9-1-1939

Small grain production in the Yazoo-Misssissippi Delta

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Bulletin No. 334 September, 1939

SMALL GRAIN PRODUCTION

In the Yazoo-Mississippi Delta

FIGURE 1—EXPERIMENTAL PLATS IN THE FERTILIZER EXPERIMENTS

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Summary and Conclusions

The results of 19 years of experimental work with small grains at the Delta Branch Experiment Station, consisting of variety comparisons, rates and dates of seeding oats, sources of nitrogen, rates and dates of applying nitrogen to oats and comparison of corn and oat production, may be summarized as follows:

1. The highest yielding oat varieties in the tests were the Red Rust Proof 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 9 to 12 pecks per acre was the best rate to seed oats for maximum yields.

4. Thirty 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 12 years.

5. For an average of 12 years, Sodium Nitrate 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 Sodium Nitrate, to produce maximum yields on fall seeded oats.

8. Sodium Nitrate and Ammonium Sulphate produced slightly better yields when applied in March, but Cyanamid produced better yields when applied in November.

9. Higher yields in pounds of grain per acre were secured from corn than from oats when the two crops were not fertilized; but when both were fertilized, the oats yielded nearly as many pounds of grain per acre.

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SMALL GRAIN PRODUCTION

In the Yazoo-Mississippi Delta

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The production of oats is of increasing importance in Mississippi, and though oats may not yet be considered as a major agricultural crop in the state the trend seems definitely in that direction.

The total acreage seeded to oats during the ten-year period 1928-1937, according to Crops and Markets, published monthly by the United States Department of Agriculture, was 43,000 acres. According to the same authority, the acreage seeded to oats in Mississippi in 1938 was 59,000 acres and in 1939, 66,000 acres. Average annual production for the ten-year period 1928-1937, was 918,000 bushels. In 1938 the total yield was 1,593,000 bushels, while the yield indicated July 1, 1939 was 2,046,000 bushels. These figures indicate an increase of more than 50 per cent in acreage and an increase of more than 100 per cent in yield in 1939 as compared with the stated ten-year period.

Other small grains have been produced to a minimum extent only, though some increase has been noted in recent years.

Oats have been produced on Mississippi farms since pioneer days, but in the main as a source of feed for workstock on the farm where produced. The agricultural census of 1935 shows that during the crop year 1934, the total of 12,620 acres of oats was threshed for grain and 31,666 acres was cut and fed unthreshed. More recently, however, and especially in the delta area, oats have developed into a cash crop for sale as grain or as seed.

The average per acre yield of oats in Mississippi has been too low for profitable production, being only 21.4 bushels per acre during the period 1928-1937. The fact that average yields have been increased during recent years—to 27 bushels per acre in 1938 and to 31 bushels per acre in 1939—indicates that farmers in all sections of the state are applying improved farm practices in oat production.

Studies conducted by the Delta Branch Experiment Station in conjunction with similar studies conducted by the Mississippi Experiment Station at State College indicate that further progress may be made. These studies show that under normal climatic conditions, delta soils produce profitable oat yields. High yielding and adapted varieties, planted in the fall at the rate of 10 to 12 pecks of seed per acre and fertilized with 30 pounds of commercial nitrogen, produce an average of approximately 60 bushels of oats per acre.

The small grain work of the Delta Branch Station has been continued since it was begun in 1921, and has been greatly extended during recent years. The purpose of this work was to determine preferred farm procedure on major factors entering into oat production and production of other small grains. The investigations have, therefore, consisted of the following experiments:

1. Oat variety comparisons.
2. Small grain comparisons.
3. Dates of seeding oats.
4. Rates of seeding oats.
5. Fertilizers for oats.

It is the purpose of this bulletin to summarize the small grain work conducted by the Delta Branch Station since 1921 and to interpret the results of the experimental work with respect to the fundamental factors in oat production.

Oat Variety Comparisons Show Value of Red-Rust-Resistant Strains

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 Sharkey 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 this work.

It will be noted that Red Rust Proof varieties, such as Nortex, Delta Station Strain, Ferguson, Hastings 100 bushel, Appler, and Bayliss usually produced higher yields than other varieties; and that Fulgrain outyielded other non-red-rust-resistant varieties. The Red Rust Proof 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 yearly and average yields of those varieties for the greatest number of years during which direct comparisons were possible. This information is shown in table 2.

TABLE II—AVERAGE YIELDS OF VARIOUS VARIETIES OF OATS FOR THE PERIOD OF 1921-39*
Bushels per Acre

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	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									

*The Fulghum average yields were obtained from combinations of Coker's Fulghums in 1921, Fulghum 106 in 1922-23, Fulghum 4 in 1933 and commercial Fulghums from the Fidelity Seed Company in 1934-36, and Fulghum from T. W. Wood and Sons in 1937-39. The Ferguson 922 average yields were obtained by combining Ferguson 71 with it wherever necessary. The TexasRed Rust Proof average yields were obtained from combinations of yields obtained from seed secured from Goyer Wholesale Company 1922-23, Ferguson Seed Company 1925, 1931-32, and selection from this Station in 1926. 1924 is not included in any average.

FIGURE 2—Oats showing extreme lodging from the use of too much nitrogen.

The results of 19 years work in variety testing indicate that the Red Rust Proof strains of oats have produced highest yields. Two varieties have been continued throughout this period and during 16 of these years, 1921-25, 1929-39, one of these, Ferguson 922, has yielded annually 58.5 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 bushels; Delta Station Red Rust Proof, 81.6 bushels; Bayliss, 80.2 bushels. Closely following in annual yields were Hastings 100 Bushel, Appler and Terruf. These last named varieties are about ten days later maturing than Fulgrain, Fulgham 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 Rust Proof strains throughout the 21-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, non-red-rust-resistant varieties to be planted for this purpose, Fulgrain or Fulgham is recommended. Many planters seed 70 per cent of their oat acreage to Red Rust Proof strains, and 30 per cent to Fulgrain or Fulgham, in order to begin combining ten days earlier than would be possible were only the Red Rust Proof strains planted.

Small Grain Variety Comparisons: Rye, Wheat And Barley Produce Well

Minimum quantities of wheat, barley, and rye have been grown in the Yazoo-Mississippi delta for grain production, though the acreage of barley has considerably increased during the past two years. Because of this interest, and for the purpose of determining yields that might be expected in this area under conditions of good farming practices, the Delta Branch Station has recently expanded its experiments begun in 1928 to determine probable yields of these small grains. The comparisons were made most years on Sharkey loam soil, and the grains were seeded in the fall. Results of this work are shown in tables 3 and 4.

TABLE III—ANNUAL YIELDS FROM WHEAT, BARLEY AND RYE FROM 1928 TO 1939

Grain and Variety	Bushels per Acre										
	1928	1929	1931	1932	1933	1934	1935	1936	1937	1938	1939
Bearded Barley	18.0	11.6	40.4	20.7	16.8	28.7	20.5	28.2	36.9	31.0	.....
Fulcaster Wheat	25.7	4.9	28.3	11.0	24.5	16.2	6.9	10.9	35.5	18.5	20.6
Red May Wheat	26.7	3.4	33.6	10.0	24.8	11.3	4.3	9.8	31.4	22.2	24.2
Purple Straw Wheat	24.0	5.8	34.0	12.6	26.3	16.5	4.8	15.4	36.7	22.2	34.7
Abruzzi Rye	12.3	7.1	.....	10.5	25.8	20.6	33.9	11.8	27.0	44.5	42.8
Beardless Barley	16.4	7.8	.....	.....	9.4	16.8	21.2	21.0	24.0	29.7	.....
Denton Wheat	.....	.....	33.5	15.9	28.4	13.1	6.4	18.9	33.5	21.6	23.9
Fultz Wheat	.....	5.3	28.8	11.5	25.6	16.1	.....	14.2	.....	.....	.....
Gasta Wheat	.....	.....	.....	.....	26.3	16.5	7.1	20.3	41.6	23 0	31.5
Red Hart Wheat	.....	.....	.....	.....	22.0	13.7	2.4	25.5	38.7	23.3	33.8
Texas Winter Barley	.....	.....	.....	.....	.....	.....	.....	21.7	46.7	40.1	42.2
Rosen Rye	6.3	6.2	.....	.....	.....	.....	.....	.....	.....	.....	.....
Penn. 44 Wheat	25.3	2.7	.....	.....	.....	.....	.....	.....	.....	.....	.....
Tenn. Winter Barley	.....	.....	.....	.....	.....	.....	.....	.....	.....	32.5	34.2
Early Black Hull Wheat	.....	.....	.....	.....	.....	.....	.....	.....	.....	20.5	30 6
Tennmarq Wheat	.....	.....	.....	.....	.....	.....	.....	.....	.....	21.9	24.5
Finley Barley	.....	.....	.....	.....	.....	.....	.....	.....	.....	32.7	.....
Missouri Winter Barley											23.4
Wintex Barley											48.8
Harlan Hybred Barley											44.7

Fairly good yields of wheat, rye, and barley were harvested throughout the entire period of experimentation. More recently, all small grain yields have considerably increased, and this is thought due in part at least to superior and better adapted varieties.

Purple Straw wheat produced 21.2 bushels per acre over a period of 11 years. It was the highest average yield made during that period with wheat varieties. Gasta, a strain of Purple Straw wheat, produced an average of 23.7 bushels per acre during the past 7 years. It was the highest wheat yield made during that period. During the two most recent years, 1938 and 1939, the highest wheat yields, were made by Red Hart, 28.6 bushels, and Purple Straw, 28.5 bushels, closely followed by Gasta, 27.3 bushels.

Over the 10-year period Abruzzi rye produced an average of 23.6 bushels. During the 7-year period the yield of Abruzzi rye was 29.5 bushels. During the 2-year period 1938-39 the yield of Abruzzi rye was 43.7 bushels.

Varieties of barley not heretofore produced in Mississippi were included in the comparisons during the years 1938 and 1939 and of these, Texas Winter Barley averaged 41.2 bushels per acre

TABLE IV—AVERAGE YIELDS OF WHEAT, BARLEY AND RYE FROM 1928 TO 1939

Grain and Variety	11 Yrs. 1928-29 1931-39	10 Yrs. 1928-29 1932-39	7 Yrs. 1928-29 1933-37	9 Yrs. 1931- 1939	6 Yrs. 1929- 1931-34 1936	7 Yrs. 1933- 1939	2 Yrs. 1928- 1929	2 Yrs. 1938- 1939
	Bushels per Acre							
Fulcaster Wheat	18.4	17.5	17.8	19.1	16.0	19.0	15.3	19.6
Red May Wheat	18.3	16.8	16.0	19.1	15.5	18.3	15.0	23.2
Purple Straw Wheat	21 2	19.9	18.5	22.6	18.4	22.4	14.9	28.5
Abruzzi rye	. ...	23.6	19.8	.....	.....	29.5	9.7	43 7
Beardless Barley	.....	.....	16.6	.....	.....	.....	12.1	.....
Bearded Barley	.....	.....	23.8	.....	24.4	.....	14.8	.....
Denton Wheat	.....	.....	.....	23.8	.....	20.8	.....	22.8
Fultz Wheat	.....	.....	.....	.....	16.9	.....	.....	.....
Gasta Wheat	..	.....	.....	.....	.....	23.7	.....	27.3
Red Hart Wheat	.....	.....	.....	.....	.....	22.8	.....	28.6
Rosen Rye	.....	.....	.....	.....	.....	.....	6.3	.....
Penn. 44 Wheat	.....	.....	.....	.....	.....	.....	14.0	.....
Tenn. Winter Barley	.....	.....	.....	.....	.....	.....	.....	33.4
Texas Winter Barley	.....	.....	.....	.....	.....	.....	.....	41.2
Early Black Hull Wheat	.....	.....	.....	.....	.....	...	.....	25.6
Tennmarq Wheat	.....	.....	.....	.....	.....	.....	.....	23.2

during the 2-year period. During 1939 barley yields were as follows: Texas winter barley, 42..2 bushels; Tennessee barley, 34.2 bushels; Missouri barley, 23.4 bushels; Harland Hybred, 44.7 bushels; Wintex barley, 48.8 bushels

Summarizing results of the more recent period, two-year average (1938-39) yields for rye, barley. and wheat were as follows: Abruzzi rye 43.7 bushels, Texas winter barley 41.2 bushels, Red Hart wheat 28.6 bushels, Purple Straw wheat 28.5 bushels and Gasta wheat 27.3 bushels per acre.

Wheat, barley, and rye are more winter resistant than oats and will probably withstand more grazing. They usually make fewer bushels and not quite so many pounds of grain per acre, but results during the past two years indicate that under favorable circumstances splendid yields may be secured from all small grains in the Yazoo-Mississippi Delta. Since there is a growing interest in livestock for this area, it seems likely that these crops may be increasingly used for grazing and for grain feeding.

Dates of Seeding Oats: Mid-October Indicated As Best Date for Planting

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 15 day intervals until November 15 and from spring plantings begun on February 15 and continued until April 1. Two varieties of oats, Ferguson 922 and Norton, were used in this experiment. The results of these tests are shown in table 5.

TABLE V—YIELDS FROM VARIOUS DATES OF SEEDING OATS

Seeding Dates	1931	1932	1933	1934	1935	1936	1937	1938	1939	Av.
					Bushels per Acre					
					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
					Norton					
October 15		23.9	37.7	55.8						39.1
September 15		20.6	23.9	57.9						34.1
October 1		24.0	34.3	65.3						41.2
November 1		19.7	35.2	69.6						41.5
November 15		19.6	27.8	57.5						35.0
February 15		0.0	0.0	9.2						3.1
March 1		0.0	0.0	12.9						4.3
March 15		0.0	0.0	6.8						2.3
April 1		0.0	0.0	0.0						0.0

The results of these 9 years of work on dates of seeding indicate very definitely that the middle of October is the best time to plant Red Rust Proof oats to obtain highest yields. Oats planted October 15 produced an average of 63.3 bushels per acre, while slightly decreased yields were secured from oats planted either October 1 or November 1, and considerably decreased yields were secured from oats planted September 15 and November 15. Plantings made still later resulted in virtual crop failure. From plantings made February 15 the yield was only 16.2 bushels per acre and from plantings made March 15 the yield was only 9.6 bushels per acre.

FIGURE 3—Oat plats in the "Sources of Nitrogen" experiment. Left to right: Untreated, Sodium Nitrate, Ammonium Sulphate, and Cyanamid with 12-year average yields of 22.5, 60.9, 52.9, and 46.8 bushels per acre, respectively.

Rates of Seeding Oats: 9 to 12 Pecks Per Acre for Highest Yields

Experimental work on rates of seeding oats was begun at the Delta Branch Station in 1929 and has been continued to date. Under procedure followed, the 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, placed in separate packages, and broadcast by hand. Most of the experiments were conducted on Sharkey loam soil. Ferguson 922 and Norton varities were used. Results of these comparisons are shown in table 6.

TABLE VI—YIELDS FROM VARIOUS RATES OF SEEDING FERGUSON 922 AND NORTON OATS

No. Pecks per Acre	Bushels per Acre											
	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	Av.
	Ferguson 922											
10 pecks	72.3	57.5	95.3	48.5	52.6	73.9	39.3	60.8	61.3	72.5	79.3	64.8
6 pecks	64.4	61.3	90.8	49.3	49.5	76.9	36.3	59.0	61.3	73.1	78.3	63.2
8 pecks	49.3	58.5	92.7	51.1	48.9	74.0	32.6	60.6	62.1	73.6	79.5	62.1
9 pecks	72.5	57.7	89.8	49.0	52.4	82.0	40.9	60.2	57.4	71.6	78.3	64.7
11 pecks	68.6	53.4	91.4	48.8	48.4	89.4	42.0	58.6	58.3	71.0	78.5	64.4
12 pecks	73.3	56.5	94.8	52.3	48.0	72.5	43.5	55.8	61.6	69.7	76.8	64.1
14 pecks	68.7	58.2	106.9	49.1	52.1	63.6	37.4	58.2	53.8	73.6	77.9	63.6
	Norton											
10 pecks					20.8	30.7	54.1	10.9				29.1
6 pecks					18.1	24.6	62.4	11.0				29.0
8 pecks					19.8	29.3	53.7	9.0				28.0
9 pecks					20.8	29.8	64.9	11.7				31.8
11 pecks					24.8	32.0	54.5	11.3				30.7
12 pecks					22.5	30.3	52.7	11.7				29.3
14 pecks					21.9	33.4	53.8	12.1				30.3

Maximum yields were produced when oats were seeded at the rate of 10 pecks per acre. However, the results show only a slight difference in yield when the quantity of oats planted varied from 1½ to 3½ bushels per acre. With the Ferguson strain the 10 pecks seeding yielded 64.8 bushels, the 8 pecks seeding yielded 62.1 bushels, and the 12 pecks seeding yielded 64.1 bushels. It is likely that these differences are not statistically significant, and from 9 to 12 pecks per acre appears to be the most desirable rates of seeding.

Comparisons to Determine Results from Sources of Nitrogen

Since yields of oats on land of low fertility are so often disappointing, the Delta Branch Station began work with commercial fertilizers with oats in 1923 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.

In order to determine which of the sources of commercial nitrogen would produce highest oat yields, a comparison of results from various sources of nitrogen was begun in 1928. This ex-

TABLE 1—ANNUAL YIELDS OF VARIOUS VA

Variety	Seed Source (a)	1921	1922	1923	192
Fulghum 708	1	31.3	49.8	20.4	....
Fulghum	2	30.1	.....	.....	83
Dwarf Culberson	1	21.7	28.1	22.7	44
Appler	2	41.0	46.9	.....	....
Ferguson 71	3	63.2	56.1	29.3	....
Hastings' 100 Bushel	4	69.5	52.5	33.7	43.
Fulghum	5	25.8	.....	.....	....
Aurora 831	1	19.7	.....	.....	....
R. E. No. 1	2	13.2	.....	.....	....
Fulghum 106	6	.....	47.2	15.7	65.
Appler	6	.....	51.1	36.8	54.
R. R. P.—Commercial	7	.....	33.0	27.5	....
Fulghum Delta	8	.....	47.7	.....	....
Burt	5	.....	.....	17.5	43.
Navarro	1	.....	.....	23.8	62.
Kanota	9	.....	.....	.....	44.
Norton-Station	8	.....	.....	.....	....
R. R. P.—Delta	8	.....	.....	.....	66.
Ferguson R. R. P.	3	.....	.....	.....	52
Ferguson 922	3	.....	.....	.....	53.
Baylis	10	.....	.....	.....	....
Norton	2	.....	.....	.....	....
Fulghum 3	2	.....	.....	.....	....
Fulghum 18-1B-4-8	2	.....	.....	.....	....
7 Al-20-5-3	2	.....	.....	.....	....
Fulghum 36		.....	.....	.....	....
Winter Turf	5	.....	.....	.....	....
Norton 3	2	.....	.....	.....	....
Black Oats		.....	.....	.....	....
Fulghum 4		.....	.....	.....	....
Norton Forage	2	.....	.....	.....	....
Fulghum—Commercial	11	.....	.....	.....	....
Nortex	12	.....	.....	.....	....
Ala. R. R. P.	13	.....	.....	.....	....
Coker 33-50	2	.....	.....	.....	....
Coker 32-1	2	.....	.....	.....	....
Coker Fulgrain	2	.....	.....	.....	....
Coker 33-47	2	.....	.....	.....	....
Delta Station R. R. P.	8	.....	.....	.....	....
Fulghum 6A	11	.....	.....	.....	....
Texas R. R. P.	14	.....	.....	.....	....
Red Oats	15	.....	.....	.....	....
Ga. P821 (R. R. P. Str.)	16	.....	.....	.....	....
Terruf	16	.....	.....	.....	....
Fulghum x Victoria	17	.....	.....	.....	.....

*All varieties accidentally mixed before they were threshed in 1924. The 1927 overflow ruined tl test that year. All varieties but Norton winter killed in Winter of 1927-28 and were replanted in sprir but results were lost.

(a) (1) U. S. D. A., (2) Coker's Pedigreed Seed Company, (3) Ferguson Seed Farms, (4) H. (

OF OATS FOR THE PERIOD OF 1921-39*

			Bushels per Acre								
926	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3.9	.....	.....	.....	.....	50.5	78.3	45.7	44.7	70.1	86.2	66.2
.....	.....	.....	.....	.....	.....	.....	.....	.....	57.2	56.7	42.3
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
70.2	36.6	48.2	77.9	10.5	.....	.....	.....	.....	.....	.....	.....
6.3	25.3	.....	.....	.....	.....	72.6	48.3	47.2	65.1	84.7	67.7
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	84.9	67.8
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3.4	24.5	37.7	52.3	8.6	29.7	44.2	14.7	30.4	56.3	44.9	38.0
.....	.....	.....	79.2	7.4	27.0	64.5	14.5	43.7	.....	.....	.....
6.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	95.1	37.4	.....	.....	.....	.....	.....	.....	.....
8.4	40.9	43.4	76.8	39.1	39.0	83.9	39.6	47.3	79.3	91.1	69.4
.....	42.5	38.4	75.5	38.0	.....	69.0	40.0	43.4	71.7	88.3	72.0
.....	41.5	39.9	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	20.1	.....	71.1	12.0	.....	.....	.....	.....	.....	.....	.....
.....	24.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	32.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	54.2	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	38.3	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	77.1	.....	33.5	67.2	.....	.....	.....	.....	.....
.....	.....	.....	.....	19.3	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	28.3	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	19.8	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	65.4	17.3	39.4	.....	.....	.....
.....	.....	.....	.....	.....	.....	81.2	50.6	65.3	69.7	92.8	76.3
.....	.....	.....	.....	.....	.....	.....	.....	49.3	74.1	.....	.....
.....	.....	.....	.....	.....	.....	.....	20.2	43.3	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	10.4	29.1	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	59.0	68.7	55.4	57.2
.....	.....	.....	.....	.....	.....	.....	.....	46.6	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	52.0	73.9	93.4	69.8
.....	.....	.....	.....	.....	.....	.....	.....	37.7	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	42.8	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	71.1	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	69.3	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	80.8	73.5
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	60.2

stings' Seed Company, (5) T. W. Wood & Sons, (6) Humphrey Coker, (7) Goyer Company, (8) Delta periment Station, (9) Kansas Experiment Station, (10) King B Seed Farms, (11) Fidelity Seed mpany, (12) Texas Experiment Station, (13) Alabama Experiment Station, (14) Buchanan Seed mpany, (15) L. P. Cook, (16) Georgia Experiment Station, (17) Texas Substation No. 6. Others unknown

periment was conducted in connection with a three-year rotation using cotton, oats, and corn. All plantings were fertilized in the same manner and oats were planted on the same plats every third year. Thirty 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 Sarpy 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 7.

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

Treatment	Bushels per Acre												
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	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	22.5
Sodium Nitrate	70.5	61.7	68.4	102.0	10.4	58.2	53.6	53.3	51.7	65.6	65.6	69.9	60.9
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	58.7
Ammonium Sulphate	69.2	56.5	49.9	66.4	6.1	39.8	40.6	50.7	55.4	62.0	65.3	72.8	52.9
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	46.8
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	36.5
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	47.1

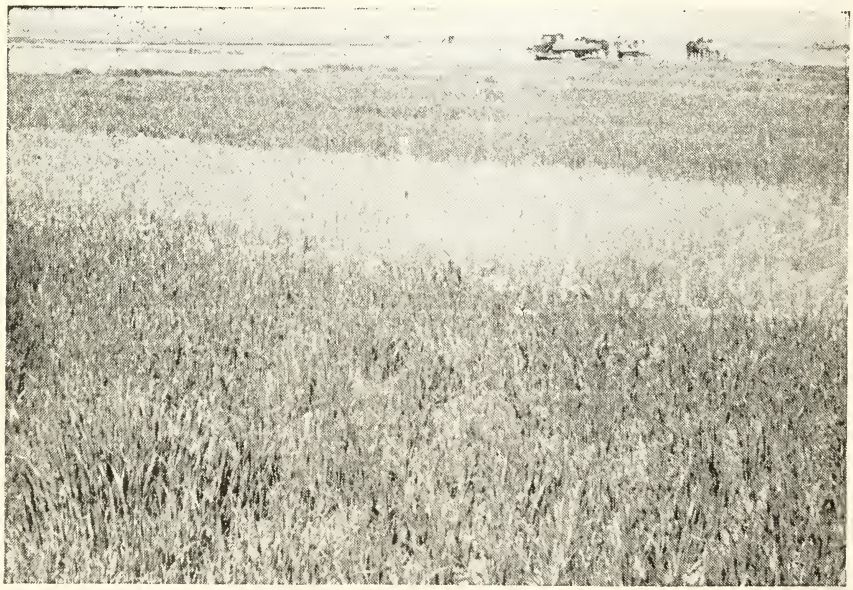

FIGURE 4—Oat fertilizer plats three weeks after the sources of nitrogen had been applied.

During the 12 year period in which old sources of nitrogen have been tested, all sources except cottonseed meal more than doubled the yield of the untreated or check plat. Thirty pounds per acre of nitrogen from sodium nitrate produced slightly higher yields than a like amount of nitrogen secured from other sources or materials, though the difference was slight when sodium nitrate was compared with ammonium nitrate. The increase in yields due to 30 pounds of nitrogen according to sources was as follows: nitrate of soda, 38.4 bushels; ammonium nitrate, 36.2 bushels; ammonium sulphate, 30.4 bushels; cyanamid, 24.3 bushels; cottonseed meal, 14.0 bushels; ½ cottonseed meal and ½ sodium nitrate, 24.6 bushels.

Thirty pounds of 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.

New Sources of Nitrogen

In 1928 another experiment was begun in sources of nitrogen for oats in which some of the newer sources then on the market were compared with the older ones. This experiment was conducted on a diffrent field every year and on Sharkey loam soil, and treatments were replicated 5 to 8 times. The oats were seeded and fertilized as in the other sources of nitrogen experiment, and Norton oats were used throughout this test. The term, "new sources" is used to distinguish this experiment from the other. Results are shown in table 8.

TABLE VIII—YIELDS OF OATS FROM NEW SOURCES OF NITROGEN APPLIED AT 30 POUNDS OF NITROGEN PER ACRE ON DIFFERENT LAND EVERY YEAR

	Bushels per Acre					Av.
Treatment	1928	1929	1930	1931	1932	1928-32
Unfertilized	58.8	15.6	29.7	41.7	5.5	30.3
Sodium Nitrate	61.0	36.5	50.1	86.5	8.9	48.6
Calcium Nitrate	61.4	26.3	46.1	85.8	9.5	45.8
Ammonium Sulphate	71.2	30.9	37.5	85.1	7.5	46.4
Cyanamid	60.5	20.5	38.4	73.3	7.9	40.1
Leunasalpeter	65.7	32.6	44.8	99.0	6.7	49.8
Calurea	60.4	31.5	47.4	80.8	6.8	45.4

During the 5-year period, 1928-1932, the results indicate that Leunaspeter, sodium nitrate, and ammonium sulphate, produced higher yields in the order named than other sources included in the comparison. Nitrogen from these sources did not double the yields when compared with the unfertilized plats, as it did in the case of the older sources tests. This difference is due in part at least to different methods employed in conducting the test. The untreated check plats in the new sources test were on a new field each year, whereas the untreated check plats in the old sources test continued on the same unfertilized plat from year to year. Hence in the new sources test the unfertilized plats received the benefit of any residual effect that may have accumulated from fertilizer carried over from the previous year. The two experiments with sources of nitrogen coincide in showing that nitrogen, applied at the rate of 30 pounds per acre, serves approximately to double yields and is a most profitable practice in oat production.

Comparisons to Determine Results from Rates of Applying Nitrogen

Figure 5—Left: Oats about three weeks after 188 pounds of Sodium Nitrate per acre had been applied. Right: Oats unfertilized.

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 sodium nitrate was the source of nitrogen used. This experiment was in the same rotation as the sources of nitrogen experiment and was conducted under similar conditions. 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 9.

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

Nitrogen Rates per Acre	Bushels per Acre												
	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	Av.
No Nitrogen	33.5	25.3	22.6	37.2	1.0	16.3	9.2	26.2	14.9	24.6	22.3	26.1	21.6
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	31.8
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	43.7
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	50.0
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	57.7
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	61.2
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	64.0

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 very profitable increases were made from applications up to 40 pounds per acre. 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 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 diminishing returns began with the fifth increment when nitrogen application was at the rate of 37½ pounds 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.

Time and method of fertilizer placement are important considerations wherever crops are fertilized. This is especially true in the instance 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 oats may most profitably be fertilized was begun in 1928 and continued through 1936. The experiment was in the same rotation as the sources and rates of applying nitrogen tests, and was conducted under similar conditions and with the same variety of oats. Nitrogen was used at the rate of 30 pounds per acre and applied in separate plats at planting on three dates. Results of this work, measured in bushels of oats per acre, are shown in table 10.

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

Date of Application	Bushels per Acre								
	1928	1929	1930	1931	1932	1933	1934	1936	Av.
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 November ½ April 1	53.7	62.6	62.8	90.4	5.6	40.3	48.3	56.8	52.6
½ November ½ April 15	66.8	61.9	59.1	89.3	3.7	29.7	35.6	49.3	49.4

FIGURE 6—Oats in "Rates of Applying Nitrogen" experiment. Left to right: Unfertilized, 94, 188, and 282 pounds of Sodium Nitrate per acre, with 12 year average yields of 21.6, 43.7, 57.7, and 64.0 bushels per acre, respectively.

FIGURE 5—Left: Oats unfertilized. Right: Oats fertilized with 300 pounds of Sodium Nitrate per acre. Photographed just before harvested.

Eight years' work indicates March 15 as the best date to apply nitrogen to fall sown oats. It was regarded as significant, however, that 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 a new experiment was inaugurated for the purpose of comparing spring and fall applications of nitrogen to oats. Three sources of nitrogen were used—sodium nitrate, ammonium sulphate, 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 11.

TABLE XI—YIELDS OF OATS FROM FALL AND SPRING APPLICATIONS OF SODIUM NITRATE, AMMONIUM SULPHATE AND CYANAMID, USING 30 POUNDS OF NITROGEN PER ACRE

Source and When Applied	Bushels per Acre			
	1937	1938	1939	Av.
Unfertilized	34.0	22.2	28.9	28.4
Sodium Nitrate—Fall	65.9	66.2	55.5	62.5
Ammonium Sulphate—Fall	64.5	61.4	54.2	60.0
Cyanamid—Fall	63.5	63.9	47.4	58.3
Sodium Nitrate—Spring	61.8	61.4	66.3	63.2
Ammonium Sulphate—Spring	62.9	57.2	65.2	61.8
Cyanamid—Spring	56.5	46.5	54.5	52.5

This experiment has been in progress only three years and the results are not yet conclusive. Results thus far are in accord with results of the 9-year experiment with dates of applying nitrogen, which indicated that sodium nitrate gave slightly better yields when applied March 15 over a period of 9 years. During the 3 years of this experiment. .7 bushels more oats were made when nitrate of soda was applied in the spring than when applied in the fall. 1.8 bushels more of oats were made when ammonium sulphate was applied in the spring than when applied in the fall, but 5.8 more bushels were made when cyanamid was applied in the fall than when applied in the spring. Higher yields in 1939, however, were obtained from the spring application of all three sources.

Oat Yields Compared with Corn Yields: Differences Scant When Fertilized

Corn is the principal grain crop produced in Mississippi, and this is true in the delta as in other areas of this state. Both crops produce satisfactory yields under proper methods of handling. Corn matures in the fall, while oats mature in the spring, and though there appears to be no conflict between these two crops, comparative yields may be of interest. Table 12 shows comparative yields of oats and corn.

TABLE XII—COMPARATIVE YIELDS OF FERTILIZED AND UNFERTILIZED OATS AND CORN

Treatment and Crop	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	Av.
					Bushels of Grain per Acre							
Unfertilized Oats	40.3	20.8	23.1	49.2	0.6	13.9	11.7	22.7	15.1	27.2	21.1	22.3
Unfertilized Corn	32.6	16.8	10.0	45.3	17.4	16.0	11.5	15.3	9.7	11.2	18.7	18.6
Fertilized Oats	70.5	61.7	68.4	102.0	10.4	58.2	53.6	53.3	51.7	65.6	65.6	60.1
Fertilized Corn	69.2	32.4	24.0	62.1	35.7	26.7	28.8	30.7	13.4	40.7	33.5	36.1
					Pounds of Grain per Acre							
Unfertilized Oats	1290	666	739	1574	19	445	374	726	483	870	675	715
Unfertilized Corn	1826	941	560	2537	974	896	644	857	543	627	1047	1041
Fertilized Oats	2256	1974	2189	3264	333	1862	1715	1706	1654	2099	2099	1923
Fertilized Corn	3875	1814	1344	3478	1999	1495	1613	1719	750	2279	1876	2022

During the 12-year period, 1928-1939, direct comparisons were made of oat yields and corn yields. These tests indicate that unfertilized oats averaged 22.3 bushels per acre and unfertilized corn, 18.6 bushels per acre. Fertilized oats produced 60.1 bushels per acre, while fertilized corn produced 36.1 bushels per acre. Because of the difference in bushel weights of these two grains, a further comparison is in order. Unfertilized oats produced 715 pounds of grain per acre and unfertilized corn produced 1041 pounds grain per acre. Fertilized oats produced 1923 pounds per acre and fertilized corn produced 2022 pounds per acre. These results indicate that oats produce more bushels of grain per acre than corn but fewer pounds of grain per acre.. Oats respond more readily to the use of nitrogen than corn and when supplied with nitrogen fertilizer, almost as many pounds of oats were produced per acre as of corn. There appears to be little choice between these two grains, and little need to choose between them. Both have a definite place in delta agriculture.

Appendix: Soil Improvement, Oat Smut, Army Worm, Pure Seed

An oat crop removes a considerable amount of plant food from the soil as shown by yields from the unfertilized and fertilized check plats 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 or sweet clover is sown with the oats; 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 thereafter 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.

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 the Delta Branch Station 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.

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 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 attack nearby 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.

Pure Seed

Oat production has an important place in delta farming. A greatly increased acreage of oats might be profitably utilized as feed for work stock on the farm where grown, for marketing as feed oats, and for sale as seed oats.

Possibly the greatest hindrance 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 harvesting period of 1939, inspections were made of numerous plantings of oats in the delta for the purpose of seed certification. In numerous instances, certification was necessarily withheld because of the considerable contamination with weeds. Fully to utilize the opportunity for profitable oat production in the Mississippi delta requires adoption of proven practices with respect to varieties, fertilization, and handling. 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.

FIGURE 8—Foreground: Alsike clover alone. Background: Oats and alsike clover.