTS AFFECTED.—The following list of plants affected with the Nematode root-galls is by no means complete. It comprises only such as with limited time I have been able to determine thus far in the vicinity of Auburn:

1 Amygdalus Persica (peach).
2 Ficus Carica (fig).
3 Vitis vinifera (grape, several varieties).
4 †Solanum tuberosum (potato).
5 Solanum esculentum (egg plant).
6 †Lycoperscium esculentum (tomato).
7 Physalis sp.
8 †Abutilon sp.
9 †Gossypium herbaceum (cotton).
10 Hibiscus esculentus (okra).
11 Sida spinosa.
12 Modiola multifida.

*Sorauer, Pflanzenkrankheiten, Vol. II p. 854.

‡Die Rüben Nematode. Zeitschrift des landwirthschaftlichen Centr l-Vereins der Provinz Sachsen. No. 12. pp. 332-335. 1870.

†Badly affected.

13 Cassia obtusifolia (coffee weed).
14 Dolichos catiang (cow pea).
15 Phaseolus.
16 Lespedeza striata (Japan clover).
17 Lotus corniculatus (bird's foot clover).
18 Melilotus alba.
19 Ipomœa tamnifolia.
20 Ipomœa lacunosa.
21 Clematis sp.
22 Phytolacca decandra.
23 †Helianthus annuus (sunflower)
24 †Citrullus vulgaris (watermelon).
25 †Cucumis melo ("nutmeg melon," "citron").
26 Beta vnlgaris (beet).
27 Amarantus retroflexus (spineless careless weed).
28 Ch nopodium Anthelminticum (worm seed).
29 Zea mays (corn).
30 †Brassica oleracea (cabbage).
31 Brassica Rapa (turnip).
32 †Brassica campestris rutabaga (rutabaga).
33 Marrubium vulgare (horehound).
34 †Pastinaca sativa (parsnip).
35 Lactuca sativa (lettuce).
36 †Tragopogon porrifolius (salsify).

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†Badly affected.

REPORT

—OF THE—

ALABAMA WEATHER SERVICE,

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

November, 1890.

STATE POLYTECHNIC INSTITUTE,
Auburn, Ala., Dec. 15th, 1890.

The month of November was remarkable for the fine weather prevalent during the entire period, the rather high temperature and the very small precipitation. Two observers reported a total absence of rain, and the average for the State was 3 .25 inches below the normal. The small amount of moisture thus indicated is singular this season of the year.

The first few days of the month were cool and so was the last week, but the temperature generally was high and the weather delightfully mild and pleasant. The season was exceedingly favorable for harvesting and the farmers have been able to save their crops in excellent condition. Roses, delicate geranium and wild flowers were in bloom up to the close of the month, and in fact no frost was heavy enough to destroy the buds of the tender plants exposed to the free circulating night air. The average temperature was 4 °.4 above the normal.

J. M. QUARLES,
Assistant.

P. H. MELL,
Director.

MOTHLY SUMMARY.

ATMOSPHERIC PRESSURE (*in inches*)—Monthly mean, 30 .179; maximum observed, 30 .565, at Auburn on the 21; minimum observed, 29 .910, at Chattanooga on the 30; range for the State, .655.

TEMPERATURE (*Degrees F.*)—Monthly mean, 57 .3; highest monthly mean, 63 .6, at Citronelle; lowest monthly mean, 46 .7, at Double Springs; maximum observed, 85, at Citronelle on the 11 and 12; mimimum observed, 23, at Valley Head on the 1 and 4; range for the State, 62; greatest local monthly range, 59, at Valley Head; least local monthly range, 39, at Union Springs.

PRECIPITATION—INCLUDING MELTING SNOW (*in inches*)—Average for the State, .59; greatest, 1 .79, at Uniontown; least, 0 .00, at Bermuda and Columbiana; mean relative humidity, 66 at Auburn, 65 at Uniontown, 83 .4 at Valley Head.

WIND.—Prevailing rirection, N. W. Miles travelled at Chattanooga, 3,140; at Montgomery, 2,077; at Mobile, 4,886; at Auburn, 2,167.

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NOTES FROM OBSERVERS.

Tuscumbia (L. B. Thornton)—At 7 P. M. on the 23 a faint halo; on the 28 smoky looking a little like Indian summer.

Livingston (J. W. A. Wright).—Heavy frost and ice ond the 1st, 4th, 21st 27th, and 29th. Only five years out of the last twenty have brought us less than two inches of rain during November. Our average rainfall here for November 3 .90, while in 1870 and 1875 we had over 7 inches, and in 1880 over 10 inches, in 1873 we had 1 .19 inches' in 1874, 1 .06 inches, but in 1876 only .52 inches; tn 1887 only .35, and in this November .67 of an inch. The average temperature for October was 3° cooler than normal for that month. The average temperature for November was 3° warmer than normal as shown by our observations for more than 23 years in western Alabama.

Greensborough (M. H. Yerby) — No unusual phenonena this month, with the exception of the very small amount of precipitation, it having rained but one day during the entire month. Better weather for harvesting a crop could not have been desired. The cotton crop has been gathered and the yield was considerably better than last year.

TABLE OF SOIL TEMPERATURES—NOVEMBER, 1890.

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

A. M. LLOYD, Observer.

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

Depth in Inches.	Set No. 1, on Hill.	Set No. 2, on Hill.	Set No. 3, in Bottom.
1	61.2	62.2	61.1
3	60.7	61.4	61.8
6	59.3	60.6	59.1
9	58.1	59.2	58.3
12	58.0	58.4	57.7
24	60.2	60.1	59.3
36	61.2	60.1	60.7
48	64.5	62.6	61.7
60	65.4	63.8	65.8
72		64.0	
84		64.6	
96		67.7	

Monthly Summary of Meteorological Reports of the Alabama Weather Service, November, 1890.

Stations.	Counties.	Altitudes	Latitude N	Longitude W.	BAROMETER. Monthly Mean	BAROMETER. MAX. Height	BAROMETER. MAX. Date	BAROMETER. MIN. Height	BAROMETER. MIN. Date	TEMPERATURE. Monthly Mean	Mean of Max.	Mean of Min.	TEMPERATURE. MAX. Degrees	TEMPERATURE. MAX. Date	TEMPERATURE. MIN. Degrees	TEMPERATURE. MIN. Date	Monthly Range	Me'n Daily R'nge	Total Precip'tation	Clear days	Fair days	Cloudy days	Days of Rain	Prevailing wind	Names of Observers.
Selma	Dallas	....	32 28	87 00	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	
Valley Head	DeKalb	1031	34 34	85 37	.....	.....	...	.....	..	53	68 6	37 4	82	11	23	1-4	59	31 2	35	21	6	3	1	Sw	E.P.Nicholson
Pine Apple	....	....	31 35	87 00	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	†
Florence	Lauderdale	....	34 48	87 37	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	C. W. Ashcraft
Chattanooga	Tennessee	783	35 03	85 30	30 188	30 413	21	29 910	30	55 8	67	44 6	79	11	28	23	51	22 4	0.16	22	5	3	3	NW	* L. M. Pindell
Montgomery	Montgomery	219	32 22	86 23	30 168	30 390	21	29 950	2	60 1	72 4	47 8	82	12-13	33	1	49	24 6	26	20	7	3	3	NW	* L. Dunne
Marion	Perry	....	33 12	87 42	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	†
Union Spr'gs	Bullock	516	32 12	85 39	.....	.....	.....	.....	..	62 5	....	....	78	11	39	4	39	....	60	3	22	5	1	N	R. J. Grady
Bermuda	Monroe	....	31 43	87 12	.....	.....	.....	.....	..	54 8	....	....	81	18	30	1	51	....	0 00	....	....	....	0	....	WM. Fowler
Mobile	Mobile	30	30 41	88 20	30 164	30 375	21	30 030	2	61 1	71 2	51	81	11-12-13	36	1	45	....	32	13	13	4	3	N	* A. Pritchard
Carrollton	Pickens	....	.....	88 03	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	M. L. Stansel.
Auburn	Lee	826	32 40	85 30	30 224	30 565	21	29 970	2	60 8	67 7	51 8	78	11-12-16	38	1	45	18	16	24	6	0	2	E	J. M. Quarles
Livingston	Sumter	150	32 34	88 08	30 190	30 370	20-22	30 090	..	57 6	70 8	44 4	81	15	29	1	52	26 4	0.67	16	8	6	1	NW	J.W.A.Wright
Greensboro	Hale	220	32 41	87 36	.....	.....	.....	.....	..	59 1	....	....	80	9-10	32	1-4	48	....	0.91	....	....	....	1	N	M. H. Yerby
Mt. Willing	Lowndes	....	32 07	86 45	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	W. M. Garrett
Uniontown	Perry	273	32 28	86 44	30 140	30 380	20	29 960	2	59 4	69 8	46	81	17	31	4	50	23 8	1.79	....	....	....	1	NW	W. H. Newman
Citronelle	Mobile	352	31 03	87 30	.....	.....	.....	.....	..	63 6	76 5	50 7	85	11-12	32	4	53	25 8	1.40	....	....	....	3	....	J G Micnael
Fayette C H	Fayette	....	33 42	83 12	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	Daniel Collier
Opelika	Lee	....	32 45	85 28	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	†
Guntersville	Marshall	655	34 24	86 18	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	A. J. Baker
Chepultepec	Blount	890	33 53	86 20	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	W. B. Allgood
Columbiana	Shelby	560	33 15	86 38	.....	.....	.....	.....	..	55	70	39 9	80	16	25	1	55	30 1	0 00	....	....	....	0	....	W. D. Lovett
Centre	Cherokee	728	34 10	85 42	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	Thos. Bradford
Double Spr'gs	Winston	....	34 08	85 35	.....	.....	.....	.....	..	46 7	....	33 8	68	8	28	27	40	....	1.10	....	....	....	3	....	A. M. Weiler
Butler	Choctaw	....	32 05	87 24	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	B. F. Gilder
Jasper	Walker	310	33 49	88 12	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	Howard Lamar
Tuscumbia	Colbert	....	34 42	87 33	.....	.....	.....	.....	..	53 7	....	....	74	7-9	29	28	46	....	0 58	23	....	7	2	Sw	L. B. Thornton
Fort Deposit	Lowndes	....	34 42	86 39	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	†
Piedmont	.....	468	....	.....	.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	
					.....	.....	.....	.....	..	....	....	....	..	.....	..	....	....	....	.....	.....	....	....	....	....	
	Averages	....			30 179	.....	.....	.....	..	57 3	70 5	44 7	..	.....	..	....	....	25 3	59	18	8	4	2	....	

*Sergeants of the United States Signal Corps. †Cotton Belt Station