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Oats in Mississippi

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The production of oats in Mississippi has increased greatly in the past few years. This is largely the result of increased acres planted to oats and improved farm practices which increase yields per acre.

The total annual acreage seeded to oats in Mississippi during the 10-year period 1929-1938, according to Crops and Markets, published monthly by the United States Department of Agriculture, was 45,000 acres. According to the same authority, the acreage seeded to oats in Mississippi in 1939 was 76,000 acres and in 1940, 114,000 acres. Average annual production for the 10-year period 1929-1938 was 1,043,000 bushels. In 1939 the yield was 2,736,000 bushels, while the yield indicated July 1, 1940, was 3,648,000 bushels. The figures indicate an increase of approximately 150 per cent in acreage and in increase of more than 250 per cent in yield in 1940 as compared with the 10-year period 1928-1939.

Oats have been produced on Mississippi farms since pioneer days, but mainly as a source of feed for livestock on that particular farm. This should still be considered an important phase for the small farm owner who does not have sufficient capital to buy the needed equipment for commercial grain production. More recently, however, and especially in the Yazoo-Mississippi Delta area, oats have developed into a cash crop for sale as grain and under controlled farm conditions for sale as seed.

The yield of oats per acre in Mississippi has been too low for profitable production, being only 22.3 bushels per acre during the period 1929-1938. In recent years the yield per acre has increased greatly, being 27.0 bushels in 1938 and 36.0 bushels in 1939.

The increasing importance of oat production in Mississippi agriculture as well as the adaptability of at least certain of our widely distributed soils, is further emphasized in figures showing Mississippi's standing in oat production in relation with other states. According to the July 1940 Crops and Markets during the 10-year period, 1929-1938, Mississippi and Kansas were tied for thirty-first place among the states in average yield of oats per acre. In 1940 Mississippi ranked seventh among the states in average yield of oats per acre

Oats in Mississippi

By ROY KUYKENDALL, JOHN PITNER, J. F O'KELLY,
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Oat studies at the Delta Branch Station were begun in 1921, and have been greatly extended during recent years. The purpose of this work was to determine preferred farm procedure on major factors entering into oat production. The investigations have, therefore, consisted of the following experiments:

1. Variety comparisons
2. Dates of seeding
3. Rates of seeding
4. Fertilizers.

Oat studies in the present series were begun by the Mississippi Experiment Station at State College in 1935 and have been greatly extended during the past two years. These investigation have consisted of the following experiments:

1. Variety comparisons
2 Fertilizers.

Possibly one of the greatest hindrances to profitable oat production at present is the prevalence of infestations of cheat, chess, and other weeds which result in poor quality and low yield. During the harvest period of 1940, inspections were made of numerous plantings of oats in the Delta and hill section of the state for the purpose of seed certification. In numerous instances certification was necessarily withheld because of the considerable contamination with weeds and because of varietal mixtures. To fully utilize the opportunity for profitable oat production in Mississippi, proven practices with respect to varieties, fertilization, and handling must be adopted. The full utilization of this opportunity also involves the necessity, first, of securing weed-free seed oats of the desired variety, and second, of maintaining freedom from weed seeds by constant vigilance, especially at the time of harvesting. It must be remembered that good quality and high yields cannot be obtained from planting "ordinary commercial feed oats." It is impossible to over-estimate the importance of planting pure seed.

Studies conducted by the Delta Branch Experiment Station, by the Mississippi Experiment Station at State College, and by substations at Holly Springs, Raymond, and Natchez, indicate that further progress may be made in profitable oat production. These studies show that under normal climatic conditions, soils of the Delta and the Brown Loam Region produce profitable oat yields. In the Delta high yielding and adapted varieties planted in the fall at the rate of 2 to 3 bushels of seed per acre and fertilized with 30 pounds of commercial nitrogen produce an average of from 60 to 90 bushels of oats per acre. In the Hills, profitable oat yields may be obtained by planting high yielding and adapted varieties at the rate of 2 to 3 bushels per acre and fertilizing with 16 pounds of commercial nitrogen. Since the results from Delta Branch Station are from tests conducted over a longer period of time than those conducted by the Mississippi Experiment Station, State College, in the hill sections, they are discussed and summarized separately.

It is the purpose of the bulletin to summarize the oat work conducted by the Delta Branch Station and the Mississippi Experiment Station and to interpret the results of the experimental work with respect to the fundamental factors of oat production.

OAT EXPERMENTS AT THE DELTA BRANCH STATION

Variety Comparisons

Each year since 1921 the Delta Branch Station has obtained planting seed of several of the leading varieties of oats on the market and some of the more promising new strains. These were planted in variety tests for the purpose of yield comparisons. The tests were not conducted on the same soil every year but most of them were on a loam soil. The oats were seeded in the fall except where comparisons were made of fall seedings and spring seedings. The same varieties were not used every year because of the year-by-year elimination of unsuitable varieties with the result that during recent years most of the older varieties have been replaced by newer strains. Table 1 presents the results of the last six years of this work.

It will be noted that Red Rustproof varieties, such as Nortex, Delta Station Strain, Ferguson, Hastings 100 Bushel Appler, and Bayliss usually produce higher yields than other varieties; and that Fulgrain outyielded other non-red-rust-resistant varieties. The Red Rustproof strains winter killed only one year.

For the purpose of more direct comparison, the yields of identical varieties obtained from different seed sources were combined in such a way as to show the average yields of those varieties for the greatest number of years during which direct comparisons were possible. This information is shown in table 2.

The results of 20 years work in variety testing indicates that the Red Rustproof strains of oats have produced highest yields. Three varieties have been continued throughout this period and during 13 of these years, 1925-26, 1929-39, one of these, Ferguson 922, has yielded annually 60.7 bushels per acre. However data from recent years show that seed of the newer strains have produced higher yields. During the two-year period, 1938-39, average annual yields were as follows: Ferguson 922, 80.3 bushels; Nortex, 84.6

FIGURE 2—EXPERIMENTAL PLATS IN FERTILIZER EXPERIMENTS

bushels; Delta Station Red Rustproof, 81.6 bushels; Bayliss, 80.2 bushels. Closely following in annual yields were Hastings 100 Bushel, Appler and Terruf. The above named varieties are about ten days later maturing than Fulgrain, Fulghum and Kanota. Yield records indicate that at present Fulgrain is the best early oat variety under the conditions of the work of the Delta Branch Station.

The consistent performance of the Red Rustproof strains throughout the 20-year period seems sufficient evidence of their superiority for grain production. It often occurs, however, that oats of a different maturity date are desired in order that the harvesting period may be extended. Of the earlier varieties to be planted for this purpose, Fulgrain or Fulghum is recommended. Many planters seed 70 per cent of their oat acreage to Red Rust Proof strains, and 30 per cent to Fulgrain or Fulghum, in order to begin harvesting ten days earlier than would be possible were only the Red Rustproof strains planted.

Dates of Seeding

In order to determine the best average date for seeding oats to produce maximum yields, comparisons were made of yields from fall plantings, begun on September 15 and continued in fifteen day intervals until November 15 and from spring plant-

TABLE 1—ANNUAL YIELDS OF VARIOUS VARIETIES OF OATS FOR THE PERIOD OF 1934-40

Variety	Seed (a) Source	1934	1935	1936	1937	1938	1939	1940	Average
Hastings' 100 Bushel	3	78.3	45.7	44.7	70.1	86.2	66.2	97.1	69.7
Fulghum	4	.....	.....	.....	57.2	56 7	42.3	92.1	62.1
Appler	5	72.6	48.3	47.2	65.1	84.7	67.7	91.5	68.1
R. R. P.—Commercial	6	.....	.....	.....	.....	84.9	67.8	88.2	80.3
Kanota	8	44.2	14.7	30.4	56.3	44.9	38.0	81.7	44.3
Ferguson 922	2	83.9	39.6	47.3	70.3	91 1	69.4	.....	66.9
Bayliss	9	69.0	40.0	43.4	71.7	88.3	72.0	83.5	66.8
Nortex	10	81.2	50.6	65.3	69.7	92 8	76.3	78.7	73.5
Coker Fulgrain (strains 1, 2, and 3)	1	.....	.....	59.0	68.7	55.4	57.2	88.9	65.8
Delta Station R. R. P.	7	.....	.....	52.0	73.9	93.4	69.8	86.9	75.2
Terruf	11	.....	.....	.....	.....	80.8	73.5	85.2	79.8
Fulghum x Victoria	12	.....	.....	.....	.....	.....	60.2	84.9	72.5

TABLE 2—AVERAGE YIELDS OF VARIOUS VARIETIES OF OATS FOR THE PERIOD OF 1921-37

Variety	13 Yrs. 1925-26 1929-39	12 Yrs. 1921-23 1925-26 1933-39	11 Yrs. 1921-23 1925-26 1934-39	8 Yrs. 1929-36	Bushels per Acre 10 Yrs. 1929-32 1934-39	4 Yrs. 1921-23 1925	3 Yrs. 1923 1925-26	6 Yrs. 1934-39	4 Yrs. 1936-39	2 Yrs. 1938-39
Fulghum	47.3	44.5	46.0	40.4	45.1	39.8	50.7	46.4	48.9	49 5
Ferguson 922	60.7	61.4	62.0	53.3	60.3	50.5	53.7	67.0	68.4	80.3
Kanota	39.2	.....	.....	30.4	35.2	.....	... ..	38.1	42.4	41.5
Hastings' 100 Bu.	60.6	60.6	.....	.....	.....	50.3	57.7	65.2	66.8	76.2
Appler			60.6	.....	.....	50.3	50.7	65.2	66.8	76.2
Norton				39.8						
Baylis					56.3	.....	.....	64.1	68.9	80.2
Texas R. R. P.							45.3	.....	.....	.....
Dwarf Culberson						29.3	.....	.....	.....	.....
Navarro							54.0	.....	.....	.....
Nortex								72.7	76.0	84.6
Fulgrain									60 1	56.2
Delta Station R. R. P.									72.3	81.6
Commercial R. R. P.										76.4
Terruf										77.2

ings begun on February 15, and continued until April 1. The variety of oats used in this experiment was Ferguson 922. The results of these tests are shown in table 3.

These results, as shown in the above table, on dates of seeding indicate very definitely that the middle of October is the best time to plant oats to obtain highest yields. Oats planted October 15 produced an average of 63.3 bushels per acre, which was slightly higher than yields secured from oats planted either October 1 or November 1, and consistently higher than yields secured from oats planted September 15 or November 15. Plantings made February 15 yielded only 16.2 bushels per acre and those made March 15 yielded only 9.6 bushels per acre; those planted later resulted in virtual crop failure.

Rates of Seeding

Experimental work on rates of seeding oats was begun at the Delta Branch Station in 1929 and has been continued to date. The procedure followed in seeding rates were replicated 4 to 8 times and all factors other than seeding rates were kept as nearly constant as possible. The designated amount of seed for each planting was weighed, put in separate packages and broadcast by hand. Most of the experiments were conducted on a loam soil. Ferguson 922 was the variety used. Results of these comparisons are shown in table 4.

Maximum yields were produced when oats were seeded at the rate of 2½ bushels per acre. However, the results show only a slight difference in yield when the quality of oats planted varied from 1½ to 3½ bushels per acre. With the Ferguson strain the 2½ bushel seeding yielded 64.1 bushels. It is likely that these differences are not statistically significant and from two to three bushels per acre appears to be the most desirable rate of seeding.

Nitrogen Fertilization

Since oat yields on land of low fertility are so often disappointing, the Delta Branch Station began work with commercial fertilizers with oats in 1928 to determine the most economical source of nitrogen to use, the most economical rate of nitrogen to apply, and the proper time of application for maximum production.

TABLE 3—YIELDS FROM VARIOUS DATES OF SEEDING OATS

Seeding Dates	Bushels per Acre									
	1931	1932	1933	1934	1935	1936	1937	1938	1939	Average
					Ferguson 922					
October 15	71.6	37.4	79.5	56.2	33.8	51.1	72.2	82.8	87.7	63.6
September 15	81.6	40.3	34.2	60.7	26.1	48 1	55.3	66.3	85.0	55.3
October 1	80.9	41.2	59.1	56.1	29.4	44.5	64.4	67.3	85.4	58.7
November 1	76.4	47.4	80.3	60.7	22.5	24.1	64 2	79.5	78.9	59.3
November 15	85.2	41.9	65.0	70.6	8.6	24.1	64.1	57.9	82.1	55.5
February 15	62 1	0.0	4.7	24.7	0.0	23.2	6.9	12.8	11.1	16.2
March 1	67.5	0.0	0.2	21.8	0.0	24.0	2.0	9.1	11.3	15.1
March 15	48.6	0.0	0.6	15.4	0.0	10 6	1.3	0.0	10.2	9.6
April 1	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	2.7	0.3

TABLE 4—YIELDS FROM VARIOUS RATES OF SEEDING FERGUSON 922 OATS

No. Bushels per Acre	Bushels per Acre											Average
	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	
						Ferguson 922						
2½ bushels	72.3	57.5	95.3	48.5	52 6	73.9	39.3	60.8	61.3	72.5	79.3	64.8
1½ bushels	64.4	61.3	90.8	49.3	49.5	76.9	36.3	59.0	61.3	73.1	78 3	63.2
2 bushels	49.3	58.5	92.7	51.1	48.9	74 0	32.6	60.6	62.1	73.6	79.5	62.1
2¼ bushels	72.5	57.7	89.8	49.0	52.4	82.0	40.9	60.2	57.4	71.6	78 3	64.7
2¾ bushels	68.6	53.4	91 4	48.8	48.4	89.4	42.0	58.6	58.3	71.0	78.5	64.4
3 bushels	73.3	56.5	94.8	52.3	48.0	72 5	43.5	55.8	61.6	69.7	76.8	64.1
3½ bushels	68.7	58.2	106.9	49.1	52.1	63.6	37.4	58.2	53.8	73.6	77 9	63.6

FIGURE 3—Oats in "Rates of Applying Nitrogen" experiment. Left to right: Unfertilized, 94, 188, and 282 pounds of Nitrate of Soda per acre, with 12 year average yields of 21.6, 43.7, 57.7, and 64.0 bushels per acre, respectively.

These tests were conducted on a loam soil and were a part of a three-year rotation consisting of corn, cotton, and oats, all fertilized identical. This rotation has been in progress for 20 years and no legume crop has been grown on this soil during that time. The residue from corn, cotton, and oats is the only organic matter that has been applied during this period.

The Sources of Nitrogen. In order to determine which of the sources of commercial nitrogen would produce highest oat yields, a comparison of results for various sources was begun in 1928. 30 pounds of nitrogen per acre was used from each source, which necessitated that the amount of fertilizer from each source vary in respect to its nitrogen content. Oats were seeded cross-wise in all plats and the fertilizer was weighed separately and applied by hand in the spring. The experiment was conducted on a loam soil. Ferguson 922 and its strains were used every year except 1932 and 1933, when Norton was planted. All factors other than the source of nitrogen were kept as nearly constant as possible. Results are presented in table 5.

During the 13 year period in which sources of nitrogen have been tested, all sources except cottonseed meal more than doubled the yield of the untreated or check plot. 30 pounds of nitrogen from nitrate of soda per acre produced slightly higher yields than a like amount of nitrogen secured from other sources or materials, though the difference was slight when nitrate of soda was compared with ammonium nitrate. The increase in yields due to 30 pounds of nitrogen according to sources was as follows: nitrate of soda, 38.8 bushels; ammonium nitrate, 36.7 bushels; ammonium sulfate, 31.0 bushels; cyanamid, 24.2 bushels; cottonseed meal, 14.1 bushels; cottonseed meal and ½ sodium nitrate, 24.9 bushels.

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

Rates of Applying Nitrogen. Since nitrogen is the only major deficient fertilizing element in the west half of the delta, and is probably the most important factor for consideration in respect to increased crop yields, a test was inaugurated in 1928 to determine the most economical rate of applying nitrogen to oats. The rates were varied in 7½ pound increments up to 45 pounds of nitrogen per acre, and nitrate of soda was the source of nitrogen used. The fertilizer was applied in the spring. Ferguson 922 variety and its strains were used every year except 1932 and 1933, when Norton was planted. Yields secured from these rates of applying nitrogen are shown in table 6.

Results of this work indicate that 30 pounds of nitrogen produced the most economical yields of oats, that the greatest response was obtained from less than 20 pounds of nitrogen per acre, and that

TABLE 5—YIELDS OF OATS FROM VARIOUS SOURCES OF NITROGEN USING 30 POUNDS OF NITROGEN PER ACRE

Treatment	Bushels per Acre													1928-40
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Av.
Unfertilized	40.3	20.8	23 1	49.2	0.6	13.9	11.7	22.7	15.1	27.2	21.1	24.8	21.7	22.5
Nitrate of Soda	70.5	61.7	68.4	102.0	10.4	58.2	53.6	53.3	51.7	65.6	65.6	69.9	65.6	61.3
Ammonium Nitrate	74.8	59.2	60.8	83.2	8.3	51.9	46.2	56.1	54.7	65.6	70.3	72.8	66.2	59.2
Ammonium Sulfate	69.2	56.5	49.9	66.4	6.1	39.8	40.6	50.7	55 4	62.0	65.3	72.8	60.6	53.5
Cyanamid	62.7	52.0	48.9	58.6	11.3	40.0	39.9	45.1	45.8	55.0	47.0	55.6	45.8	46.7
Cotton Seed Meal	58.1	37.0	34.1	67.0	3.5	20.0	21.3	37.0	34 0	45.9	39.0	41.5	37.3	36.6
½ C.S.M. and ½ S. Nitrate	59.5	52.9	39.5	87.7	7.2	34.4	38.4	46.2	44.3	52.1	47.1	55.9	51.0	47.4

TABLE 6—YIELDS FROM RATES OF APPLYING NITROGEN IN 7½ POUND INCREMENTS UP TO 45 POUNDS PER ACRE, USING NITRATE OF SODA AS THE SOURCE

Nitrogen Rates Per Acre	Bushels per Acre													1928-40
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Average
No Nitrogen	35.5	25.3	22.6	37.2	1 0	16.3	9.2	26.2	14.9	24.6	22.3	26.1	17.7	21.3
7.5 pounds	42.4	32.1	25.6	44.8	4.1	27.1	18.5	37.8	26.1	45.2	39.0	39.3	25.5	31.3
15.0 pounds	52.5	43.5	37.6	57.1	5 6	41.9	31 3	53.1	39.9	60.0	51.7	50.0	37.6	43.2
22.5 pounds	65.1	45.7	46.6	77.2	9.3	44.6	34.2	44.1	48.9	63.2	60.3	60.4	52.4	50.2
30.0 pounds	69.4	50.4	56.2	79 2	7.6	57.9	51.0	54.3	63.0	71.5	61 7	69.8	64.8	58.2
37.5 pounds	78.5	58.4	62.8	77.3	5.0	61.6	57.0	57.4	64.0	74.3	64.8	73.5	66.3	61.6
45.0 pounds	73.4	63.5	66.8	73 6	9.6	70.3	72 2	59.5	68.8	63.3	71.9	75.0	66.5	64.2

very profitable increases were made from applications up to 40 pounds per acre. The application of 7½ pounds of nitrogen increased the yield of the unfertilized plot by nearly 50 per cent, and applications of 15 pounds of nitrogen more than doubled the yield of the unfertilized plot. The use of 30 pounds of nitrogen increased the yield to 56.6 bushels per acre. The second increment, 15 pounds of nitrogen per acre, was the most profitable; and the diminishing returns began with the fifth increment when nitrogen application was at the rate of 37½ pounds of nitrogen per acre. More than one bushel increase in oat yield was obtained for each pound of nitrogen used when the rate of application was 30 pounds per acre.

Dates of Applying Nitrogen. Time and method of fertilizer placement are important considerations wherever crops are fertilized. This is especially true in the case of oats in the Yazoo-Mississippi delta, where the peak of work in cotton production coincides to some extent with the time at which oats are customarily fertilized. An experiment to determine the time at which cats may most profitably be fertilized was begun in 1928 and continued through 1936. Nitrogen was used at the rate of 30 pounds per acre and applied in separate plots at planting on four dates. Results of this work, measured in bushels of oats per acre, are shown in table 7.

Eight years' work indicates March 15 as the best date to apply nitrogen to fall sown oats. It was regarded as significant, although, during these 8 years the results of spring applications of nitrogen barely exceeded results of nitrogen applied at the time oats were planted.

In 1937, the preceding experiment was replaced by a new experiment which was inaugurated for the purpose of comparing spring and fall applications of nitrogen to oats. Three sources of nitrogen were used—nitrate of soda, ammonium sulfate, and cyanamid—and treatments were uniformly at the rate of 30 pounds nitrogen per acre. Fall applications were made in late November, and spring applications were made in early March. Results are shown in table 8.

This experiment has been in progress only four years and the results are not yet conclusive. Results thus far are in accord with results of the 8-year experiment with dates of applying nitrogen, which indicated that nitrate of soda gave slightly better yields when applied March 15. During the 4 years of this experiment,

TABLE 7—YIELDS OF OATS FROM DATES OF APPLYING 30 POUNDS OF NITROGEN PER ACRE USING NITRATE OF SODA AS THE SOURCE

Date of Application	Bushels per Acre							Average
	1928	1929	1930	1931	1932	1933	1934	1936	
No Nitrogen	30.5	25.3	29 3	45.7	0.7	20 3	9.5	14.3	22.0
November	46.2	60.7	60.0	100.3	3.8	59.5	41.8	53.3	53.2
March 15	57.2	59.7	62.7	101.8	8.2	44 6	51.7	59.2	55.6
April 1	64.6	65.8	62.2	70.4	4.5	40.5	50.7	48.9	51.0
April 15	60.2	64 1	63.8	94 3	2.0	28.2	21.1	47.6	47.7
½ Nov. ½ April 1	53.7	62.6	62.8	90.4	5.6	40.3	48.3	56.8	52.6
½ Nov. ½ April 15	66 8	61.9	59.1	89.3	3.7	29.7	35.6	49.3	49.4

TABLE 8—YIELDS OF OATS FROM FALL AND SPRING APPLICATIONS OF NITRATE OF SODA, AMMONIUM SULFATE AND CYANAMID, USING 30 POUNDS OF NITROGEN PER ACRE

Source and When Applied	Bushels per Acre				Average
	1937	1938	1939	1940	
Unfertilized	34.0	22.2	28.9	21.2	26.6
Nitrate of Soda—November	65.9	66.2	55.5	50.1	59.4
Ammonium Sulfate—November	64.5	61.4	54 2	49.4	57.4
Cyanamid—November	63.5	63.9	47.4	41.9	54.2
Nitrate of Soda—March	61.8	61.4	66.3	64.6	63.5
Ammonium Sulfate—March	62.9	57.2	65.2	61 5	61.7
Cyanamid—March	56.5	46 5	54.5	43.6	50.3

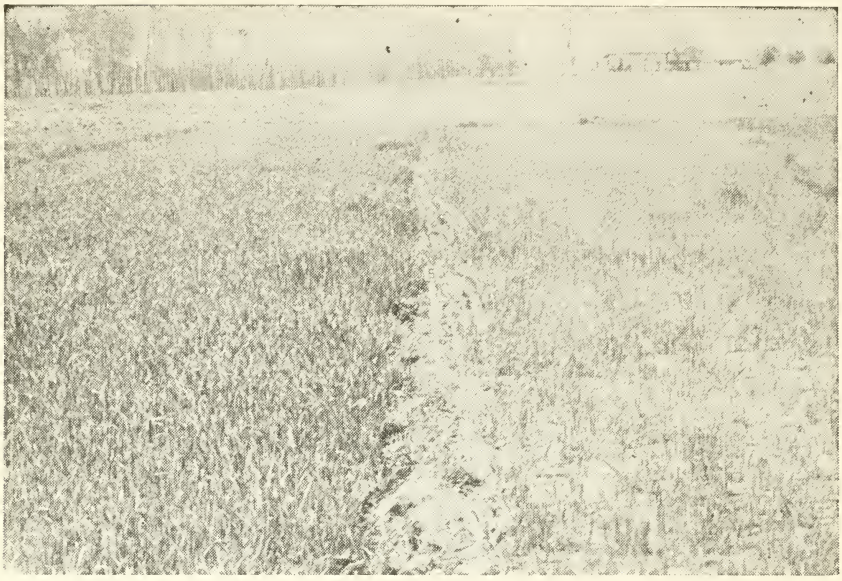

Figure 4—Left: Oats about three weeks after 188 pounds of Nitrate of Soda per acre had been applied. Right: Oats unfertilized.

4.1 bushels more oats were made when nitrate of soda was applied in the spring than when applied in the fall. 4.3 bushels more of oats were made when ammonium sulfate was applied in the spring than in the fall, but 3.9 more bushels were made when cyanamid was applied in the fall than when applied in the spring. Higher yields in 1939 and 1940, however, were obtained from the spring application of all three sources.

SUMMARY AND CONCLUSIONS

Yazoo-Mississippi Delta

The results of 20 years of experimental work with oats at the Delta Branch Experiment Station, consisting of variety comparisons, rates and dates of seeding, sources of nitrogen, rates and dates of applying nitrogen, may be summarized as follows:

1. The highest yielding oat varieties in the tests were the Red Rustproof strains including Ferguson 922, Nortex, Delta Station selection, Hastings' 100 Bushel, Appler, and Baylis. Among the earlier varieties, Coker's Fulgrain, Fulghum, and Kanota have given best yields.

2. October 15 was the best date to sow oats for maximum yields.

3. From 2 to 3 bushels per acre was the best rate to seed oats for maximum yields.

4. 30 pounds of nitrogen per acre from most all the commercial sources of nitrogen more than doubled the yields of oats planted in the fall on Sarpy loam soil of low fertility over an average of 13 years.

5. For an average of 13 years, nitrate of soda produced slightly higher yields than the other sources of nitrogen used.

6. In the Rates of Application experiment, the most economical yield of oats was produced from 30 pounds of nitrogen.

7. March 15 was indicated as the best time to apply nitrogen, from nitrate of soda to produce maximum yields on fall seeded oats.

8. These results indicate that spring applications of nitrate of soda and ammonium sulfate produced slightly higher yields than of fall applications; however, the data are not conclusive as to the best date to apply cyanamid.

OAT INVESTIGATIONS IN HILL SECTIONS OF MISSISSIPPI

Variety Comparisons

Results from recent tests in the hill sections of the state shown in tables 9 and 10 indicate that the Rustproof strains, as has been the case for many years, are the most dependable producers. These strains include Terruf, New Nortex, Appler, Ferguson 922, and Hastings. They are, when properly maintained, practically identical.

The Fulgrains, Victorgrain and Fulghum are earlier than the so-called Rustproof strains and usually produce a little less. They are, however, excellent varieties and should be considered where earliness is required.

Damage from rust was much less in the spring of 1939 and again in 1940 than was the case in the several preceding seasons.

Ordinarily oats planted in the fall will considerably outyield the same variety planted in the spring if winter killing is not great. Stands of oats planted in the fall of 1939 were thinned considerably by the severe winter. The spring of 1940 was abnormally cool and there was very little damage by rust. As a consequence, the yields from spring planted oats compared quite favorably with those from the fall planting.

TABLE 9—OAT VARIETIES, STATE COLLEGE, 1939 AND 1940

Variety	Yield in Bushels per Acre 1939	1940 Fall	1940 Spring	Average
Ferguson 922	91.7	51.4	50.7	64 6
Terruf	96.7	44.2	49.5	63.5
Hastings	86.0	50.7	51.4	62.7
Appler	88.6	49.2	49.9	62.6
Fulgrain 1	80 9	54.5	51.4	62.3
New Nortex	83.9	51.8	50.7	62.1
Fulgrain 2	87.2	49.3	49.5	62.0
Fulgrain x W. Turf 18-3	85.3	52.9	43.9	60.7
Fulghum	66.4	48.1	46 1	53.5
Kanota	66.8	48.8	43.4	53.0
Fulgrain 3	.....	51.0	51.0	.....
Fulgrain 4	.....	56.9	50.2	.....
Victorgrain	.....	42 8	52.3	.....
Columbia	.....	.....	43.9	.....
Planted	11-25-38	11-30-39	3-6-40	

TABLE 10—OAT VARIETIES, BRANCH STATIONS, 1939 AND 1940

Variety	Yields in Bushels Per Acre Holly Springs 1939	1940	Average	Raymond 1939	1940	Average	Natchez 1939	1940	Average
Terruf	17.7	55.0	36.3	39.5	69.7	54.6	53.6	57.5	55.5
New Nortex	17.1	56 4	36.7	34.7	72.2	53.5	53.6	57.8	55.7
Appler	17.2	51.9	34.5	37.8	75.0	56.4	54.4	50.3	53.5
Hastings	16.5	58.4	37.5	37.5	69.9	53 7	52.0	53.3	52.7
Ferguson 922	17.5	54.5	36.0	38.2	69.1	53.7	53.8	51.6	52.7
Ful. x W. T. 18-3	12.8	57.8	35.1	25.6	36.0	30.8	12.3	51.8	32.0
Fulgrain 1	16.2	56.7	36.5	14.8	37.9	26.4	*13.2	44.0	28.6
Fulgrain 2	12.6	52.9	32.7	13.7	35.2	24 4	*15.8	42.9	29.4
Fulghum	13.0	56.0	34.5	16.6	32.3	24.5	*9.5	42.3	25.9
Kanota	9.8	38 0	23.9	16.0	25.0	20.5	*9.8	30.9	20.3
Fulgrain 3	.....	57.3	.....	.....	34.5	.....	.....	45.5	.....
Fulgrain 4	.....	52.5	.....	.....	36.7	.....	.....	44.1	.....
Victorgrain	.....	56.2	.....	.....	53.7	.....	.....	52.6	.....

*Moderate to severe bird damage. This damage affects average.

Rates and Sources of Nitrogen

In the spring of 1940, tests were made with oats in the hill sections of the State including rates and sources of nitrogen applied as a top-dressing. Eight locations, six in the Brown Loam Area and two in the Prairie Belt, were used. These tests included the application of 16 and 32 pounds of nitrogen from nitrate of soda, cyanamid, and ammonium sulfate and consisted of six replications of each treatment at each location. All plots were fertilized on or near the date of March 15.

The approximate cost of these three nitrogenous fertilizers is as follows: nitrate of soda, $36.00 per ton; ammonium sulfate, $36.00 per ton; and cyanamid from $33.50 to $36.00 per ton.

16 pounds of nitrogen is obtained from the following amounts of the indicated materials: nitrate of soda, 100 pounds; ammonium sulfate, 78 pounds; and cyanamid, 72.7 pounds. 32 pounds of nitrogen is obtained from 200 pounds of nitrate of soda, or 156 pounds of ammonium sulfate, or 145.4 pounds of cyanamid.

In seven out of the eight tests as shown in table 11 the application of 16 and 32 pounds of nitrogen from nitrate of soda produced the highest yields. The increase in yield due to 16 pounds of nitrogen from nitrate of soda was slightly lower than the increase in yield as a result of the application of 16 pounds of nitrogen from cyanamid in one test. In another test the application of 32 pounds of nitrogen from ammonium sulfate gave a larger increase than did 32 pounds of nitrogen from nitrate of soda.

The application of 16 pounds of nitrogen from ammonium sulfate gave the second highest increase in yields in all of the tests. The application of 32 pounds of nitrogen from ammonium sulfate produced the second highest increase in yield in six out of the eight tests. On Grenada silt loam on the farm of C. C. Lutz, Canton, Mississippi, 32 pounds of nitrogen from ammonium sulfate was slightly superior to 32 pounds of nitrogen from nitrate of soda. On Bell Clay loam soil the increase in yield as a result of the application of 32 pounds of nitrogen from cyanamid was slightly higher than that produced by 32 pounds of nitrogen from ammonium sulfate.

The increase in yield due to nitrogen from cyanamid was somewhat higher on the terrace and bottom soils, where probably there was more moisture. This is shown by the results in table 5. On the valley test at the Holly Springs Branch Experiment Station the increase in yield due to 16 pounds of nitrogen from cyanamid was slightly higher than the increase from the application of 16 pounds of nitrogen from nitrate of soda.

A weighted average of all tests, table 11, shows that 16 pounds of nitrogen from nitrate of soda increased the yield 16.7 bushels of oats per acre, 16 pounds of nitrogen from cyanamid increased the yield 9.6 bushels per acre, and 16 pounds of nitrogen from ammonium sulfate increased the yield 12.1 bushels per acre. In other words, on the basis of a 16 pound application of nitrogen, 1 pound of nitrogen from nitrate of soda increased the yield 1.04 bushels of oats, 1 pound of nitrogen from cyanamid gave an increase of .60 of a bushel, and 1 pound of nitrogen from ammonium sulfate gave an increase of .75 of a bushel per acre.

The weighted average also shows that 32-pound applications of nitrogen from nitrate of soda, cyanamid, and ammonium sulfate increased the yield 24.6, 13.9, and 20.4 bushels of oats per acre, respectively. Then, on the basis of a 32-pound application of nitrogen per acre, 1 pound of nitrogen from nitrate of soda produced .77 of a bushel, 1 pound of nitrogen from cyanamid produced .43 of a bushel, and 1 pound of nitrogen from ammonium sulfate produced .64 of a bushel.

Using the figures obtained in the weighted average, taking the price of oats

FIGURE 5—AN OAT FIELD IN MADISON COUNTY, MISSISSIPPI

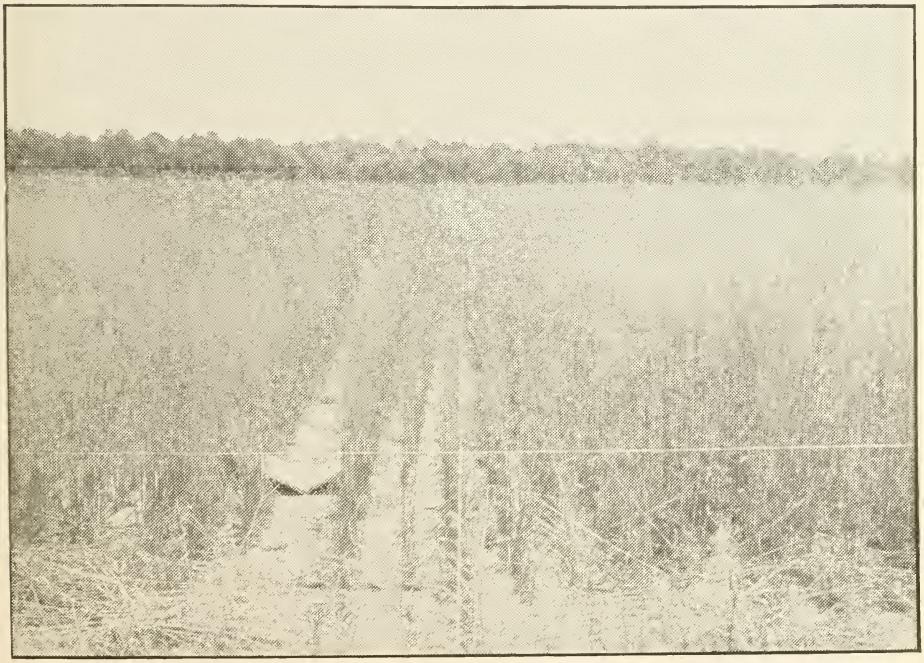

Figure 6—Two plots in the oat test on the H. H. Miller Farm, Madison, Mississippi. The plot on the left received no nitrogen and the plot on the right received 32 pounds of nitrogen from ammonium sulfate (156 pounds of ammonium sulfate) per acre.

TABLE 11—EFFECT OF TOP-DRESSING OATS WITH DIFFERENT RATES AND SOURCES OF NITROGEN

Treatment	Yield in Bushels Per Acre	Increase over no Nitrogen Bushels Per Acre
Howard Green, Canton, Mississippi Olivier Silt Loam		
No Nitrogen	37.3	
16 pounds of nitrogen from nitrate of soda	59.5	22.2
16 pounds of nitrogen from cyanamid	54.4	17 1
16 pounds of nitrogen from ammonium sulfate	56.0	19.7
32 pounds of nitrogen from nitrate of soda	64.4	27.1
32 pounds of nitrogen from cyanamid	58.8	21.5
32 pounds of nitrogen from ammonium sulfate	61.4	24.1
C. C. Lutz, Canton, Mississippi Grenada Silt Loam		
No Nitrogen	32.2	
16 pounds of nitrogen from nitrate of soda	51.2	19.0
16 pounds of nitrogen from cyanamid	41 0	8.8
16 pounds of nitrogen from ammonium sulfate	49.1	16.9
32 pounds of nitrogen from nitrate of soda	59.5	27.3
32 pounds of nitrogen from cyanamid	53.5	21.3
32 pounds of nitrogen from ammonium sulfate	60.4	28.2
Hugh Henderson, Canton, Mississippi Waverly Very Fine Sandy Loam		
No Nitrogen	49.4	
16 pounds of nitrogen from nitrate of soda	65.0	15.6
16 pounds of nitrogen from cyanamid	61.0	11.6
16 pounds of nitrogen from ammonium sulfate	63.6	14 2
32 pounds of nitrogen from nitrate of soda	71.7	22.3
32 pounds of nitrogen from cyanamid	65.6	16.2
32 pounds of nitrogen from ammonium sulfate	70.5	21.1
H. H. Miller Farm, Madison, Mississippi Grenada Silt Loam		
No Nitrogen	35.4	
16 pounds of nitrogen from nitrate of soda	62.3	26.9
16 pounds of nitrogen from cyanamid	42.6	7.2
16 pounds of nitrogen from ammonium sulfate	50 7	8.4
32 pounds of nitrogen from nitrate of soda	68.8	33.4
32 pounds of nitrogen from cyanamid	52.8	17.4
32 pounds of nitrogen from ammonium sulfate	67.8	32.4
Holly Springs Branch Experiment Station, Holly Springs, Mississippi Grenada Silt Loam, Hill Test		
No Nitrogen	30.6	
16 pounds of nitrogen from nitrate of soda	40.0	9.4
16 pounds of nitrogen from cyanamid	34.0	3.4
16 pounds of nitrogen from ammonium sulfate	38.2	7.6
32 pounds of nitrogen from nitrate of soda	49.3	18 7
32 pounds of nitrogen from cyanamid	35.8	5.2
32 pounds of nitrogen from ammonium sulfate	49.0	18.4

TABLE 11 (CONTINUED)—EFFECT OF TOP-DRESSING OATS WITH DIFFERENT RATES AND SOURCES OF NITROGEN

Treatment	Yield in Bushels Per Acre	Increse over no Nitrogen Bushels Per Acre
Holly Springs Branch Experiment Station, Holly Springs, Mississippi Valley Test		
No Nitrogen	31.4	.
16 pounds of nitrogen from nitrate of soda	50.8	19.4
16 pounds of nitrogen from cyanamid	51.7	20.3
16 pounds of nitrogen from ammonium sulfate	42.8	11.4
32 pounds of nitrogen from nitrate of soda	66.4	35.0
32 pounds of nitrogen from cyanamid	40 6	9.2
32 pounds of nitrogen from ammonium sulfate	49.2	17.8
Kahl Farm, Egypt, Mississippi Sumpter Clay Loam		
No Nitrogen	23.6	.
16 pounds of nitrogen from nitrate of soda	32.9	9.3
16 pounds of nitrogen from cyanamid	27.3	3.7
16 pounds of nitrogen from ammonium sulfate	28.0	4.4
32 pounds of nitrogen from nitrate of soda	39.1	12.5
32 pounds of nitrogen from cyanamid	32.4	8.8
32 pounds of nitrogen from ammonium sulfate	34.9	11.3
Kahl Farm, Egypt, Mississippi Bell Clay Loam		
No Nitrogen	38.2	.
16 pounds of nitrogen from nitrate of soda	50.0	11.8
16 pounds of nitrogen from cyanamid	43.0	4.8
16 pounds of nitrogen from ammonium sulfate	46.5	8.3
32 pounds of nitrogen from nitrate of soda	57.7	19.5
32 pounds of nitrogen from cyanamid	50.0	11.8
32 pounds of nitrogen from ammonium sulfate	48.2	10.0
Weighted Average of All Tests		
No Nitrogen	34 8	.
16 pounds of nitrogen from nitrate of soda	51.5	16.7
16 pounds of nitrogen from cyanamid	44.4	9.6
16 pounds of nitrogen from ammonium sulfate	46.9	12.1
32 pounds of nitrogen from nitrate of soda	59.4	24.6
32 pounds of nitrogen from cyanamid	48.7	13.9
32 pounds of nitrogen from ammonium sulfate	55.2	20.4

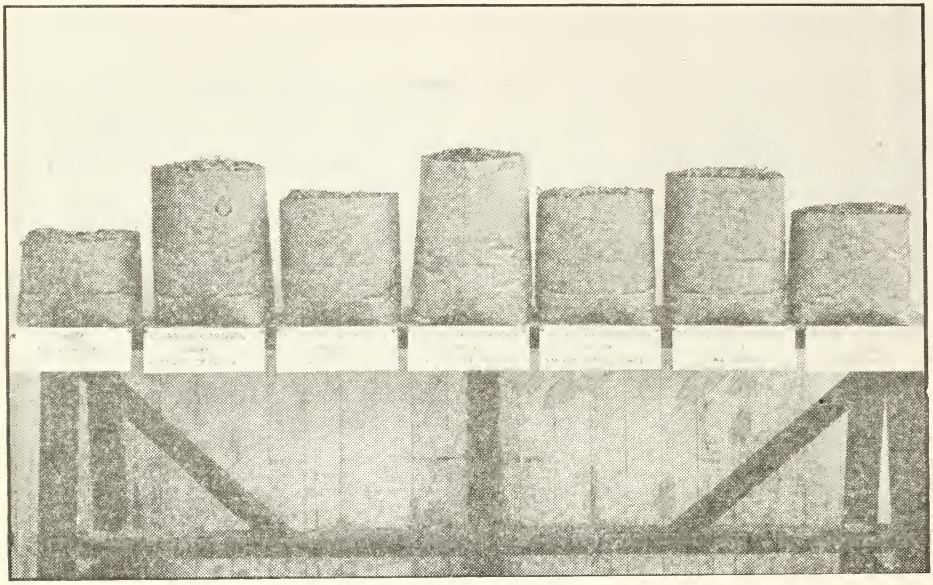

FIGURE 7—A comparison of the yields from a test on the farm of C. C. Lutz, Canton, Mississippi. Left to right: No nitrogen, 32.2 bushels; 200 pounds of nitrate of soda, 59.5 bushels; 100 pounds of nitrate of soda, 51.2 bushels; 156 pounds of ammonium sulfate, 60.4 bushels; 78 pouunds of ammonium sulfate, 49.1 bushels; 145.4 pounds of cyanamid, 53.5; and 72.7 pounds of cyanamid, 41.0 bushels per acre.

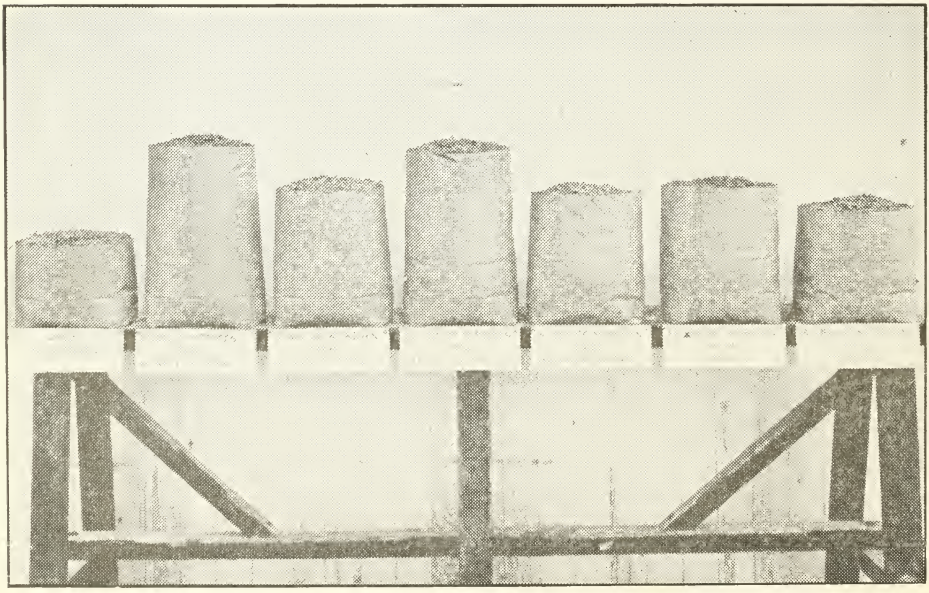

Figure 8—A comparison of the yields from a test on the H. H. Miller Farm, Madison, Mississippi. Left to right: no nitrogen, 35.4 bushels; 200 pounds of nitrate of soda, 68.8 bushels; 100 pounds of nitrate of soda, 62.3; 156 pounds of ammonium sulfate, 50; 145.4 pounds of cyanamid, 52.8; and 72.7 pounds of cyanamid, 42.6 bushels per acre.

to be 30c per bushel and the cost of 16 pounds of nitrogen from nitrate of soda, cyanamid, and ammonium sulfate to be $1.80, $1.22, and $1.40, respectively, the profit per acre from the different sources of nitrogen was calculated. These calculations showed a profit of $3.21 per acre when 16 pounds of nitrogen from nitrate of soda was applied per acre, $1 66 when 16 pounds of nitrogen from cyanamid was used, and $2.23 when 16 pounds of nitrogen from ammonium sulfate was applied. By calculating in the same manner, a profit of $3.78 per acre was obtained when 32 pounds of nitrogen from nitrate of soda was applied, a profit of $1.73 per acre when 32 pounds of nitrogen from cyanamid was applied and a profit of $3.32 per acre was secured when 32 pounds of nitrogen from ammonium sulfate was applied.

Using the figures in the weighted average, taking the price of oats to be 30c per bushel and the cost of 16 pounds of nitrogen from nitrate of soda, cyanamid, and ammonium sulfate to be $1.80, $1.22 and $1.40, respectively, the net return per dollar invested in nitrogenous materials was calculated. These calculations show a net return of $1.78 per dollar invested when 16 pounds of nitrogen from nitrate of soda was applied per acre, a net return of $1.36 per dollar invested when 16 pounds of nitrogen from cyanamid was used, and a net return of $1.45 per dollar invested when 16 pounds of nitrogen from ammonium sulfate was used. Calculating in the same manner, a net return of $1.05 per dollar invested was obtained when 32 pounds of nitrogen from nitrate of soda was applied, $0.71 per dollar invested when 32 pounds of nitrogen from cyanamid was applied, and $1.19 per dollar invested when 32 pounds of nitrogen from ammonium sulfate was applied.

Effect of Nitrogen, Phosphorus and Potassium on the Yield of Oats

In 1935 fertilizer tests were begun with spring-sown oats using different analyses of fertilizer. The rate of fertilization was 400 pounds and the different analyses were 4-8-4, 0-8-4, 4-8-0, 4-0-4, and one plot in each series was left unfertilized. In 1937 the tests with spring-sown oats was discontinued and tests with fall-sown were started on the same plots. These tests were fertilized as follows: 400 pounds 4-8-4, 400 pounds 0-8-4 followed by a top-dressing the next spring with 16 pounds of nitrogen, 400 pounds 4-8-0, 400 pounds 4-0-4, and no fertilizer. The results of these tests are shown in table 12 and table 13.

Although all of these tests were located in Lowndes County, the soil series represented are prevalent throughout the Coastal Plains region. On the hills, the tests were located on Ruston and Savannah series; and on the terrace or benchland the tests were located on Cahaba and Kalmia series.

The data on fall oats, table 12, show the plot treated with 400 pounds of 0-8-4 in the fall when the oats were seeded and then top-dressed in March with 16 pounds of nitrogen (100 pounds of nitrate of soda) per acre, consistently produced higher yields than the plot treated with 400 pounds of 4-8-4 at the time oats were seeded. Slight increases were obtained in every case from the application of 32 pounds of P_2O_5 (160 pounds of 20% superphosphate) per acre. Very small increases were obtained from applying potash.

The data on spring-sown oats, table 13, show very little response to applications of phosphorus or potash when nitrogen was not applied. There are only small differences in yields on the plots receiving 400 pounds of 4-8-4, 400 pounds of 4-8-0, and 400 pounds of 4-0-4. This indicates that nitrogen is largely responsible for increased yields on spring-sown oats.

The weighted average of the fall-seeded tests shows that the plot treated with 400 pounds of 0-8-4 in the fall and followed by a top-dressing in the spring with 16 pounds of nitrogen gave a yield of 27.3 bushels per acre, as com-

TABLE 12—THE EFFECT OF NITROGEN, PHOSPHORUS, AND POTASSIUM ON THE YIELD OF FALL-SOWN OATS

Treatment	T. F. Richards Columbus, Mississippi Savannah fine sandy loam	D. E. Egger Caledonia, Mississippi Kalmia fine sandy loam	S. E. Bryant Columbus, Mississippi Ruston fine sandy loam	H. G. Betts Caledonia, Mississippi Cahaba fine sandy loam	Bob Egger Caledonia, Mississippi Savannah fine sandy loam	Weighted Average of all tests	Increase over No Fertilizer For all tests
	3-Year Average Yield in bushels per acre						
400 pounds 4-8-4	26.1	18.7	32.7	18.1	20.3	23.2	11.2
400 pounds 0-8-4*	31.3	23.2	34.3	20.1	27.8	27.3	15.3
400 pounds 4-8-0	27.7	20.9	31.2	16.1	20.2	23.2	11.2
400 pounds 4-0-4	19.3	11.6	25.0	13.4	15.5	17.0	5.0
No fertilizer	11.0	9.0	22.3	8.3	9.3	12.0	

*Top-dressed March 15 with 16 pounds of nitrogen (100 pounds of nitrate of soda) per acre.

TABLE 13—THE EFFECT OF NITROGEN, PHOSPHORUS, AND POTASSIUM ON THE YIELD OF SPRING-SOWN OATS

Treatment	D. E. Egger Caledonia, Mississippi Kalmia fine sandy loam	S. E. Bryant Columbus, Mississippi Ruston fine sandy loam	H. G. Betts Caledonia, Mississippi Cahaba fine sandy loam	Bob Egger Caledonia, Mississippi Savannah fine sandy loam	Weighted Average of all tests	Increase over No Fertilizer for all tests
	2-Year Average Yield in bushels per acre					
400 pounds 4-8-4	20.6	19.6	23.1	23.3	21.7	11.2
400 pounds 0-8-4	10.9	9.3	11.1	14.6	11.5	1.0
400 pounds 4-8-0	20.6	18.9	18.3	25.2	20.8	10.3
400 pounds 4-0-4	19.7	16.1	19.6	17.6	18.3	7.8
No Fertillizer	11.5	8.8	9.0	12.5	10.5	

pared with a yield of 12.0 bushels per acre on the no fertilizer plots. This is an increase in yield of 15.3 bushels of oats per acre as a result of the fertilizer treatment. The application of 32 pounds of P_2O_5 (160 pounds of 20% superphosphate) increased the yield 6.2 bushels per acre. On plots receiving the identical fertilizer treatment of 400 pounds of 4-8-4 per acre, top-dressing with 16 pounds of nitrogen in the spring instead of applying at planting time resulted in an increase in the yield of 4.1 bushels of oats per acre.

The weighted average of the spring-seeded oat tests shows a definite response to nitrogen applications but very little response to applications of phosphorus and potash. The application of 400 pounds of 4-8-4 produced a yield of 21.7 bushels per acre as compared with a yield of 10.5 bushels on the no fertilizer plot, while the application of 400 pounds of 0-8-4 produced a yield of ony 11.5 bushels per acre.

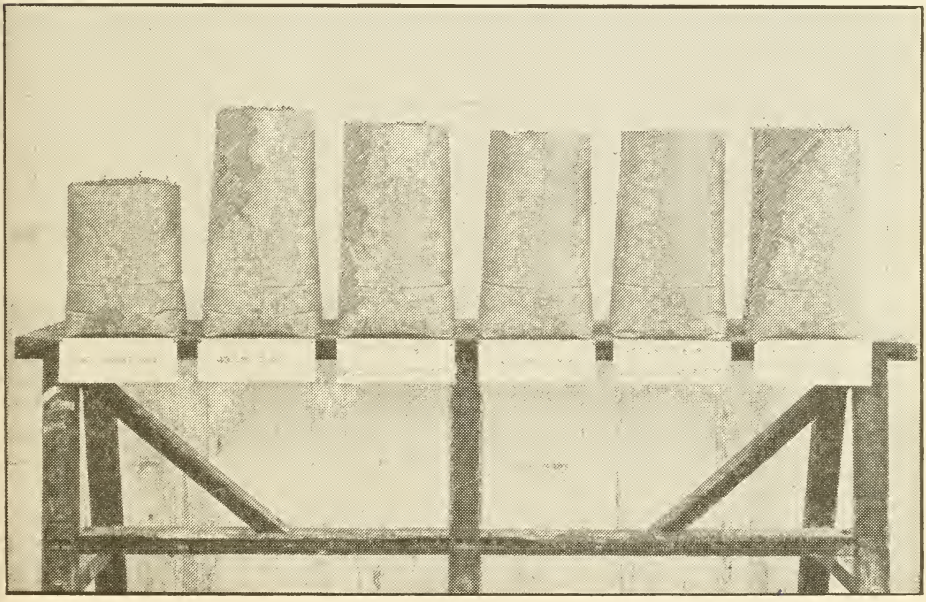

Figure 9—The effect of a crop of lespedeza cut for hay on the yield of oats top-dressed with 24 pounds of nitrogen. From left to right: lespedeza not fertilized and oats not top-dresses, 50 bushels; lepedeza 400 pounds of 0-8-0, 76 bushels; lespedeza, 400 pounds of 0-8-0 using basic slag as the source of phosphorus, 71 bushels; lespedeza, 400 pounds of 0-8-8, 69 bushels; lepedeza, 400 pounds 0-8-8 using basic slag as source of phosphorus, 70 bushels; lespedeza not fertilized, 71 bushels of oats per acre.

Rotation of Lespedeza, Crotalaria and Soybeans with Oats

During the summer of 1939, a test was started at the Raymond Branch Experiment Station, Raymond, Mississippi, to study the effect of lespedeza, crotalaria and soybeans on the yield of the oat crop which followed. Varying analyses of fertilizer were placed under the different legumes, and all plots except a check series were top-dressed March 15 with 24 pounds of nitrogen per acre from nitrate of soda.

A strain of Texas red rustproof oats was seeded in the Fall. The soybeans and crotalaria were turned under prior to the oat seeding, whereas the lespedeza was cut for hay and the land was not broken on the lespedeza plots before seeding to oats. The plots were 1/40 acre in size and there were four series for each treatment.

The results herein reported are for only one year but it is the present plan to continue this test until 5 years' results have been obtained.

That nitrogen applied during the Spring is the chief factor in increasing oat yields in the Brown loam region of Mississippi is shown by table 14 and figures 9 and 10, in which 32 pounds of P_2O_5 from superphosphate alone or in combination with 32 pounds of K_2O (potash) failed to produce more oats than no fertilizer under the lespedeza followed by 24 pounds of nitrogen applied as a top-dressing during March.

There were no check plots for the crotalaria and soybeans where nitrogen was not added during March, but from the yields on plots having oats continuously with and without nitrogen it is reasonable to assume that part of the 9 and 12 bushels per acre increases over the lespedeza plots for crotalaria and soybeans, respectively, are due to the additional nitrogen obtained by turning them under; the lespedeza was cut for hay.

It is interesting to note that the lespedeza did not depress the yield of oats and yet produced a good crop of hay.

Although the yield of oats on the lespedeza plots was about 9 bushels per acre less than on the crotalaria and soybean plots, a good crop of hay is worth considerably more than 9 bushels of oats. Therefore, from the standpoint of land use and based on

TABLE 14—THE EFFECT OF SUMMER LEGUMES AND THEIR FERTILIZER TREATMENT ON THE YIELD OF OATS TOP-DRESSED WITH 24 POUNDS OF NITROGEN.

Treatment	Yield of Oats bushels per acre
Oats continuously—not top-dressed	45.0
Oats following corn—oats top-dressed	68.0
Lespedeza unfertilized and cut for hay—oats not top-dressed	50.0
Lespedeza fertilized with 400 pounds 0-8-8 and cut for hay—oats top-dressed	69.0
Lespedeza fertilized with 400 pounds 0-8-0 and cut for hay—oats top-dressed	76.0
Lespedeza unfertilized and cut for hay—oats top-dressed	71.0
Crotalaria unfertilized and turned under—oats top-dressed	80.0
Crotalaria fertilized with 400 pounds 0-8-8 and turned under—oats top-dressed	81.0
Crotalaria fertilized with 400 pounds 0-8-0 and turned under—oats top-dressed	88.0
Tokio soybeans unfertilized and turned under—oats top-dressed	83.0
Tokio soybeans fertilized with 400 pounds 0-8-8 and turned under—oats top-dressed	83.0
Tokio soybeans fertilized with 400 pounds 0-8-0 and turned under—oats top-dressed	77.0

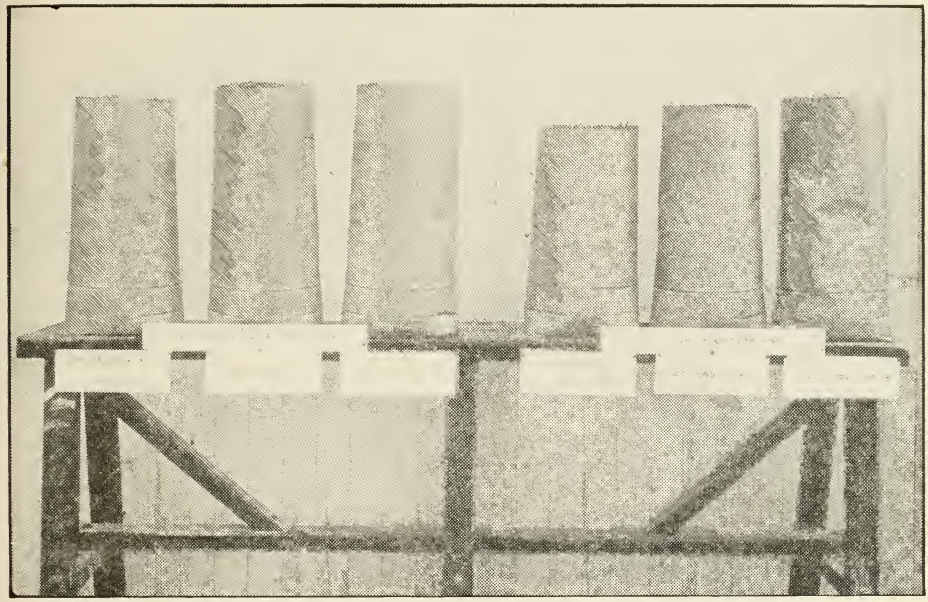

FIGURE 10—Fertilizer applied under crotalaria and soy beans, which were turned under, followed by oats top-dressed with 24 pounds of nitrogen from nitrate of soda.

these results, the lespedeza-oat rotation is superior to the crotalaria and soybean-oat rotations.

The increase in the yield of oats per pound of nitrogen applied is slightly less than 1 bushel following lespedeza and is a little more than 1 bushel following crotalaria and soybeans.

SUMMARY AND CONCLUSIONS

Hill Sections of Mississippi

The results of from 1 to 5 years of experimental work with oats conducted by the Mississippi Experiment Station in the hill sections of the state, consisting of variety comparisons, fertilizers for fall-sown and spring-sown oats, rates and sources of nitrogen, and a rotation study including legumes and oats, may be summarized as follows:

1. Results indicate that the Rustproof strains are the most dependable producers. These strains include Terruf, New Nortex, Appler, Ferguson 922, and Hastings. The Fulgrains, Victorgrain and Fulghum are among the best of the earlier-producing varieties.

2. Fall-sown oats give higher yields than spring-sown.

3. Applications of nitrogen are necessary if high yields are to be obtained, and March 15 appears to be the best date to apply this needed nitrogen.

4. On eight tests conducted in areas where most of the oats in the hill sections are grown nitrate of soda produced higher yields than ammonium sulfate or cyanamid.

5. The tests mentioned above also indicate that 16 pounds of nitrogen is the most economical rate. The application of 16 pounds of nitrogen from nitrate of soda (100 pounds of nitrate of soda) increased the yield 50 per cent.

6. One year's results obtained from a rotation study of summer legumes with oats at the Raymond Branch Experiment Station show that 24 pounds of nitrogen from nitrate of soda applied in March produced an increase in yield of oats of 20 bushels per acre following lespedeza which was cut for hay and 30 bushels per acre following crotalaria and Tokio turned under.

An oat crop removes a considerable amount of plant food from the soil as shown by yields from the unfertilized and fertilized check plots in the fertilizer experiments. Successful oat production is therefore dependent upon high yields, secured either by commercial fertilization or the use of legumes turned under.

It is a practice in several parts of the delta to sow oats on land on which soybeans have been combined for grain production or turned under after the seed have matured, thereby obtaining a volunteer crop of soybeans in the oats before they are combined the next spring. Under another practice alsike or sweet clover is planted, the oats are combined in the spring, the clover cut for hay during the summer, and the stubble allowed to grow the following winter when it is turned under for soil improvement. There is also a possibility of maintaining soil fertility in the Yazoo-Mississippi delta by seeding bur clover with the oats and permitting the clover to mature seed for a succeeding winter crop to be turned under for soil improvement.

In the hill section of the state data in this bulletin show that lespedeza cut for hay or soybeans or crotalaria turned under are defective in maintaining soil fertility and increased oat yield.

If there is sufficient moisture in the soil, a crop of soybeans, cowpeas, sagrain, sudan grass or corn may be produced following an oat crop. Experiments are under way at State College and at Stoneville to determine what crops may be produced most profitably after oats, and yields that may be expected of such crops under average seasonal conditions.

Oat Smut. Controlling oat smut is an important problem. A simple method is to sprinkle a mixture of one pint of formaldehyde and ten gallons of water to 40 to 80 bushels of grain, turning them thoroughly with a shovel as they are being sprinkled. After sprinkling, the oats should be covered with clean sacks and planted as soon as possible.

Army Worm. Probably the most important insect attacking small grains is the army worm, Cirphis unipuncta (Haworth). The winter is passed mainly in the partly grown larvae stage. These larvae shelter in the soil about clumps of grasses or small grains, or under litter on the ground. They begin feeding early in the spring and develop moths which deposit their eggs for the first generation around the latter part of April or the first part of May. Within a few days the eggs hatch, producing young worms green in color which have a looping habit of crawling until about half grown. They may often be found by the thousands in fields of grass or small grains, and because of their habit of feeding at night, their presence is generally not suspected until the crop is nearly destroyed. When the feed supply becomes exhausted in the fields where they have developed, the caterpillars move out in hordes or armies and attach near-by fields. When these worms become full grown they are nearly two inches long, of a dark green color, with a narrow broken stripe down the coster of the back and three light stripes on the sides, the lower one being of a yellowish shade. In the delta this generation pupates about the middle of May and the moths emerge within about two weeks.

The approved method of controlling the army worm is to poison them by scattering broadcast a poison-bran mixture in the fields of oats where they are feeding, or across the line of march of worms when they are leaving the fields where food has become scarce. A very good bait for this purpose is as follows:

25 pounds of dry wheat bran
3 gallons of water
2 quarts of cheap molasses
1 pound of sodium arsenite or Paris green, or white arsenic.

A satisfactory kill may be expected when the bait is used in oats at the rate of 12 pounds to the acre.