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Fertilizer response and requirements for profitable crop production in the Yazoo-Mississippi Delta

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Fertilizer Response and Requirements For Profitable Crop Production In the Yazoo-Mississippi Delta

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Summary

The soil fertility experiments throughout the Yazoo-Mississippi Delta tend to indicate that:

1. Soils on the west side of the Delta respond to nitrogen only.

2. Most soils on the east side respond to nitrogen, potash, and phosphorus.

3. The most practical rate of applying nitrogen is 30 to 40 pounds per acre.

4. Ordinarily, the nitrogen can be applied on heavy soils from late fall to three weeks prior to planting, and on lighter soils any time in the spring up to 10 days before planting with very little difference in yields of seed cotton and corn, and any time from fall to March 15 for oats.

5. Little difference is obtained from the various placements so long as they are mixed in the seed bed, if applied before planting.

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Fertilizer Response and Requirements For Profitable Crop Production In the Yazoo-Mississippi Delta

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High yields are necessary if crops are to be produced profitably, and high yields are produced on fertile soils. Nitrogen availability is probably the most important controllable fertility factor in the eastern Cotton Belt, but is even more important in the Yazoo-Mississippi Delta. On a majority of Delta soils, a sufficient amount of available nitrogen represents the difference between a profitable and unprofitable crop yield.

Until 1913, periodic overflows tended to maintain soil fertility on a large portion of the Delta, and the addition of plant food was not practiced. Less frequent overflows during the past quarter-century, and 25 to 100 years of continuous cropping have reduced the nitrogen and other plant food. While it is difficult to build up the organic content and the nitrogen supply in soils, normal amounts of each as needed in crop production can be obtained by proper farm practices. This has been demonstrated by our experiments and by large increases in the average cotton yields under the Government farm program.

The Yazoo-Mississippi Delta is a lens shaped body of land about 185 miles long and about 68 miles in width at the broadest point. It embraces some four and one-half million acres, of which 40% are still in wood land. It is the largest body of fertile land in the state and one of the largest in the United States. It is practically level and free from erosion.

Three Soils in Delta

Soil fertility experiments, begun at the Delta Branch Experiment Station in 1921, indicated that most Delta soils are deficient in nitrogen, and some of them in phosphorus and potash also. Recent work shows that so far as fertilizer requirements for profitable crop yields are concerned, the Yazoo-Mississippi Delta may be divided into at least three areas.

The alluvium on the west side was formed primarily from contributions by the Mississippi River and carries a sufficient amount of lime, phosphorus and potash, but a deficiency of nitrogen. Soils on the east side of the Delta have been influenced by later contributions from outwash and the overflow of streams arising in the adjacent hills. Investigations in this area indicate a distinct deficiency of lime and nitrogen, a distinct to a slight deficiency of potash and of phosphorus in localized areas.

The intervening soil types between these two areas were probably built up from mixtures of the overflow of the Mississippi River and of streams arising in the adjacent hills, and show a distinct deficiency of lime and nitrogen and a deficiency of potash and phosphorus. In this area, responses to potash and phosphorus are erratic and not as consistent as in the case of nitrogen.

Since the Experiment Station can not make tests on all farms and plantations, it is apparent that planters in the east half of the Delta should proceed on an experimental basis to determine whether or not phosphorus or potash may be profitably used on their particular soils.

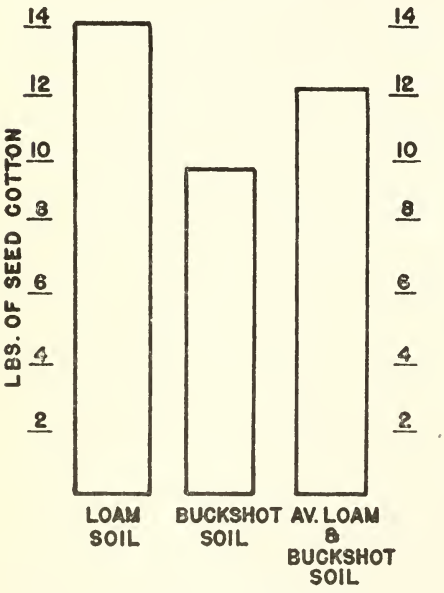
Experimental field trials indicate that the much needed nitrogen can be supplied to Delta soils economically by commercial nitrogenous fertilizers or with summer or winter legume crops.

Fertilizers for the Delta should be considered from the following angles: (1) what kind of fertilizers to use, (2) how much to use, (3) when to apply, and (4) how to apply.

What Kinds of Fertilizer to Use in Delta Area?

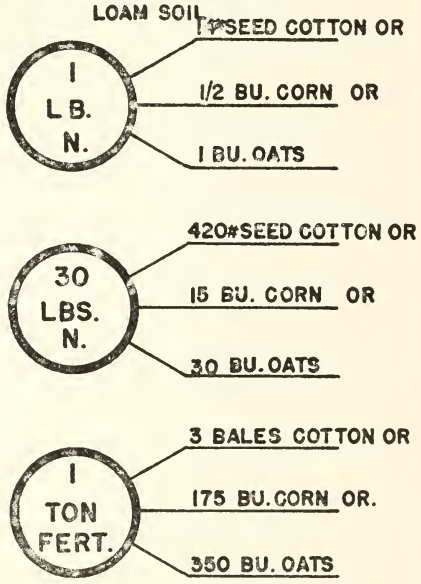
On the west side of the Delta, experimental results indicate that nitrogenous fertilizers are the only kind to use on most soils for profitable crop yields. Experiments extending over a period of 18 years show that a pound of commercial nitrogen produces approximately 14 pounds of seed cotton on loam soil and about 10 pounds on buckshot soil, or an average of 12 pounds for the two soil types. The results of these tests are shown graphically in Figure 1.

INCREASE IN COTTON YIELDS DUE TO THE USE OF ONE LB. OF NITROGEN



These results also show that one pound of nitrogen produces an extra one-half bushel of corn or one bushel of oats. Using these same results, 30 pounds of nitrogen, which is equivalent to 188 pounds of sodium nitrate, 188 pounds of calnitro, 146 pounds of ammonium sulphate, or 136 pounds of cyanamid, produces approximately 420 pounds of seed cotton, or 15 bushels of corn, or 30 bushels of oats on loam soil. Calculating from these data then, one ton of nitrogenous fertilizers produces an extra three bales of cotton, or 175 bushels of corn, or 350 bushels of oats, assuming an average of 350 pounds of nitrogen per ton. These data are shown in Fig. 2.

INCREASED YIELDS DUE TO COMMERCIAL NITROGEN

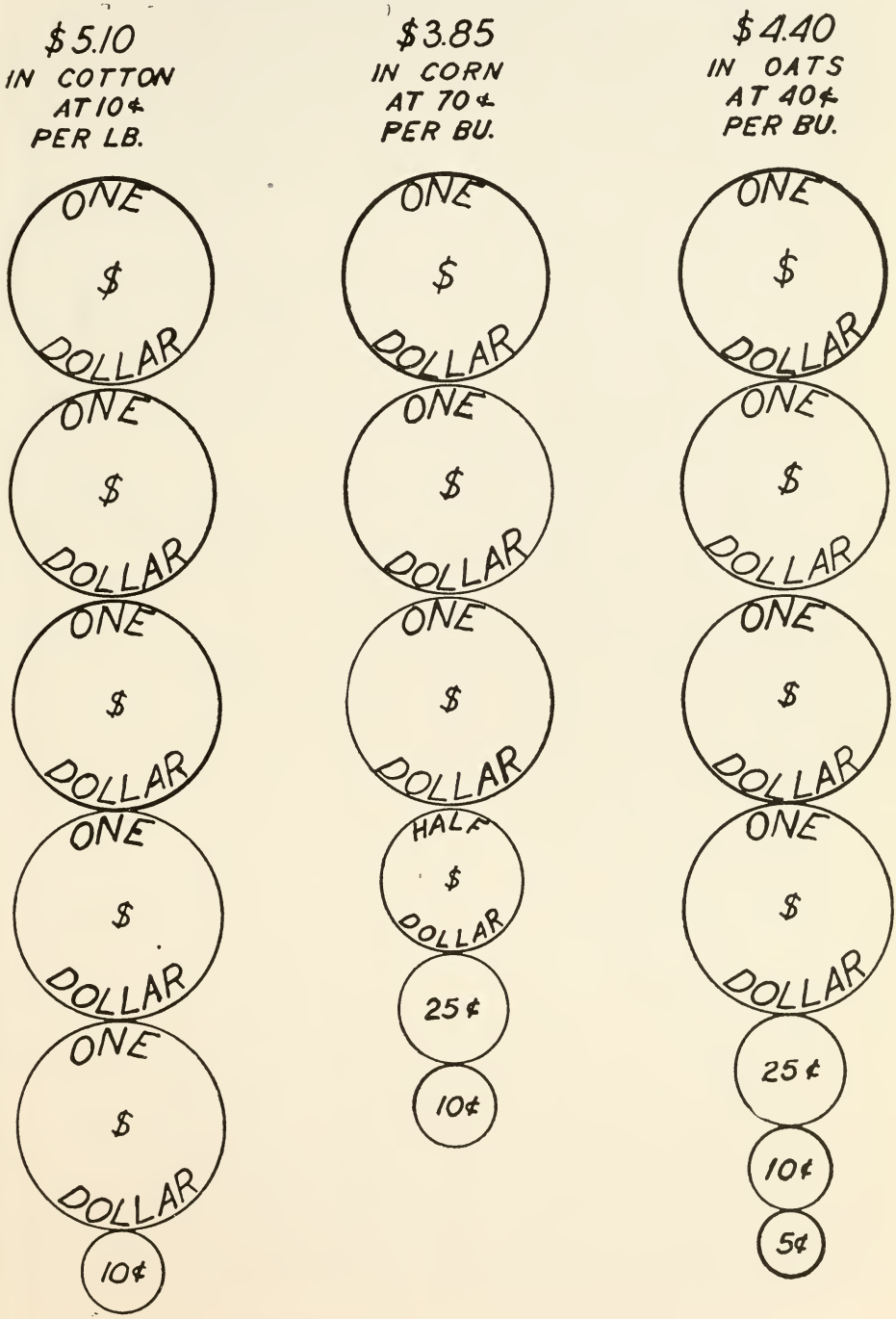


USED AV. 350 LBS. NITROGEN IN TON OF FERTILIZER

This increased yield, due to a ton of nitrogenous fertilizers, probably represents the lowest cost part of the crop so produced. At current nitrogen prices, the increased yields are produced at a cost of approximately 2c per pound for lint exclusive of picking and ginning, 18c per bushel of corn, and 9c per bushel of oats.

Using 1939 prices for fertilizers, these results indicate that $1.00 spent for nitrogenous fertilizers returns $5.10 worth of lint cotton at 10c per pound, $4.40

One Dollar Spent for Nitrogen Fertilizer (11 Pounds Nitrogen) Increases Crop Returns:

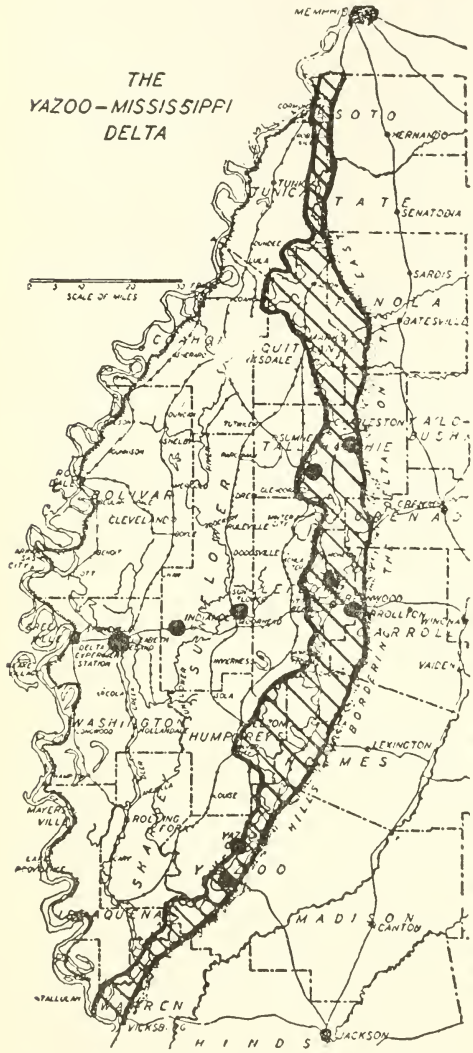


worth of oats at 40c per bushel, or $3.85 worth of corn at 70c per bushel. These values are shown in Fig. 3. (Page 5).

As already stated, on the extreme East Delta and in the Coldwater-Tallahatchie-Yazoo River basin, crops respond to phosphorus and potash in addition to nitrogen. Since there has been no recent soil survey made in the Delta, it is difficult to determine the boundary lines between these soil areas.

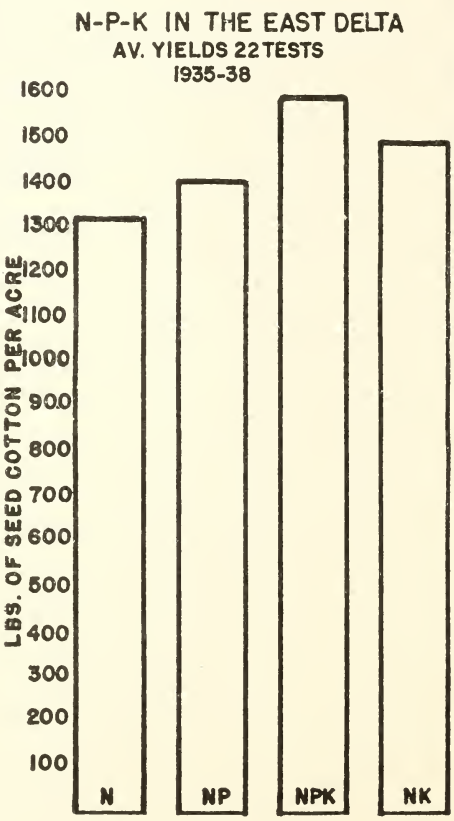
Experimental results indicate that nitrogen increases cotton yields, on an average, 200 to 500 pounds of seed cotton per acre; and where needed, phosphorus 60 to 170 pounds and potash 100 to 300 pounds per acre.

An average of 22 tests over a period of four years shows increases of 99, 162, and 250 pounds of seed cotton per acre for phosphorus, for potash, and for potash and phosphorus combined, respectively. These data are summarized graphically in Figure 4.



The shaded area represents the East Delta Area.

The black circles represent experimental fields.



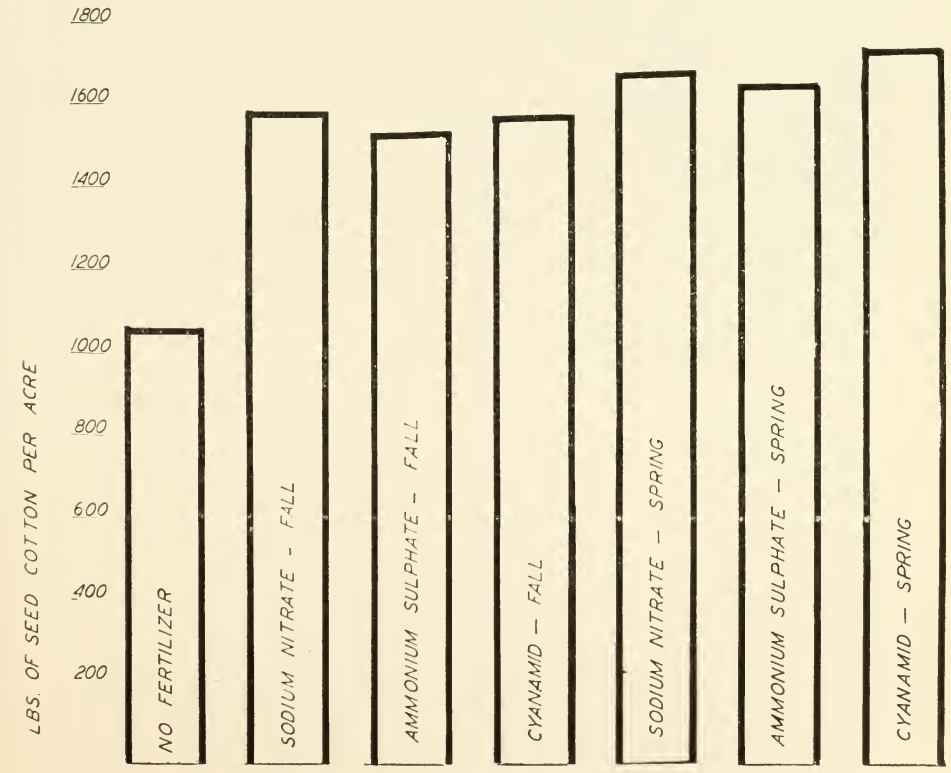
When to Apply Fertilizer --Spring or Fall?

The next question is, "When to apply nitrogenous fertilizers in the Delta?" Since 16-year average results show that but slightly better yields were obtained by side-dressing cotton or corn, the safest, most satisfactory and economical time to apply in the Delta is before planting.

As there was very little difference in cotton yields from applications of fertilizers applied any time between February 1 and planting time, the Delta Station conducted an experiment using sources of nitrogen applied in the fall and in the spring on cotton, corn, and oats.

Eight years' work indicates that March 15 is the best date to apply nitrogen to oats in the spring, but a two-year average on the present experiment shows better yields for the three sources when applied in the fall. On corn, spring applications of the three sources produced three to six bushels more corn per acre than fall applications. Spring applications made slightly more cotton than fall applications with the same three sources of nitrogen. However, increases of more than 400 pounds of seed cotton per acre were obtained from fall applications.

Figure 8 shows graphically the two-year average yields for cotton.



How Much Fertilizer For Most Profitable Crop Production?

After the question of what kind of fertilizer to use is settled, the next question is, "How much to apply?" Data from 18 years of experimental work varying nitrogen in 7½-pound increments from 0 to 45 pounds per acre, using sodium nitrate as the source, shows that profitable increases are received from all applications up to 37½ pounds of nitrogen per acre on cotton and corn, and 11 years' work shows the same results for oats. These data apply to cotton, oats, and corn in a 3-year rotation. Average yields for cotton are shown in Figure 5.

The average yield of corn from rates-of-applying-nitrogen test for an 18-year period, 1920 to 1938, are presented graphically in Figure 6.

Figure 7 shows an 11-year average yield for different rates of applying nitrogen to oats.

These results indicate that oats respond to nitrogen more readily than cotton or corn. Thirty pounds of nitrogen on soils that have not had a legume crop turned under recently have approximately doubled oat yields.

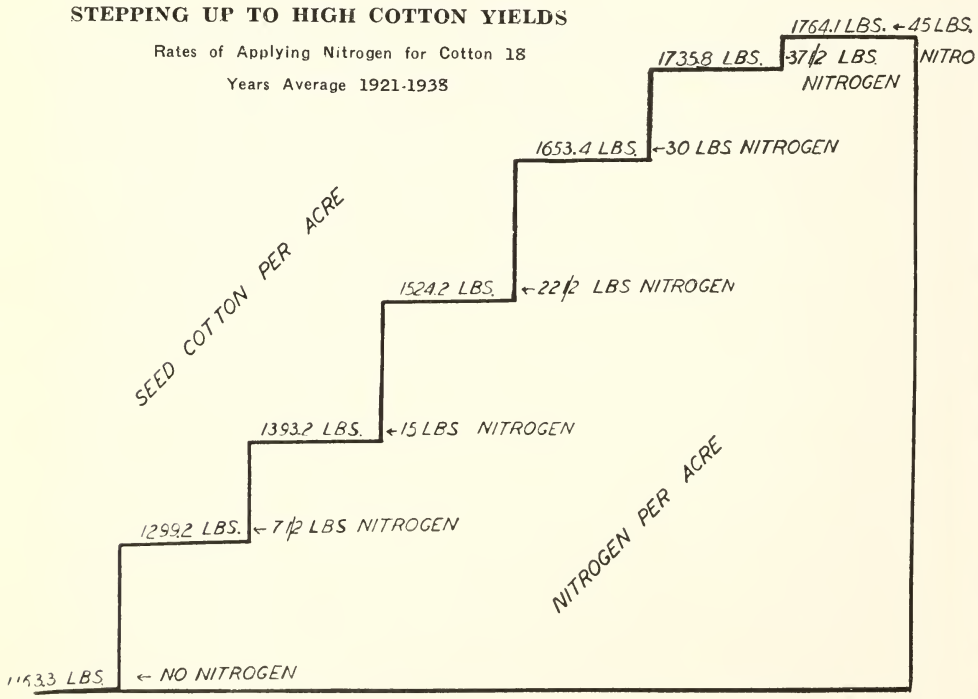


Table 5, above, shows average annual results of 18 years' work on rates of applying nitrogen for cotton. Every increase in the quantity of nitrogen applied resulted in increased cotton yield. The average annual yield of the unfertilized check plat was 1163.3 pounds seed cotton. When 7½ pounds nitrogen was applied, the yield was 1299.2 pounds. The application of additional nitrogen in 7½ pound increments resulted in yields of seed cotton per acre as follows: 15 pounds nitrogen, 1393.2 pounds seed cotton; 22½ pounds nitrogen, 1524.2 pounds seed cotton; 30 pounds nitrogen, 1653.4 pounds seed cotton. Rates of application higher than 30 pounds per acre yielded less profitable returns.

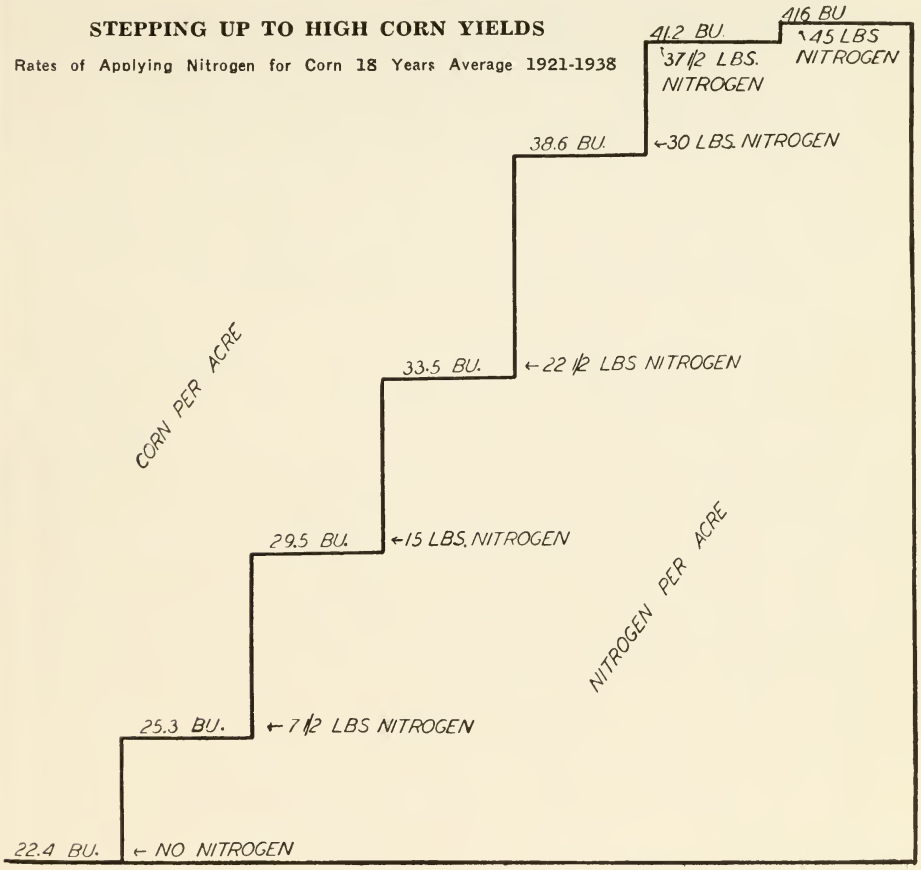


Table 6, above, shows average annual results of 18 years' work on rates of applying nitrogen for corn. From the yield of 22.4 bushels per acre from unfertilized check plat, the application of commercial nitrogen at the rate of 7½ pounds per acre increased the yield to 25.3 bushels. Increased application of nitrogen, in 7½ pound increments, gave the following results: 15 pounds nitrogen, 29.5 bushels; 22½ pounds nitrogen, 33.5 bushels; 30 pounds nitrogen, 38.6 bushels. Further increase in nitrogen application gave increased yields but diminished returns.

Thirty pounds nitrogen is derived from the following amounts of indicated materials: sodium nitrate, 188 pounds; calcium nitrate, 200 pounds; calnitro, 188 pounds; ammonium nitrate, 167 pounds; ammonium sulphate, 146 pounds; granular cyanamid, 143 pounds; pulverized cyanamid, 136 pounds; cottonseed meal, 460 pounds.

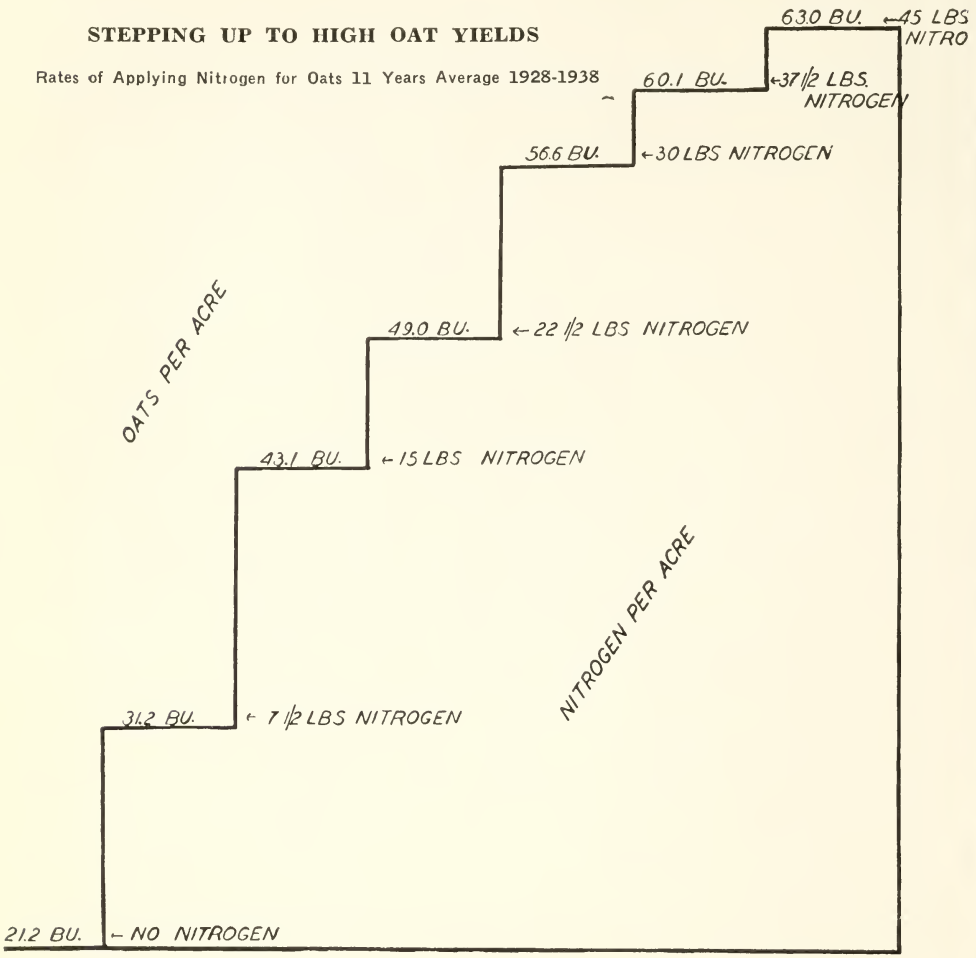


Table 7, above, shows annual results of 11 years' work on rates of applying nitrogen for oats. As in the instances of similar experiment with cotton and corn every increase in the quality of nitrogen applied resulted in increased oat yields. Differing somewhat from the cotton and corn experiments however, was the fact that more profitable yields were secured from the 7½ pound and 15 pound applications of nitrogen for oats. The application of 7½ pounds nitrogen increased the yield of the unfertilized plat by nearly 50 per cent, and applications of 15 pounds nitrogen more than doubled the yield of the unfertilized plat. Profitable returns were had from higher applications ofnitrogen, especially the use of 30 pounds of nitrogen per acre. Average annual yields were as follows: no nitrogen, 21.2 bushels per acre; 15 pounds nitrogen, 43.1 bushels per acre; 30 pounds nitrogen, 56.6 bushels per acre; 45 pounds nitrogen, 63 bushels per acre.

Most Economical and Practical Placement of Fertilizer

From 1929 to 1937, experiments were conducted to determine the most practical and economical placement of nitrogenous fertilizers in connection with seed bed preparation for cotton production. Calcium nitrate and cyanamid were used in this experiment. These tests indicated that there was very little difference in yields from the various placements of the two fertilizers so long as they were mixed in the seed bed prior to planting time. A very good method of applying fertilizer is to drill or broadcast it and bed or rebed on it any time within two weeks of planting.

Data covering the placement work from 1929 to 1936 are shown in detail in the following table:

SEED COTTON YIELDS PER ACRE FROM VARIOUS PLACEMENTS OF CALCIUM CYANAMID AND CALCIUM NITRATE—DELTA EXPERIMENT STATION—1929-1936

Placements	1929	1930	1931	1932	1933	1934	1935	8-Year 1936	Average 1929-36
				Calcium Cyanamid					
On bed—disk in	1864.1	899.1	972.3	706.2	1531.8	969.0	1004.7	1065.0	1126.5
In buster furrow	1859.2	874.2	1025.1	762.7	1528.4	952.5	934.7	1018.7	1119.4
In shovel furrow)									
In buster furrow)	1860.9	925.6	996.7	692.2	1638.0	1025.6	961.7	1054.8	1144.4
On the list	1873.9	776.4	1036.6	705.4	1500.4	954.3	936.0	1065.3	1106.0
Broadcast on beds	1829.9	939.6	938.6	706.4	1668.4	1050.3	993.6	1065.6	1149.1
Broadcast before rebedding	1784.9	672.7	1007.5	778.6	1601.7	1011.3	1035.7	1141.5	1129.2
In furrow on beds	1809.1	731.3	1021.0	729.7	1475.4	1006.3	998.4	1149.3	1115.1
				Calcium Nitrate					
On bed—disk in	1807.6	1004.0	1017.6	783.6	1353.9	877.2	849.3	973.5	1083.3
In buster furrow	1837.7	1164.6	1175.1	880.0	1389.8	881.5	871.4	988.5	1148.6
In buster furrow)	1796.6	1173.3	1147.8	854.0	1454.3	1000.6	951.4	1030.0	1176.0
On the list	1788.1	1035.4	1115.7	816.9	1386.8	963.7	949.1	1016.9	1134.1
Broadcast on beds	1843.8	781.4	969.3	769.3	1382.3	886.5	738.9	905.8	1034.7
Broadcast before rebedding	1720.0	779.9	1073.8	840.0	1284.5	820.5	663.4	943.8	1015.7
In furrow on beds	1698.2	847.3	1099.0	828.1	1292.8	827.1	656.8	983.9	1029.2

Seed Cotton Yields

Seven methods of placement extending over a period of eight years show little choice between methods used for applying cyanamid and only a small increase in yield for the deep application of calcium nitrate. Although crop yields fluctuate greatly from year to year because of seasons, yields from all placements were reasonably close together whether the season was conducive to high, medium, or low yields.