

# COTTON ROOTROT SPOTS

By C. S. SCOFIELD, *Agriculturist in Charge, Western Irrigation Agriculture, Bureau of Plant Industry, United States Department of Agriculture*

## INTRODUCTION

The disease of cotton commonly known as rootrot, which occurs in certain sections of Texas, New Mexico, and Arizona, usually appears in cotton fields during the latter part of the growing season. The affected plants wilt down rapidly and within a few days become dry and turn brown.

It is generally believed that this disease is due to a soil-inhabiting fungus known as *Ozonium omnivorum*,<sup>1</sup> which invades the root system of the host plant and by breaking down the root tissue cuts off the water supply and causes death. The same fungus is believed to attack many species of plants other than cotton, though the grasses appear to be immune.

One of the peculiarities of the rootrot disease as it occurs in cotton fields is that it usually appears in certain well-defined areas or spots within the limits of which nearly every cotton plant is killed. With the advance of the season, these spots of dead cotton gradually increase in size, the disease apparently spreading from plant to plant. Occasionally a plant remains alive within the infected area, but upon examination it is found that the lower roots are dead and that continued growth is supported by one or more lateral roots that branch out close to the surface of the soil.

The well-defined areal occurrence of the disease and the completeness with which it kills all the plants within the area naturally led to the impression that its destructiveness must be due to some purely local soil condition. Furthermore, it has been thought that the disease reappears from year to year in the same spots.

## FIELD OBSERVATIONS<sup>2</sup>

Rootrot has been prevalent in the vicinity of San Antonio, Tex., for many years, and an opportunity has been afforded to observe its behavior at a field station located about 5 miles south of the city of San Antonio, where an extensive series of crop rotations have been conducted since 1909. The disease was so serious on the rotation plots of cotton in 1916 that it seemed advisable to survey each plot and locate definitely the infected areas, with a view to determining the rate of

---

<sup>1</sup> More recently named *Phymatotrichum omnivorum* (Shear) Duggar. (DUGGAR, B. M. THE TEXAS ROOTROT FUNGUS AND ITS CONIDIAL STAGE. *In* Ann. Mo. Bot. Gard., v. 3, No. 1, p. 22. 1916.)

<sup>2</sup> The author is indebted to Mr. C. R. Letteer, Superintendent, and Mr. A. A. Bryan, Assistant, at the San Antonio Field Station for cooperation in making the observations here reported.

spread in future years and also whether any of the different rotation and tillage treatments were really effective in retarding this spread.

These rotation plots are  $\frac{1}{4}$  acre in size, being 264 feet long and 41.25 feet wide, and afford space for 10 rows of cotton 4.1 feet apart. Each row was carefully measured, and the location of the portion of the row in which the plants were dead was indicated on a diagram drawn to scale. The survey of 1916 was made near the end of the growing season, October 21, after the final picking of cotton had been finished. One of these plot diagrams, showing the areas of dead plants, is shown in figure 1. This diagram shows two main areas of infection, as shown by the brush-like lines. A count of the living and dead plants in this plot at the time the survey was made showed that 60.5 per cent of the total number of plants were dead. This plot had been planted in cotton each year since 1909. It had been plowed in November each year and had received an annual application of manure at the rate of 12 tons per acre.

The plowing and other tillage operations were made lengthwise of the plot so that any distribution of soil infection would naturally be favored.

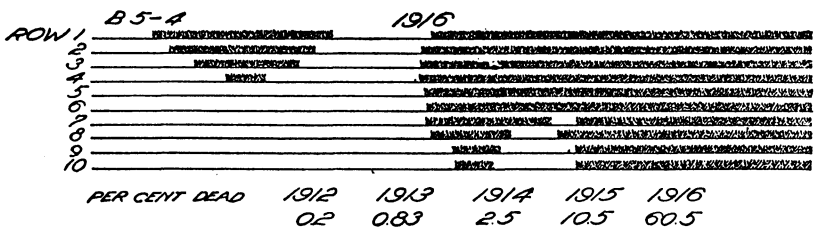


FIG. 1.—Diagram of plot B5-4, showing by the brushlike lines the portions of the rows in which the cotton plants were killed by rootrot in 1916.

Notwithstanding this fact, the limits of the affected areas were very sharp, dead plants standing adjacent to living ones in each row at the edge of the diseased area.

This same plot was planted to cotton again in 1917, each row being planted as nearly as possible in the same place as in the previous season. The count of living and dead plants and the diagram of the areas of dead plants were made on October 25, 1917, at the end of the growing season. The count of plants showed that 36.8 per cent of the total number were dead with symptoms of rootrot. The diagram of the plot for 1917 is shown in figure 2.

The distribution of the disease in 1917 was more scattered than in 1916; and the spot that is shown on the north side of the west half of the plot in the 1916 diagram (fig. 1) gives some indication of a progressive spread, in that living plants were found in 1917 where only dead plants were noted in 1916. This tendency for the spread of the disease to take place like the spreading of a fairy ring is not very pronounced, however, as can be seen in the diagram for the east half of the plot, nor is it to be found so definitely expressed in the diagrams of other plots.

The distribution of the diseased areas on this same plot in 1918 is shown in figure 3. The diagram for that year was made on October 28, 1918, when a count of the living and dead plants showed that 42.0 per cent of the total number were dead, apparently from the effect of rootrot.

The west half of this plot again showed some indication of a progressive spread of the disease, in that there was a V-shaped area of living plants in approximately the same place where nearly complete infection had been noted the previous season. The 1916 area of infection was

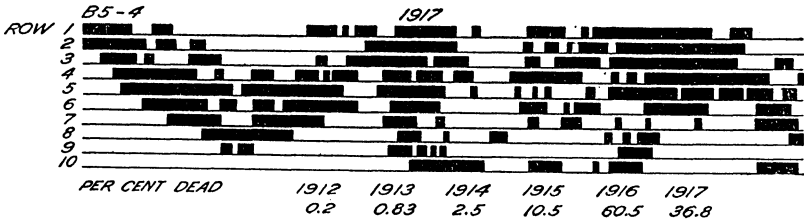


FIG. 2.—Diagram of plot B5-4, showing by the heavy lines the portions of the rows in which the cotton plants were killed by rootrot in 1917.

again infected, as were also the areas in the southwest corner of the plot and in the southeast corner of the west half, areas that had been free from dead plants in 1916 and 1917. However, this tendency toward alternate occurrence or progressive spread was not shown in the east end of the plot or in other plots with sufficient regularity to be considered significant.

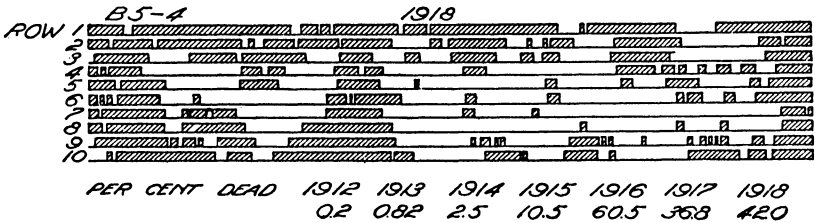


FIG. 3.—Diagram of plot B5-4, showing by the diagonal hatching the portions of the rows in which the cotton plants were killed by rootrot in 1918.

SUMMARY OF THREE YEARS' RECORDS

If the records of the occurrence of the disease in this plot for the three years be brought together as in figure 4, it will be seen that almost the entire plot has been affected within that time. Yet during the last two years less than half the plants have been taken by the disease.

It seems clear from the evidence here presented that these rootrot spots do not carry over from year to year. This may explain the difficulty that has been experienced by investigators in attempting to determine, by a comparative study of the soil conditions inside and outside the rootrot spots, what conditions permit the disease to become destructive.

There are three other plots in these San Antonio rotations on which cotton has been grown each year and on which the location of the diseased plants has been recorded since 1916. On plot A4-19 (fig. 5)

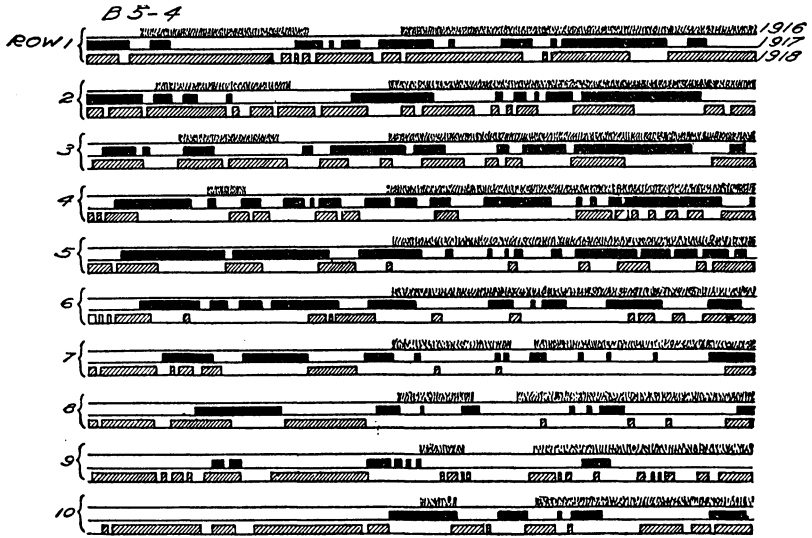


FIG. 4.—Diagram of plot B5-4, showing the portions of the rows in which the cotton plants were killed each year by rootrot in 1916, 1917, and 1918.

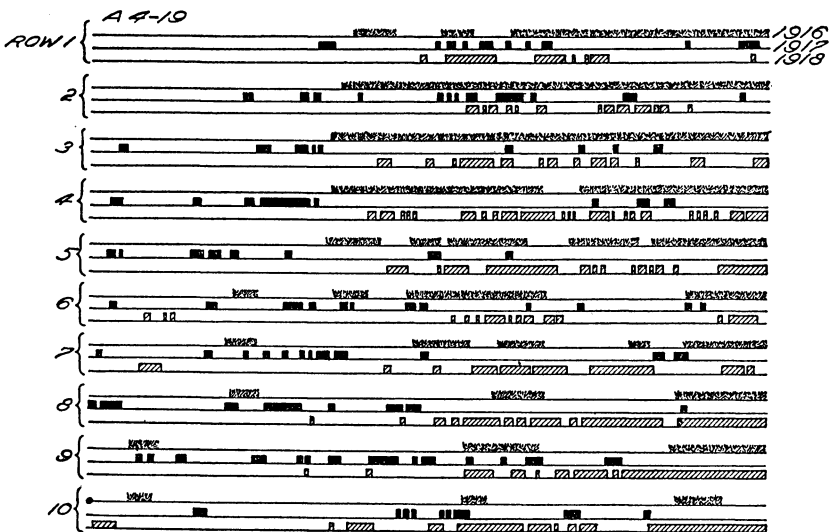


FIG. 5.—Diagram of plot A4-19, showing the portions of the rows in which the cotton plants were killed each year by rootrot in 1916, 1917, and 1918.

cotton has been grown each summer since 1913. The cotton stalks are plowed out in the fall, and the land is then disked and seeded to Canada field peas, which are plowed under the following spring in time to plant cotton

again. On plot A6-3 (fig. 6), cotton has been grown each summer since 1912, the land being plowed in the fall, after the cotton stalks are removed, and allowed to lie fallow during the winter. The plot B5-3

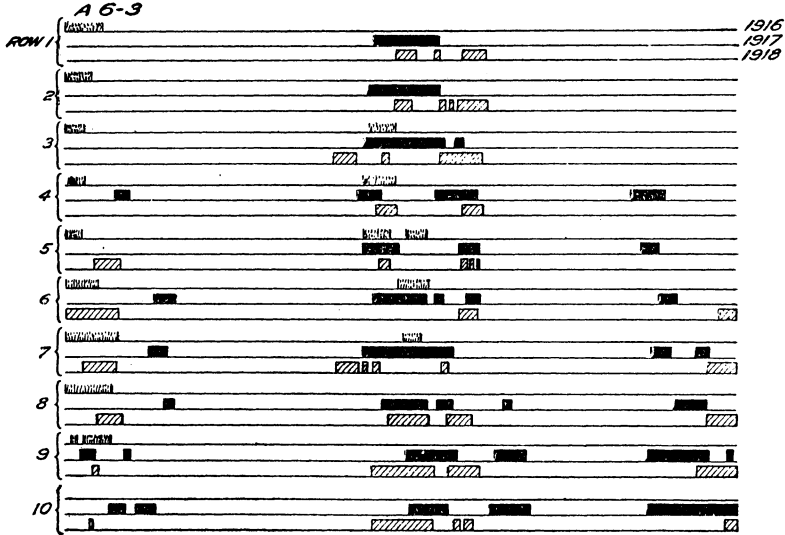


FIG. 6.—Diagram of plot A6-3, showing the portions of the rows in which the cotton plants were killed each year by rootrot in 1916, 1917, and 1918.

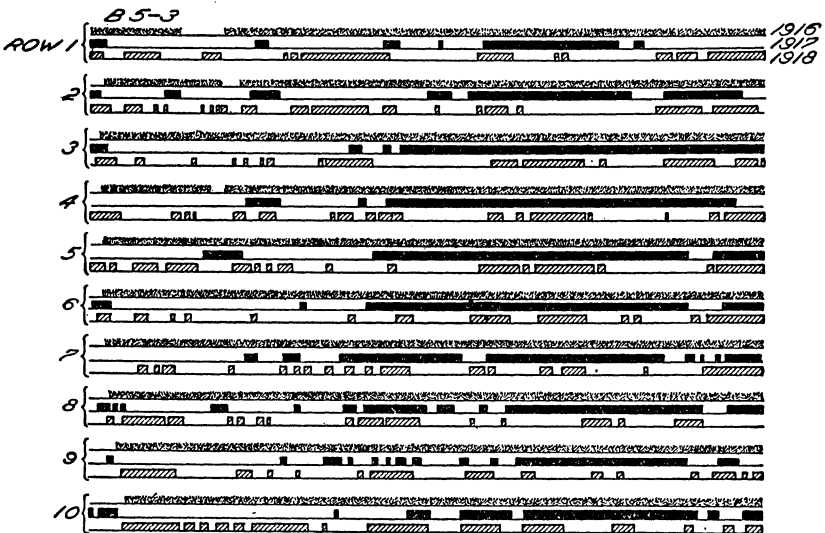


FIG. 7.—Diagram of plot B5-3, showing the portions of the rows in which the cotton plants were killed each year by rootrot in 1916, 1917, and 1918.

(fig. 7) receives the same cultural treatment as A6-3; and B5-4 receives the same treatment, except that manure is applied in the fall each year at the rate of 6 tons per acre. The diagrams of the occurrence of rootrot

in all these plots show conclusively that the disease does not continue to reappear in successive seasons in the same spots.

To complete the record of these field observations concerning cotton rootrot as it has been observed in these four plots, the percentages of loss for each season are shown in Table I. These percentages were determined at the end of the crop season by counting the total number of living and dead plants and dividing the number of dead plants by the total number of plants.

TABLE I.—Percentage of cotton plants taken by rootrot in rotation plots at San Antonio, Tex.

Plot.	Treatment.	1912.	1913.	1914.	1915.	1916.	1917.	1918.
A4-19 . . . . .	Field peas; spring plowed . . . . .	0.0	4.2	11.7	42.0	10.6	25.6	
A6-3 . . . . .	Fall plowed . . . . .	0.7	.82	.46	.7	7.4	15.1	9.2
B5-3 . . . . .	do . . . . .	.9	3.8	17.6	49.4	96.2	43.7	30.3
B5-4 . . . . .	Fall plowed; manured . . . . .	.2	.83	2.5	10.5	60.5	36.8	42.0

This table shows that there has been a marked increase since 1912 in the percentage of plants dying from rootrot, yet the disease has not been so severe in the last two seasons as it was in 1916. There does not appear to be a very direct or significant relation between the climatic conditions and the extent of the disease.

It is not the purpose here to attempt to explain the anomalous distribution of rootrot spots from year to year or to suggest any cultural method for the control of the disease. It is rather to show that even though the disease does usually occur in well-defined spots in one season, it may not recur there the following season but may appear in a new place.