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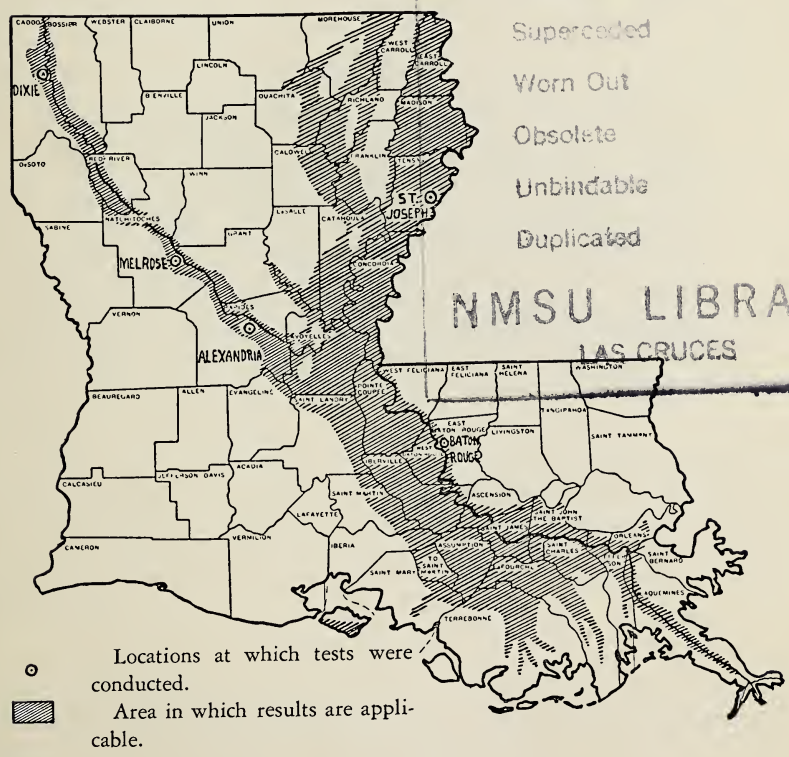
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By
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C. T. DOWELL, Director

STATEMENT

The test at St. Joseph has been conducted cooperatively by C. B. Haddon, Superintendent of the Northeast Louisiana Experiment Station. The Outfield tests have been conducted on the farms of A. M. Andries at Alexandria, J. H. Henry at Melrose, and W. H. North at Dixie, in cooperation with the County Agricultural Agents of the respective parishes. Members of the Department of Crops and Soils who have supervised or conducted the experiments have been H. B. Brown, John Gray, the late A. H. Meyer, John R. Cotton, H. C. Lovett, and Franklin L. Davis. The manuscript has been prepared by H. C. Lovett and Franklin L. Davis.

Fertilizers for Cotton on the Red and Mississippi River Alluvial Soils of Louisiana

BY
H. C. LOVETT
AND
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In a discussion of any soil-improving practice, such as the use of fertilizers, there is but one sound basis upon which the value of the practices can be measured, and that is profit. This is well demonstrated by the fact that only those practices that have proven profitable to the farmer have persisted and have widespread application. Even when the expressed purpose for soil-improvement measures is "to maintain soil fertility" or "to conserve the soil," the fundamental reason for following them can be only that they eventually produce profitable returns.

The average yield of cotton in Louisiana is approximately 200 pounds per acre of lint cotton.¹ There is no doubt that these yields can be profitably increased. This can be done by following soil-improving and conserving practices, such as rotating crops, turning under certain green legumes, and applying the right kinds and amounts of commercial fertilizers.

While not all of the fertilizer used in the state is applied to cotton, a consumption of nearly 106,000 tons² during the season of 1936 indicates a fairly large usage of fertilizers for cotton. Furthermore, inquiries from farmers and agricultural workers show that there is a good deal of interest in the analyses and rates of application of fertilizers best suited for cotton.

During the past ten years, the Experiment Station has conducted a series of fertilizer tests on cotton. In addition, tests have been conducted cooperatively with quite a number of farmers in the state and at each of the branch experiment stations. The results of the tests carried on each year have been given in the annual preliminary report of the Department of Crops and Soils. A summary of the results of all tests conducted on alluvial soils of the Red and Mississippi river bottoms or "Delta" is reported herein.

PLAN OF EXPERIMENTS

The fertilizer experiments were designed to determine the ratio or analyses of fertilizers best suited for the production of cotton. They also give some information as to the rate at which fertilizers may be profitably applied.

The tests were based upon a 5-8-4 analysis. These figures signify a composition of the fertilizer as follows: 5.0 per cent nitrogen (N), 8.0 per cent phosphoric acid (P_2O_5), and 4.0 per cent potash (K_2O). Within this basic analysis each of the fer-

¹ Agricultural Statistics, 1936. Prepared by Yearbook Statistical Committee of the U. S. Department of Agriculture.

² Figure from the Department of Agriculture and Immigration, State of Louisiana.

tilizing constituents was varied, one at a time. Thus, as shown in Table 1, the fertilizer applied to plats Nos. 1 to 5 contained 5 per cent of nitrogen and 4 per cent of potash, but different amounts of phosphoric acid. Similarly, plats Nos. 7 to 12 received varying amounts of nitrogen, with the phosphoric acid and potash constant, and plats Nos. 14 to 18 represented the potash series. Plats Nos. 6 and 13 were not fertilized.

The fertilizer was applied to the plats at a rate equivalent to 600 pounds per acre. The cotton was grown continuously on the same land in most instances, and the plats were located in the same places each successive year. No intervening crops were grown for the duration of the experiments.

Each plat consisted of two rows of sufficient length to provide one-fiftieth of an acre. The plats were separated from each other by an unfertilized border row. Each treatment was replicated four times in each test, the replications being arranged in a manner to minimize, as far as possible, the effects of any variations in the soil.

The fertilizer was distributed in the furrow and "bedded on" about two weeks before planting. The cotton was "chopped out" and cultivated according to the usual farm practices. In most instances, the cotton was picked two times, an attempt being made to get one-half of the crop at the first picking and the remainder at the second picking.

DESCRIPTION OF SOILS

The tests have been conducted at five different places and on four different types of alluvial soils. The locations of the tests and the area of the state to which the results are applicable are shown in the map on the cover.

At the Northeast Louisiana Experiment Station at St. Joseph the test was conducted on Sarpy very fine sandy loam soil and at Baton Rouge on Sharkey clay loam. These two soils represent the predominating series of alluvial soils along the Mississippi River. In general, the Sarpy series occurs on the higher locations and has a sandier and more porous subsoil. Both are dark gray or black in color.

At Alexandria the test was located on Miller very fine sandy loam and at both Melrose and Dixie, on Yahola very fine sandy loam. Soils of both these series are brownish red in color. They are the most extensive of the Red River alluvial soils. These soils are differentiated by their subsoils. The subsoil of the Yahola very fine sandy loam consists of layers of interbedded materials varying in texture from fine sand to very fine sandy clay; that of the Miller soils is more uniform and generally heavier in texture.

Most of the area of alluvial soils of the Red and Mississippi River bottom lands falls within these four series. Within the limits of soil texture and climatic conditions, these series are similar in crop adaptations and fertility. Their response to fertilization can be safely considered as representative of the area indicated in the cover map.

DISCUSSION OF RESULTS

The average annual yields of seed cotton produced by the different fertilizer ratios at each of the tests are shown in Table 1. The annual net profit or loss resulting from the use of the fertilizers has been calculated and is given in Table 2. These figures may vary from year to year, depending upon the price of fertilizer and cotton.

TABLE 1. PLAT NUMBER, FERTILIZER TREATMENT, AND AVERAGE ANNUAL YIELDS PER ACRE OF SEED COTTON PRODUCED BY THE DIFFERENT FERTILIZER ANALYSES.

Plat No.	Analysis of fertilizer applied at the rate of 600 pounds per acre*	St. Joseph 7-year ave. 1930-1936	Baton Rouge 6-year ave. 1929-1935	Alexandria 5-year ave. 1932-1936	Melrose 4-year ave. 1929-1933	Dixie 3-year ave. 1927-1930	Average of all tests 25 years
		Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1	5-0-4	1936	2145	1734	1220	1018	1611
2	5-4-4	2011	2199	1912	1245	1078	1689
3	5-8-4	2060	2113	1826	1207	1104	1662
4	5-12-4	2004	2153	1858	1262	1131	1682
5	5-16-4	2012	2191	1889	1288	1148	1706
6	0-0-0	1524	1989	1206	913	978	1322
7	0-8-4	1543	1844	1360	956	969	1334
8	3-8-4	1831	2098	1655	1142	1031	1551
9	4-8-4	1954	2082	1701	1176	1090	1601
10	5-8-4	1993	2125	1805	1199	1144	1653
11	6-8-4	2109	2154	1886	1327	1119	1719
12	7-8-4	2160	2205	2007	1391	1131	1779
13	0-0-0	1534	1872	1267	1002	892	1313
14	5-8-0	1924**	2192	1820	1250	1144	1666
15	5-8-2	1905**	2121	1799	1240	1083	1630
16	5-8-4	1870**	2132	1804	1259	1048	1623
17	5-8-6	1892**	2080	1795	1311	1103	1636
18	5-8-8	1915**	2136	1758	1235	1174	1644
19	5-0-0	—	2130***	1858†	1310‡	—	—

*Nitrate of soda was used as the source of nitrogen, superphosphate as the source of phosphoric acid, and muriate of potash as the source of potash, with the exception that sulphate of ammonia was used as the source of nitrogen in the test at Baton Rouge in 1933, 1934, and 1935.

**Average of six years only. The treatment on these plats was changed in 1936.

***Average of three years only. This treatment was not included in the test before 1933.

†Average of four years. This treatment was not included the first year of the test.

‡Yield in 1933 only.

TABLE 2. PLAT NUMBER, FERTILIZER TREATMENT, AND AVERAGE ANNUAL NET PROFIT OR LOSS PER ACRE FROM DIFFERENT FERTILIZER ANALYSES.*

Plat No.	Analysis of fertilizer applied at the rate of 600 pounds per acre	St. Joseph 7-year ave. 1930-1936	Baton Rouge 6-year ave. 1929-1935	Alexandria 5-year ave. 1932-1936	Melrose 4-year ave. 1929-1933	Dixie 3-year ave. 1927-1930	Average of all tests 25 years
1	5-0-4	\$12.44	\$4.72	\$16.04	\$ 6.64	\$ -.52	\$ 7.86
2	5-4-4	14.24	5.68	21.96	6.44	.68	9.80
3	5-8-4	15.00	1.04	17.32	3.72	.52	7.52
4	5-12-4	11.56	1.44	17.40	4.72	.40	7.10
5	5-16-4	10.68	1.70	17.44	4.56	-.12	6.85
6	0-0-0						
7**	0-8-4	-.64	-3.48	3.72	-.08	1.36	.17
8**	3-8-4	9.08	4.88	13.72	5.56	2.04	7.06
9**	4-8-4	13.40	3.64	14.96	6.32	3.80	8.42
10**	5-8-4	14.36	4.76	18.52	6.64	5.36	9.93
11**	6-8-4	18.40	5.32	21.16	11.16	3.76	11.96
12**	7-8-4	19.84	6.76	25.40	13.12	3.64	13.75
13	0-0-0						
14	5-8-0	10.40	5.04	17.92	6.28	2.96	8.52
15	5-8-2	9.22	1.78	16.66	5.46	.10	6.64
16	5-8-4	7.40	1.80	16.44	5.80	-1.72	5.94
17	5-8-6	7.86	-.70	15.66	7.46	.06	6.07
18	5-8-8	8.36	1.12	13.76	4.00	2.48	5.94

*The seed cotton was valued at 4c per pound, nitrate of soda at \$32.00 per ton, 20% superphosphate at \$20.00, and muriate of potash at \$35.00.

**In calculating the profit or loss from the use of fertilizers on plats Nos. 7 to 12, inclusive, the cost of potash and phosphoric acid, with the exception of 24 pounds of P₂O₅ per acre on the tests at St. Joseph and Alexandria, were not included as they did not produce profitable increases in yields.

As shown in Table 1, increased yields of cotton were obtained in practically every case from the use of phosphate. The amount of the increase, however, varied from practically nothing at Melrose and Baton Rouge to as much as 178 pounds of seed cotton per acre at Alexandria. At Dixie it ranged from 60 to 130 pounds and at St. Joseph, from 68 to 124 pounds. These increases in yields are all relatively small. Data given in Table 2 show that the addition of phosphate to the fertilizer in plats Nos. 1 to 5 did not produce sufficient profits to be worthwhile at Baton Rouge, Melrose, and Dixie. On the other hand, 4 per cent of phosphoric acid in the fertilizers, or 24 pounds of P_2O_5 per acre, has given significant profits at both St. Joseph and Alexandria. These have amounted to \$1.80 per acre at St. Joseph and \$5.92 per acre at Alexandria. Expressed in another way, these profits represent returns of \$2.50 per \$1.00 invested at St. Joseph and \$5.92 per \$1.00 invested at Alexandria.

The average annual yields of cotton in these experiments were increased in all cases by application of nitrogen fertilizers. The response to gradually increasing applications of nitrogen is shown in particular by the yields of plats Nos. 7 to 12, inclusive. On all tests, with the exception of the one at Dixie, the largest increase in yield was obtained from the largest application of nitrogen. The maximum increases at each of the locations were 617 pounds per acre of seed cotton at St. Joseph, 361 pounds at Baton Rouge, 647 pounds at Alexandria, 435 pounds at Melrose, and 175 pounds at Dixie. The figures in Table 2 show the average annual net profit produced by each of the applications of nitrogen. At Dixie the most profitable increase in yield was obtained from 30 pounds per acre of nitrogen. All applications of nitrogen up to 42 pounds per acre, which was the maximum application made in these tests, increased both yield and profit at all of the other locations. The average annual profit from the use of nitrogen in these tests ranged from \$4.00 per acre at Dixie to \$21.68 per acre at Alexandria, with all tests averaging \$13.90. These profits represent returns ranging from \$2.33 per dollar invested at Dixie to \$6.16 per dollar invested at Alexandria. The average return for all the tests was \$4.25 per dollar spent for nitrogen fertilizers.

In no case did applications of potash increase the net returns per acre. In only three of twenty instances in which potash was included in the fertilizer (see plats Nos. 15 to 18) was the yield larger than when it was omitted (plat No. 14). The addition of potash to these soils apparently had a slightly depressing effect upon the yield of seed cotton.

From the results secured in these experiments, it is clear that nitrogen has considerable influence on the yields of cotton on all these soils. While increases in yields were obtained in nearly all cases from applications of phosphoric acid, the amount of the increase was insufficient, in most instances, to justify its use. It is interesting to note in this connection that soils that gave the largest responses to nitrogen also responded profitably to phosphoric acid. From 30 to 42 pounds of nitrogen per acre have given the most profitable increases in yields on all soils. This can be supplied by application of 200 pounds per acre of nitrogen-carrying fertilizers containing 15 to 20 per cent nitrogen. On soils in which the reserve supplies of available phosphorus are becoming depleted by cropping, quite profitable increases in yields will be obtained from the use of as much as 24 pounds of phosphoric acid per acre. This can be supplied by applications of 300 pounds per acre of a 12-8-0 mixture.

SUMMARY

The results of the cooperative cotton fertilizer tests conducted on the Red and Mississippi River alluvial soils from 1927 to 1936, inclusive, are reported.

When added to a combination of the other two fertilizing constituents, potash did not produce a profitable increase in yield in any of these tests. Additions of phosphate gave definitely profitable returns in two of the five tests.

The maximum application of nitrogen, i.e., 42 pounds per acre, produced the largest profits in all but one of the tests, in which 30 pounds of nitrogen per acre was the most profitable. Average annual profits from the use of nitrogen ranged from \$4.00 to \$21.68 per acre, with an average of \$13.92 for all tests. This represents an average return of \$4.25 per \$1.00 spent for nitrogen fertilizers.

The area of the state in which the results of these tests are applicable is shown on a parish outline map of the state.

Recommendations are made for the fertilization of cotton in this area.