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IMPROVED BY APPLICATION
OF FERTILIZER

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INTRODUCTION

In the rice district of Southwest Louisiana there are numerous areas where rice does not grow satisfactorily. These are usually poorly drained in comparison with adjoining areas, the rice in them is not thrifty, and yields are usually low. They are locally known as root rot areas, or alkali spots.

In 1939, work was started to determine if the yields in these areas could be improved profitably by the application of fertilizer. Several reports on the progress of this work have been published (1), (2), (4). Because of the great need for increased rice production at the present time, the results of these studies are brought together in this bulletin.

SYMPTOMS

The symptoms of root rot are usually first noticed in the latter part of May and early June. The plants are yellow, stunted, and in most cases plentifully covered with the circular brown spots caused by *Helminthosporium oryzae*. The most characteristic symptom is a rotting of the

¹ Cooperative investigations of the Louisiana Agricultural Experimental Station, the Bureau of Entomology and Plant Quarantine, and the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture. This work was initiated in 1939 by T. C. Ryker and W. A. Douglas.

² The authors wish to express their appreciation for the fine cooperative spirit and assistance of the farmers in the experiments. They also wish to acknowledge the help of the Rice Experiment Station, Crowley, La.

roots (Fig. 1). When severely affected, the plants can be easily pulled from the ground. Badly affected plants produce small heads with relatively few grains.



Fig. 1. A healthy rice plant (right) and two plants affected with root rot (center and left).

CAUSE

More studies are necessary before the specific cause of the root rot can be determined. There seems to be an accumulation of alkali in a root rot area and the p^h of the soil is usually higher than in other parts of the field. When the roots are examined, the root maggot (*Lissorhoptrus simplex* (Say)) is usually found infesting them. However, since this insect is also found in rice roots from healthy fields, and has been proven to cause only negligible injury under ordinary rice field conditions, it is not considered the primary cause of the trouble (3). Species of *Pythium* are also found in the rotted roots, but attempts to produce the characteristic disease with this organism alone, or combined with the root maggot, have been unsuccessful in soil from unaffected areas.

MATERIALS AND METHODS

Only one fertilizer was used in the experiments. This was a 10-10-0 fertilizer made by mixing equal quantities of 20% ammonium sulfate and 20% acid phosphate. These two materials were used, as it was felt that they might have a more lasting corrective effect by reducing the alkalinity of the soil. The fertilizer was applied at the rate of 400 lbs. per acre.

The fertilized and check plots were usually 36 by 100 feet. In one experiment they were 18 by 100 feet. There were two replications in each experiment on drained areas in all tests except two. In one of these, three replications were used, and in the other, only one. The fertilizer was applied by scattering it by hand over the plots. To determine yields, plants from areas 3 by 15 feet were harvested from several places (usually five) in each plot and threshed separately. The rice was then weighed and the necessary calculations made to give the yields in barrels (162 lbs.) per acre.

TESTS ON UNDRAINED ROOT ROT AREAS

In 1939 and 1940 most of the tests were made by applying the fertilizer on the surface of the water without draining the field. The results of six tests with four varieties of rice, Blue Rose, Early Prolific, Rexoro, and Lady Wright, on 4 farms, are given in Table 1. Little increase in yield resulted from the use of the fertilizer, only .9 of a barrel per acre more rice being obtained from the fertilized areas than the check areas. Root rot was not severe in these tests and yields from the unfertilized plots were relatively high, averaging 12.6 barrels per acre.

TABLE 1. COMPARATIVE YIELDS OF RICE IN UNFERTILIZED PLOTS AND PLOTS FERTILIZED WITH 10-10-0 FERTILIZER AT RATE OF 400 LBS. PER ACRE. FERTILIZER APPLIED WITHOUT DRAINING WATER FROM FIELD; ROOT ROT SEVERITY MODERATE

| FARM | VARIETY | Date fertilizer applied | No. replications | YIELD PER ACRE IN BARRELS | | Differences |
|--------------------|---------------------|-------------------------|------------------|---------------------------|---------|-------------|
| | | | | Check | Treated | |
| J. Heinen..... | Blue Rose..... | June 6, 1939..... | 2 | 14.3 | 12.1 | - 2.2 |
| "..... | Early Prolific..... | May 24, 1939..... | 2 | 14.9 | 15.7 | + .8 |
| Wm. M. Hoyt..... | Lady Wright..... | June 5, 1939..... | 1 | 9.6 | 10.7 | + 1.1 |
| "..... | Rexoro..... | June 5, 1939..... | 1 | 18.7 | 18.8 | + .1 |
| L. B. Lawson..... | Blue Rose..... | June 28, 1940..... | 1 | 7.8 | 11.2 | + 3.4 |
| J. Zaumbrecher.... | Blue Rose..... | May 23, 1940..... | 2 | 10.0 | 12.0 | + 2.0 |
| AVERAGE..... | | | | 12.6 | 13.4 | + .9 |

TESTS ON DRAINED ROOT ROT AREAS

At the same time that the fertilizer was applied to undrained areas, other root rot spots were drained and fertilizer applied at the same rate of 400 lbs. per acre. Only the major part of the water was removed and often there was an inch or more of water on areas in the plots. The fields were not permitted to dry out. After the fertilizer was put on, the fields were then reflooded within the next few days. The results of these

experiments made over a period of five years, on six farms, are given in Table 2.

TABLE 2. COMPARATIVE YIELDS OF RICE IN FERTILIZED AND UNFERTILIZED PLOTS IN ROOT ROT AREAS. A 10-10-0 FERTILIZER WAS APPLIED AT RATE OF 400 LBS. PER ACRE AFTER DRAINING

| FARMER | PARISH | Severity of root rot | Date fertilizer applied | YIELD PER ACRE IN BARRELS | | Increased yield |
|--------------------|----------------|----------------------|-------------------------|---------------------------|---------|-----------------|
| | | | | Check | Treated | |
| <i>Blue Rose</i> | | | | | | |
| Smith..... | Acadia..... | Severe..... | June 19, 1939.... | 10.0 | 19.1 | 9.1 |
| J. Heinen..... | "..... | Moderate..... | May 28, 1940.... | 12.4 | 16.0 | 3.6 |
| "..... | "..... | Moderate..... | July 8, 1940.... | 13.2 | 16.9 | 3.7 |
| "..... | "..... | Moderate..... | July 15, 1940.... | 14.0 | 18.5 | 4.5 |
| "..... | "..... | Mild..... | Aug. 1, 1941.... | 10.0 | 11.6 | 1.6 |
| "..... | "..... | Severe..... | July 14, 1943.... | 5.7 | 11.0 | 5.3 |
| Lawson Estate.... | "..... | Moderate..... | July 1, 1940.... | 6.9 | 9.7 | 2.8 |
| L. B. Lawson..... | "..... | Moderate..... | June 29, 1940.... | 9.2 | 13.4 | 4.2 |
| J. Zaumbrecher.... | Vermilion..... | Mild..... | June 27, 1941.... | 12.4 | 12.8 | .4 |
| Dugas..... | Calcasieu..... | Severe..... | July 21, 1941.... | 5.7 | 8.7 | 3.0 |
| <i>Rexoro</i> | | | | | | |
| Lawson Estate.... | Acadia..... | Severe..... | June 23, 1941.... | 4.5 | 6.3 | 1.8 |
| P. Lambert..... | "..... | Severe..... | Aug. 11, 1942.... | 3.6 | 10.0 | 6.4 |
| J. Zaumbrecher.... | Vermilion..... | Mild..... | July 2, 1943.... | 7.2 | 7.7 | .5 |
| <i>Fortuna</i> | | | | | | |
| P. Lambert..... | Acadia..... | Moderate..... | July 2, 1943.... | 9.2 | 12.7 | 3.2 |
| AVERAGE..... | | | | 8.9 | 12.5 | 3.6 |

Increases in yield of fertilized plots over unfertilized plots ranged from .4 of a barrel per acre to as much as 9.1 barrels per acre. The average yield from the 14 experiments was 8.9 barrels per acre in the untreated areas and 12.5 barrels per acre in the fertilized areas, or an average increase of 3.6 barrels of rice per acre where fertilizer was used.

Little increase was found in two years tests on one farm, that of Mr. J. Zaumbrecher near Gueydan. The reason for this is unknown, although in one experiment, not given in this bulletin, where potash was included in the fertilizer, the plots with potash gave a considerably higher yield than those with the 10-10-0 mixture which contained no potash. Further studies will be necessary before it is known whether the potash was responsible.

It is interesting that in the three experiments with the variety Rexoro only one gave an appreciable increase. This was in 1942 on the farm of Mr. P. Lambert, where the fertilizer was applied August 11, much later than in the other two experiments. It is possible that fertilizer should be applied later to Rexoro than to other varieties because of its late maturity. With Blue Rose, little difference was noted whether the fertilizer was applied in June or July.

The value of the increased yields is given in Table 3. In order to have a basic price of rice to calculate the increased value the so-called "ceiling prices" were used. Blue Rose and Fortuna were valued at \$6.15 a barrel,

TABLE 3. VALUE OF INCREASED YIELDS IN RICE FROM APPLICATION OF 10-10-0 FERTILIZER AT RATE OF 400 LBS. PER ACRE

| FARM | No. years tests | Increase in barrels per acre | Value at ceiling prices | Value after cost of fertilizer deducted* |
|--------------------------------------|-----------------|------------------------------|-------------------------|--|
| <i>Blue Rose (\$6.15 per barrel)</i> | | | | |
| J. Heinen..... | 3 | 3.7 | \$22.76 | \$+15.96 |
| Smith..... | 1 | 9.1 | 55.97 | +49.17 |
| Lawson Estate..... | 1 | 2.8 | 17.22 | +10.42 |
| L. B. Lawson..... | 1 | 4.2 | 25.83 | +19.03 |
| J. Zaumbrecher..... | 1 | .4 | 2.46 | - 4.34 |
| AVERAGE..... | | 3.9 | \$23.99 | \$+17.19 |
| <i>Rexoro (\$7.05 per barrel)</i> | | | | |
| P. Lambert..... | 1 | 6.4 | \$45.12 | \$ 38.32 |
| Lawson Estate..... | 1 | 1.8 | 12.69 | 5.89 |
| J. Zaumbrecher..... | 1 | .5 | 3.53 | - 3.27 |
| AVERAGE..... | | 2.9 | -\$20.45 | \$ 13.65 |
| <i>Fortuna (\$6.15 per barrel)</i> | | | | |
| P. Lambert..... | 1 | 3.2 | \$19.68 | \$ 12.88 |
| AVERAGE OF ALL TESTS..... | | 3.6 | \$21.37 | \$ 14.57 |

*Cost of fertilizer figured at \$34.00 per ton or \$6.80 for 400 lbs.

and Rexora at \$7.05 a barrel. The cost of the fertilizer was calculated at \$34.00 a ton or \$6.80 an acre for a 400 lb. application. There was a net gain, after the cost of the fertilizer was deducted, of \$17.19 per acre in the eight tests with Blue Rose, \$13.65 per acre in the three tests with Rexoro, and \$12.88 per acre in one test with Fortuna. The average was \$14.57 per acre for the five years' experiments. This seems sufficiently large to justify the use of fertilizer on root rot areas with present rice prices.

SUMMARY

The results of five years experiments to test the effect of applying a 10-10-0 fertilizer at the rate of 400 lbs. per acre on root rot areas of rice are reported. The fertilizer was made by mixing equal quantities of 20% ammonium sulfate and 20% acid phosphate. Little increase in yield was found where the fertilizer was applied without draining. When the areas were drained and the fertilizer was then applied, an average increase of 3.6 barrels of rice was obtained.

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