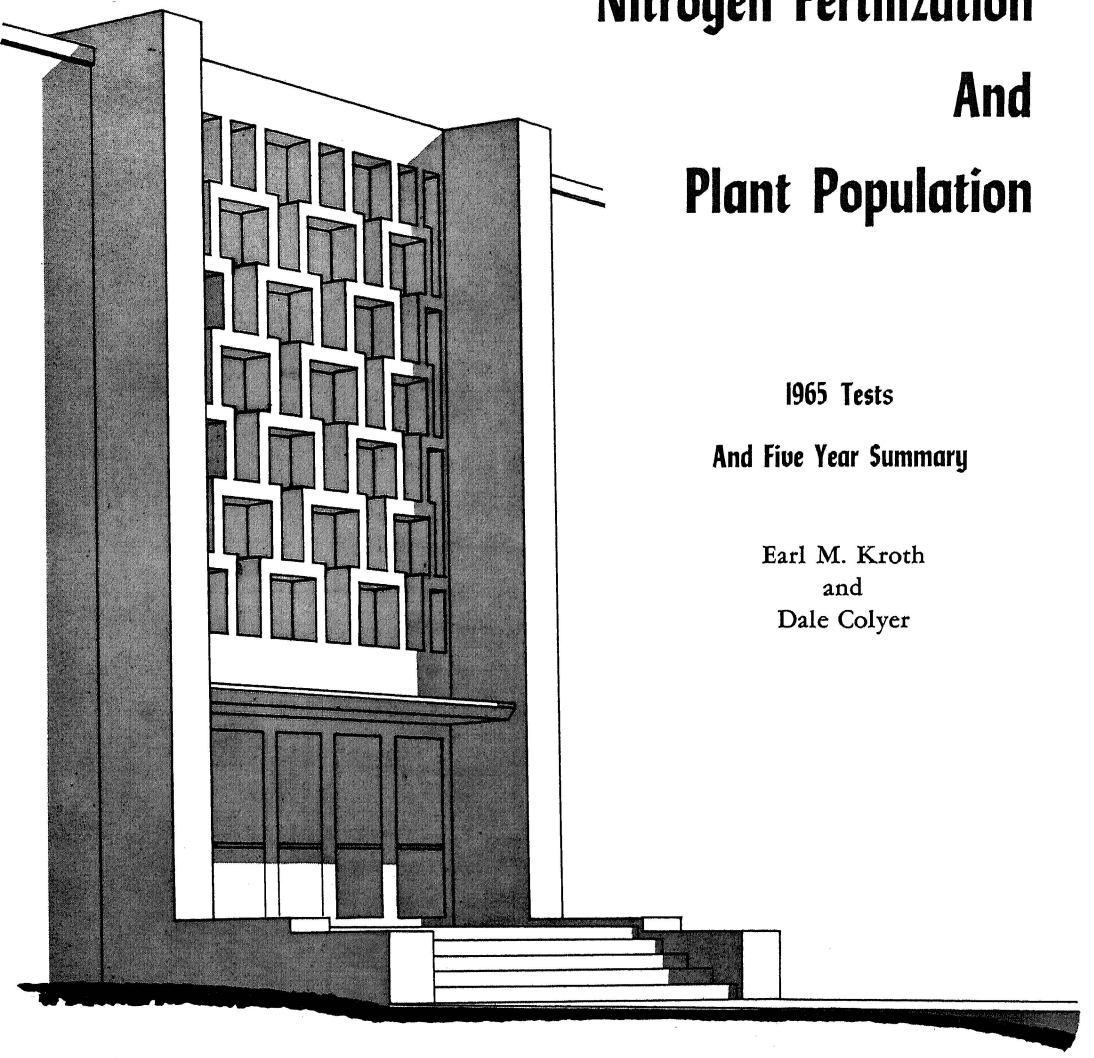
Response Of Corn To Nitrogen Fertilization And Plant Population



1965 Tests

And Five Year Summary

Earl M. Kroth
and
Dale Colyer

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CONTENTS

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This report is a joint contribution of the Departments of Soils and Agricultural Economics on research project 445, The Economics of Fertilizer Use in Missouri. E. M. Kroth is assistant professor of Soils and Dale Colyer is an associate professor of Agricultural Economics.

Professors C. M. Woodruff, G. E. Smith, W. E. Decker, and T. R. Fisher of the Soils Department contributed significantly to this project. Decker supplied the climatological data. The experimental work was directed by Earl L. Barnes, Theo M. Dean, Melton H. Brown, and James A. Roth.

RESPONSE OF CORN TO NITROGEN FERTILIZATION AND PLANT POPULATION, 1965

Earl M. Kroth and Dale Colyer

Experiments were conducted for the fifth year at four different sites in Missouri (see Figure 1) to determine corn yield response to nitrogen applications at different planting rates. Seven nitrogen treatment rates and four plant population rates were used to test yield response on different soil types at four widely separated locations in the state. The nitrogen applications were at levels between 0 and 200 pounds per acre while the plant population rates were 9,000 to 24,000 plants per acre with different population rates used for different soil types.

The 1965 growing season was very favorable with adequate precipitation during the growing season in most areas of Missouri. Consequently, moisture was less of a limiting factor for yield response than during recent years. The highest

Figure 1. Location of Experimental Sites

single plot yield was obtained at the Delta Research Center near Portageville. It was 160 bushels per acre from a plot with 200 pounds of nitrogen and about 24,000 plants per acre. The highest treatment average yield (3 replications) was also at Portageville and was 158 bushels per acre from the plots with 200 pounds of nitrogen and an intended population of 24,000 plants per acre. Relatively high yields also were obtained at the Spickard, Marshall, and Columbia experimental sites. Yields at low nitrogen treatments were relatively high at the latter three sites because of large nitrogen carryover from the preceding dry seasons.

Yield variations were highly significant statistically for nitrogen treatments at all four locations. Plant population variances were not statistically significant except at the Marshall site but nitrogen-plant population interaction was significant at all sites except the North Missouri Center, Spickard. The data from the five years this experiment has been conducted indicate that response to nitrogen fertilization and plant popluation rates vary considerably with moisture, soil type, and other factors. Thus care should be used in interpreting results from one year's data alone.

PROCEDURES

The experiment was conducted for the fifth year on the same plots at the North Missouri Agricultural Research Center, Spickard, the A. H. Orr Farm, Marshall, the Bradford Farm, Columbia, and for the third year at the Delta Research Center, Portageville. Experiments were conducted at other sites in southeast Missouri during the first two years of the project. Four levels of plant population were the whole-plot treatments while seven nitrogen treatment rates were applied to subplots within each plant population plot.*

Applications of potassium and phosphorus were made to the plots originally on the basis of soil tests. Annual applications also have been made with the intention of maintaining the levels of these nutrients so that they do not become limiting. Starter fertilizer is used to provide 25 pounds of nitrogen, phosphorus, and potash except that in 1965 the P_2O_5 and K_2O were increased to 50 pounds per acre at the Marshall, Portageville, and Bradford Farm sites. The remainder of the nitrogen is plowed down in the spring except at Portageville, where, because of the sandy nature of the soil and the use of irrigation, 50 pounds of the 150-pound treatment and 100 pounds of the 200-pounds treatment are applied by side-dressing at the time of cultivation. All plots are planted at high plant population rates and thinned after emergence to obtain the desired stands. The plots at Spickard, Marshall, and Columbia are harvested by hand while those at Portageville are machine harvested. Dropped ears are included in the yield calculations which are given in shelled corn equivalents on the basis of a 15.5 percent moisture level.

*The experiment was designed as a complete factorial imposed on a randomized block split-plot design.

STATISTICAL METHODS USED

Statistical measures are presented in this report to aid the reader in interpreting results of the experiments. Experiments such as these are subject to error because of uncontrollable factors in the soil, seed, fertilizer, etc., and because of measurement problems. The experiment was designed so the uncontrollable or "chance" errors in yield variance could be measured. When yield variations among the test plots exceed the variations that could be due to "chance," the rates of planting and fertilizer application are said to produce significant variances. One statistical measure, the LSD (least significant difference), is listed under the yield tables. Analysis of variance tables also are given in the Appendix for those who are interested.

The LSD gives the minimum difference which must exist between two treatment plot yields for the yields to be considered significantly different—or, in other words, for the difference to be attributed to the treatment rather than to chance or error. The *probability levels* given with the LSD measures indicate the percentage of the time a variation as large the one indicated would occur by chance alone.

As an example, the footnote of Table 2 lists an LSD for nitrogen treatments of 8.9 bushels per acre at the 0.05 (or 5 percent) probability level. This means that in two plots where different nitrogen treatments are being tested, if the yields differ *more than* 8.9 bushels, there is only a 5 percent probability that this difference is due to the uncontrollable errors or chance and a 95 percent probability that it is due to the difference in nitrogen treatment.

RESULTS

A table of yield means (averages) per treatment, a chart showing the yield trends as nitrogen applications were increased at the four plant population levels, and a brief description of the results at each experimental site are given in the following pages. Table 1 gives the weather conditions at the stations closest to the experimental sites.

North Missouri Research Center

The experimental plots at the North Missouri Research Center near Spickard in Grundy County are located on Seymour silt loam. MFA-K6 variety was planted on May 13, 1965, thinned to the desired stands on June 19, and harvested on October 2, 1965. The intended populations were 9,000; 13,000; 17,000; and 21,000 plants per acre. The nitrogen was plowed down on May 7, 1965, except for 25 pounds which were supplied with 25-25-25 starter fertilizer when the corn was planted. On the no-nitrogen plots 0-25-25 starter fertilizer was used. Moisture was more adequate in 1965 than in either 1963 or 1964 but a dry period in August limited corn yields.

TABLE 1 - CLIMATOLOGICAL DATA FROM WEATHER RECORDING STATIONS NEAREST THE EXPERIMENTAL SITES, 1965

Station	Rainfall[a]	Departure	Days With Rain					Dry Periods[b]	Avg. Temp.	Departure	No. of Days 90° or More		No. Days 100° or More
			May	June	July	Aug.	Sept.				1965	Avg.	
Spickard	18.10	-1.23	7	13	11	11	6	5/9-5/25 6/6-6/20 7/3-7/17	71.6°	-1.7°	17	44	0
Marshall[c]	24.59	5.21	5	11	10	5	4	5/10-5/25 7/28-8/17	74.2°	0.5°	34	39	0
Columbia	25.14	6.97	5	13	10	13	4	---	71.2°	-1.1°	15	39	0
Portageville	16.78	1.08	11	9	8	3	6	5/11-5/26 7/16-8/22	76.4°	-0.2°	43		1

[a] May 1 to September 15.

[b] Dry Period: At least 15 consecutive days with less than 0.25 inches of precipitation.

[c] Rainfall data is for the experimental site eight miles west of the weather station.

The nitrogen treatments produced statistically significant yield responses at the 1 percent probability level but the plant population yield responses and nitrogen, plant population interaction were not statistically significant. The differences in yields at different planting rates tended to be greater with low nitrogen than with high nitrogen treatments. The highest single plot yield was 147 bushels per acre at 150 pounds of nitrogen and 17,000 plants per acre. The highest average treatment yield, about 129 bushels per acre, was obtained for three different treatment combinations. The average treatment yields are summarized in Table 2 and Figure 2.

TABLE 2. AVERAGE CORN YIELDS FOR NITROGEN TREATMENTS AT FOUR PLANTING RATES
North Missouri Agricultural Research Center, Spickard, 1965
Bushels Per Acre

No. of Plants Per Acre	Pounds of Nitrogen Per Acre						
	0	25	50	75	100	150	200
9,968	77.0	88.9	101.4	102.4	118.5	121.9	116.6
13,886	70.6	85.1	110.2	108.8	123.9	129.3	129.1
17,560	60.5	70.2	90.3	112.3	114.4	119.4	128.1
21,390	51.5	70.7	79.9	102.4	104.4	129.0	122.2

LSD for Plant Population (0.05 probability level):
16.1 Bushels Per Acre

LSD for Nitrogen Treatments (0.05 probability level):
8.9 Bushels Per Acre

A. H. Orr Farm

The experimental plots on the A. H. Orr farm near Marshall in Saline County are on Marshall silt loam. MFA K6 hybrid seed corn was planted May 6, thinned June 8, and harvested October 23. The intended populations were 9,000; 13,000; 17,000; and 21,000 plants per acre and actual numbers were very close to intended stands. The nitrogen was plowed down on May 5 except for 25 pounds which were supplied with 25-50-50 starter fertilizer. The no-nitrogen plots received 0-50-50 starter fertilizer at planting time. Moisture was adequate through most of the 1965 growing season and consequently relatively high yields were obtained. A large nitrogen carryover from 1964 resulted in high yields at even the low nitrogen treatments.

Yield responses were statistically significant at the 1 percent probability level for nitrogen treatments and the 5 percent for the plant population. The highest treatment average yield was 155 bushels per acre and was from plots treated with

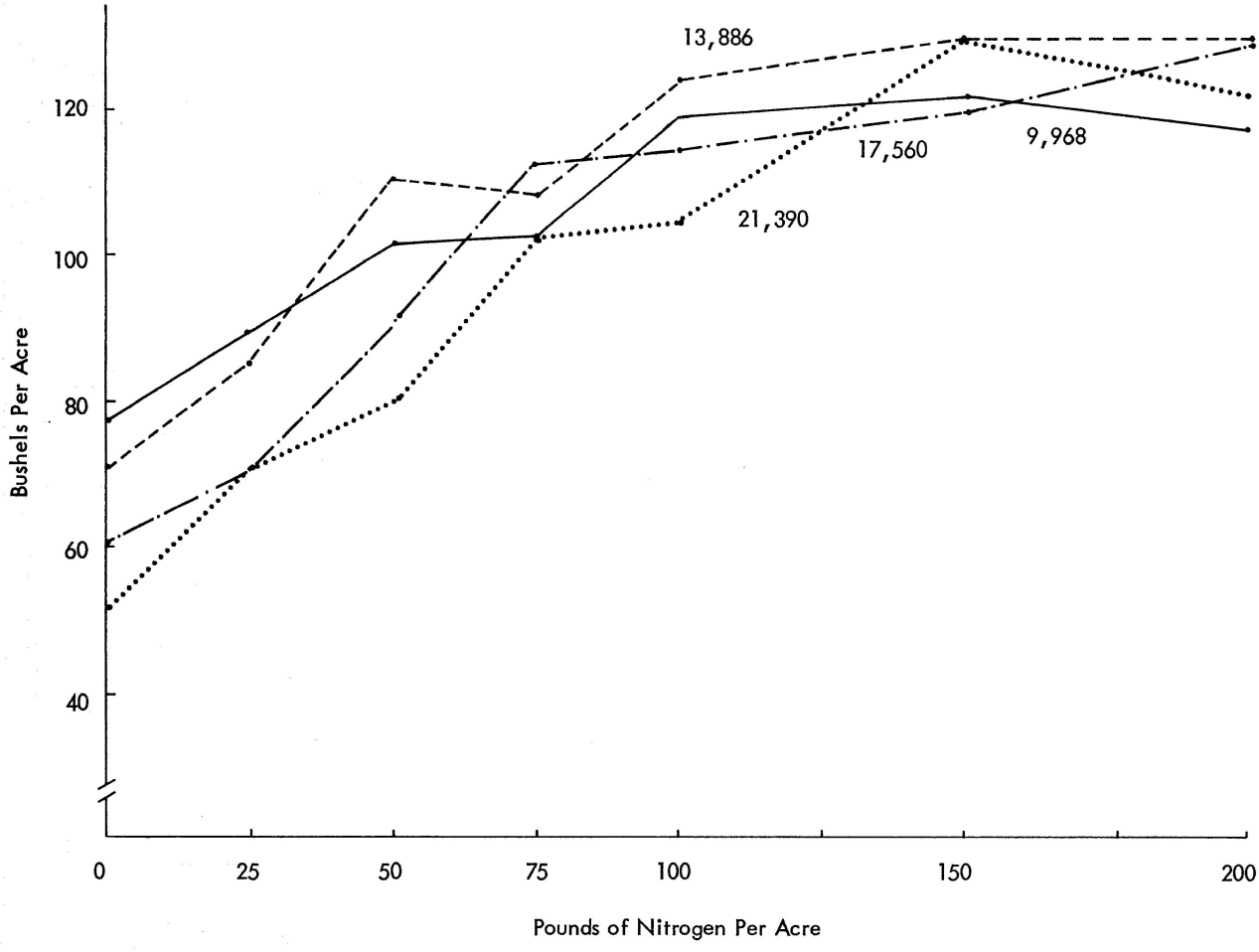

Figure 2. Response of Corn Yield to Nitrogen Applications at Four Planting Rates, Research Center, Spickard, 1965.

150 pounds of nitrogen at the intended 17,000 planting rate. The lowest average treatment yield was 89 bushels from the no-nitrogen plots planted at the intended rate of 17,000 plants per acre. Yields at 21,000 plants per acre were lower than those at 17,000 plants for all levels of nitrogen except the highest one. At very low nitrogen rates, yields with low plant population were greater than those with large plant population. The opposite was true for the higher nitrogen treatments so that total response was greater with high plant population than with low stands. The average treatment yields for the A. H. Orr farm plots are shown in Table 3 and Figure 3.

TABLE 3. AVERAGE CORN YIELDS FOR NITROGEN TREATMENTS AT FOUR PLANTING RATES

A. H. Orr Farm, Marshall, 1965

Bushels Per Acre

No. of Plants Per Acre	Pounds of Nitrogen Per Acre						
	0	25	50	75	100	150	200
9,198	102.6	110.6	115.4	117.7	116.6	119.7	118.0
13,237	106.5	131.3	138.5	144.5	148.3	143.5	143.6
17,246	88.8	115.1	136.0	148.4	154.6	155.2	149.5
20,705	81.7	111.2	132.0	144.7	149.0	145.4	150.3

LSD for Plant Population (0.05 probability level): 11.3 Bushels Per Acre

LSD for Nitrogen Treatments (0.05 probability level): 5.1 Bushels Per Acre

Bradford Experimental Farm

The plots on the Bradford Experimental Farm, near Columbia in Boone County, are located on Mexico silt loam. The plots were planted May 6, thinned June 10, and harvested October 25. Mo 880 hybrid seed corn was used. The intended populations were 9,000; 13,000; 17,000; and 21,000 plants per acre. The nitrogen was plowed down May 3 except for 25 pounds which were supplied with 25-50-50 starter fertilizer. On the no-nitrogen plots 0-50-50 started fertilizer was used. Rainfall during the growing season, May 1 to September 15, was 6.97 inches above normal.

The nitrogen treatments produced significant yield responses and the nitrogen plant population interaction also was significant, but yield response to the different planting rates was not statistically significant. The highest treatment average yield was about 151 bushels, which was obtained from 200 pounds of nitrogen and the 21,000 plants per acre. Yields were relatively high at the low ni-

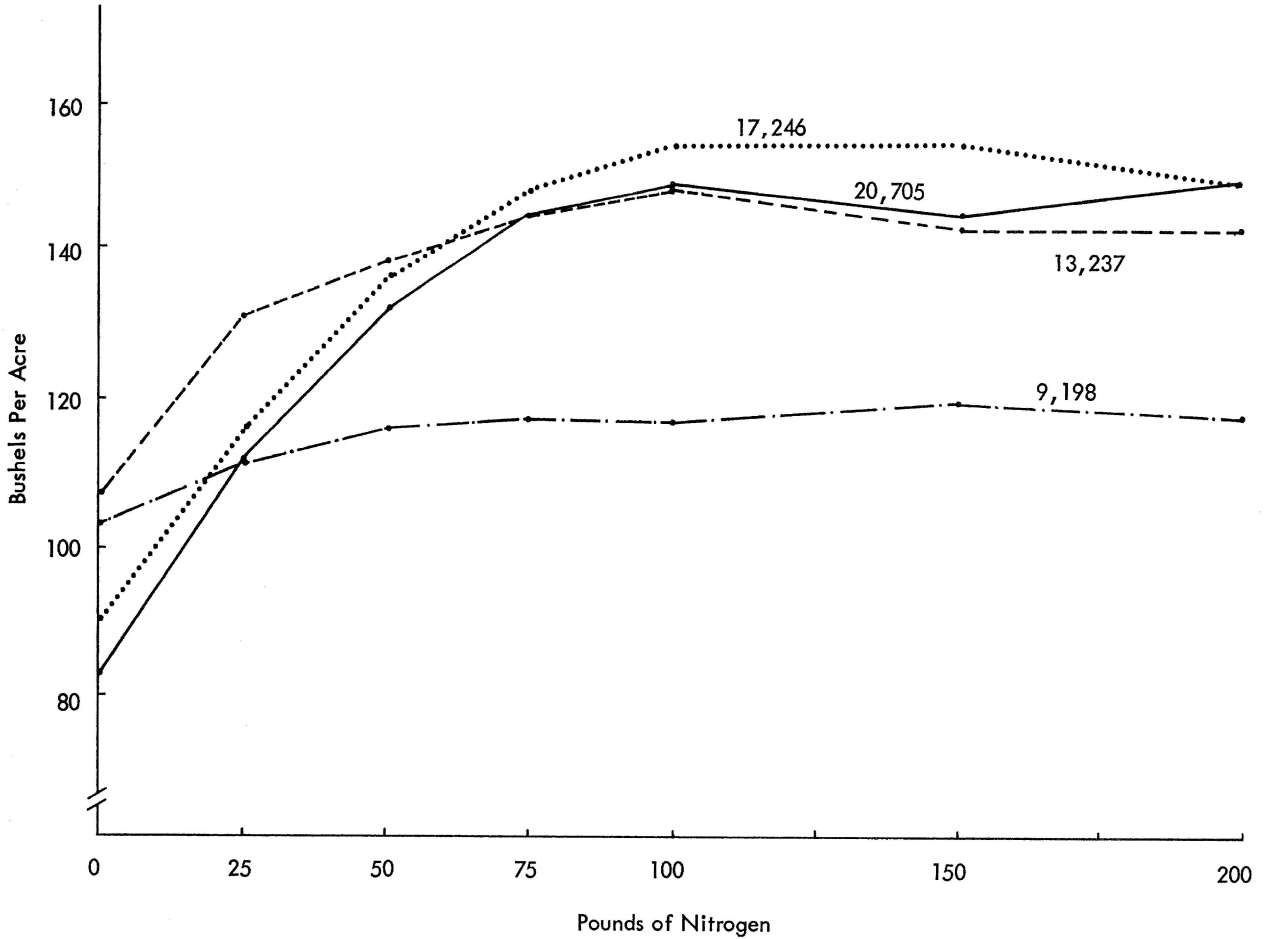

Figure 3. Response of Corn Yield to Nitrogen Applications at Four Planting Rates, A. H. Orr Farm, Marshall, 1965.

trogen treatments. This probably resulted from a large nitrogen carryover, since 1964 was dry and yields were relatively low that year. The treatment average yields for the Bradford Farm experiment are shown in Table 4 and Figure 4.

TABLE 4. AVERAGE CORN YIELDS FOR NITROGEN TREATMENTS AT FOUR PLANTING RATES

Bradford Experimental Farm, Columbia, 1965

Bushels Per Acre

No. of Plants Per Acre	Pounds of Nitrogen Per Acre						
	0	25	50	75	100	150	200
12,771	98.5	119.0	121.0	123.3	131.3	126.5	124.7
14,498	85.3	115.9	133.4	133.7	134.2	142.9	137.5
18,564	69.5	114.8	135.4	135.6	145.0	145.6	146.7
20,792	58.0	97.9	120.6	139.7	141.2	144.6	150.6

LSD for Plant Population (0.05 probability level): 10.5 Bushels Per Acre

LSD for Nitrogen Treatments (0.05 probability level): 10.1 Bushels Per Acre

Delta Research Center

The plots at the Delta Research Center near Portageville in New Madrid County are on Salix silt loam. They are the only plots in the experiment which are irrigated. Pioneer 3304 was planted April 19, thinned May 19, and harvested August 24. The intended plant populations were 12,000; 15,000; 19,000; and 24,000 plants per acre. A self-propelled combine with a corn head was used for the harvest. On the no-nitrogen plots 0-25-25 starter fertilizer was used while on the other plots 25-25-25 was used to provide 25 pounds of nitrogen. The remainder of the nitrogen was plowed down on April 14, except on the 150 and 200 pound treatment plots where 50 and 100 pounds of nitrogen were applied by side-dressing May 11.

Yields were very responsive to nitrogen treatments and were statistically significant at the 1 percent probability level. Yields, however, were similar at all planting rates although at the lowest planting rates and higher nitrogen applications they were significantly different. The highest average treatment yield was 156 bushels per acre, obtained with the largest nitrogen application and highest plant population used for the experiment. The average treatment yields are summarized in Table 5 and Figure 5. Apparently, the nitrogen and/or population rates used were not high enough to reach the maximum yield possible for the site under 1965 growing conditions.

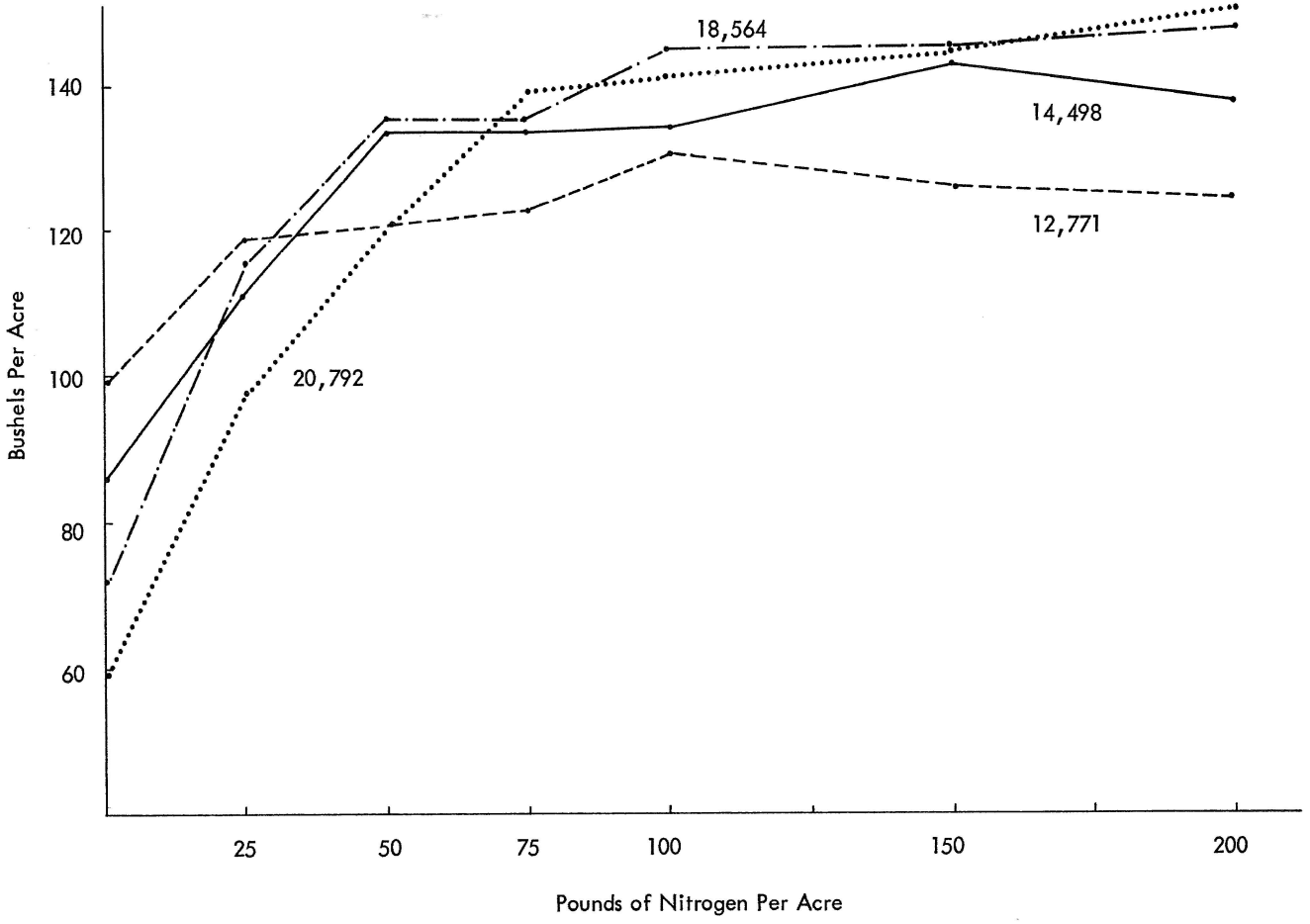

Figure 4. Response of Corn Yield to Nitrogen Applications at Four Planting Rates, Bradford Experimental Farm, Columbia, 1965.

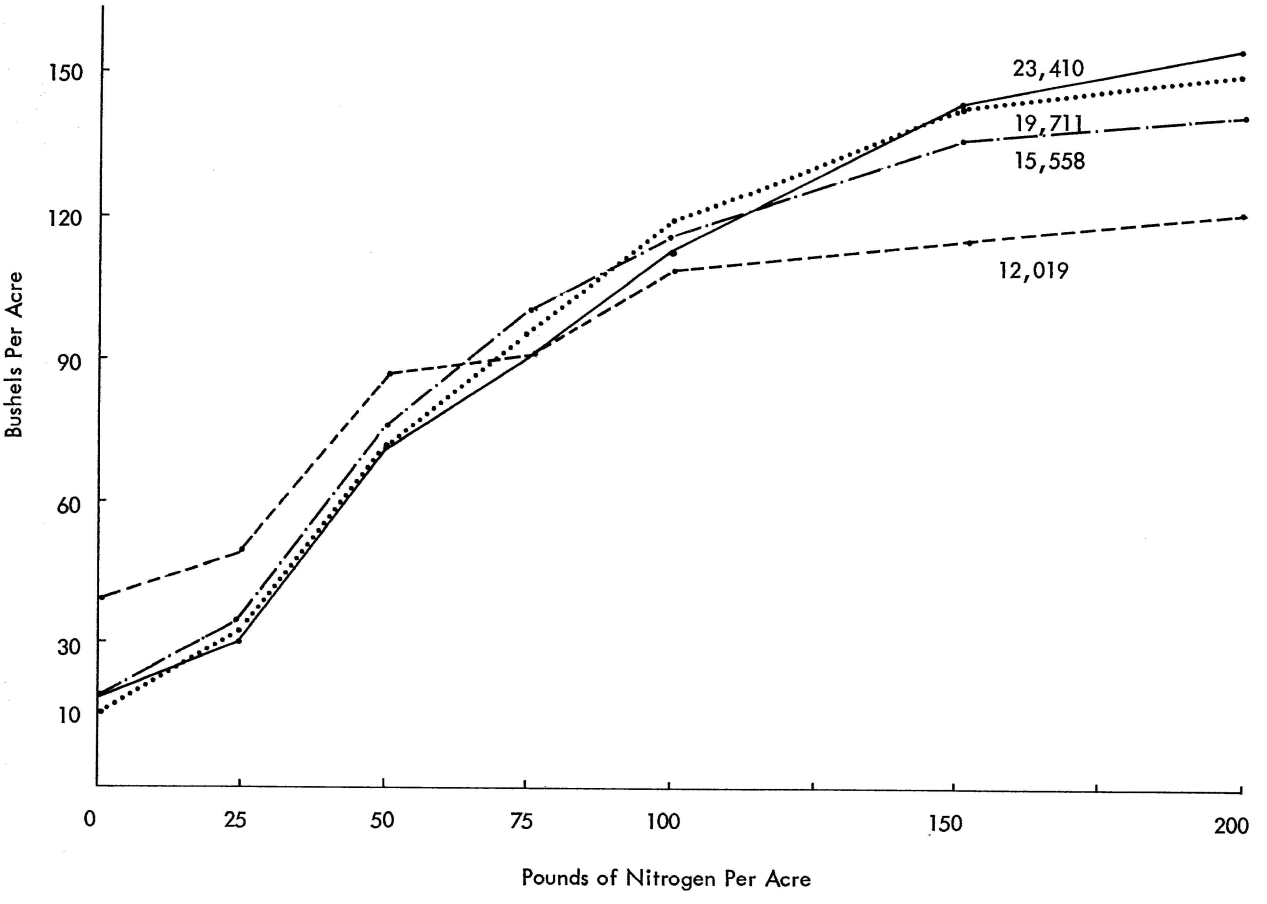

Figure 5. Response of Corn Yield to Nitrogen Application at Four Planting Rates, Delta Research Center, Portageville, 1965.

TABLE 5. AVERAGE CORN YIELDS FOR NITROGEN TREATMENTS AT FOUR PLANTING RATES

Delta Research Center, Portageville, 1965

Bushels Per Acre

No. of Plants Per Acre	Pounds of Nitrogen Per Acre						
	0	25	50	75	100	150	200
12,019	39.8	49.4	87.1	91.9	109.1	115.5	121.4
15,558	20.2	35.5	76.0	101.2	116.4	136.6	142.3
19,711	15.0	32.9	71.8	95.3	118.9	142.5	151.2
23,410	19.6	30.1	71.8	91.0	114.0	144.0	156.0

LSD for Plant Population (0.05 probability level): 17.64 Bushels Per Acre

LSD for Nitrogen Treatments (0.05 probability level): 7.4 Bushels Per Acre

FIVE YEAR SUMMARY

The experiment to determine the effect nitrogen and plant population on corn yields in Missouri has been conducted for five years at four different sites. At Columbia, Marshall, and Spickard the same sites have been used consecutively but at Portageville the present site has been used only for the last three years (1963, 1964, and 1965). The first two years, experiments were conducted at different locations in Southeast Missouri but were on soil types similar to that at Portageville. The experiment at Portageville was irrigated; those at the other three sites were not. The data for the first four years were reported in Special Reports 13, 27, 36, and 47 of the Missouri Agricultural Experiment Station.

Weather was a variable factor during the five-year period with generally favorable conditions during the first two years, relatively unfavorable conditions during the second two, and very favorable weather the fifth year.

Highlights and summaries of economic analyses of the first five years of the experiment are presented in the following section for each of the four sites. The profits were computed only at the levels of treatments actually used for the experiment.

North Missouri Research Center

The highest profit producing yields and maximum yields for the first five years of the experiment at the North Missouri Research Center are given in Table 6, along with the rainfall during the growing season. Rainfall was above or near normal during each of the five years. Rainfall was relatively well distributed, too, with only one dry period of 15 or more days each year prior to 1965.

TABLE 6. MOST-PROFITABLE AND MAXIMUM YIELDS FOR THE EXPERIMENT AT THE NORTH MISSOURI RESEARCH CENTER, SPICKARD

	1961	1962	1963	1964	1965
Yield at Highest Profit (Bushels/acre)*	113.8	123.3	142.0	128.3	123.9
Nitrogen at Highest Profit (Pounds/acre)*	150	150	150	150	100
Plant Population at Highest Profit (Plants/acre)*	16,324	15,887	15,857	13,713	13,886
Maximum Yield (Bushels/acre)	113.8	127.8	146.7	128.3	129.3
Nitrogen at Maximum Yield (Pounds/acre)	150	200	200	150	150
Population at Maximum Yield (Plants/acre)	16,324	15,887	15,857	13,713	13,886
Rainfall During Growing Season (inches)	28.82	22.30	18.69	19.89	18.10
Deviation from Normal (inches)	9.50	3.03	-0.63	0.57	-1.23

*Profit was computed only at the discrete values of nitrogen treatments and planting rates used for the experiment. It was assumed that all costs except for seed and nitrogen were constant regardless of the level of treatment.

The *most profitable* rate of nitrogen over the first five years was about 150 pounds per acre. That was true for four of the five years; 100 pounds was the optimal rate the other year.

The planting rate at the highest profit treatment combination was around 16,000 plants per acre for three of the years and slightly less than 14,000 the other two years. The most profitable yields during the five years varied from 113 to 142 bushels per acre.

Maximum yields were obtained with 200 pounds of nitrogen two of the years and with 150 pounds of nitrogen the other three years. Plant populations for maximum yields were identical with those for optimal yields. In general, highest profit yields will be less than maximum yields because response to additional nitrogen tends to become lower as the level of nitrogen is reduced. In some cases the experiments produced identical maximum yield and high profit treatments. This results from the fact that nitrogen was added in 25 or 50 pound units rather than continuously, i.e., since no 175 pound treatment was made we do not know what the yield would have been with that level of nitrogen use.

A. H. Orr Farm

Maximum and highest profit yields for the experiment conducted on the A. H. Orr farm in Saline County are given in Table 7. These experiments are on highly productive soil that has a high organic matter content. Thus yields tend to be high at lower nitrogen treatments than for the other sites. The weather was variable with above average rainfall in the first and fifth years but below average in the other three years.

During the years of low rainfall the most profitable level of nitrogen was about 25 pounds of nitrogen per acre, whereas, during the years of above average rainfall, 75 to 100 pounds of nitrogen were the most profitable treatment levels. Best results from planting rates varied from about 10,000 to 13,000 plants per acre during the poor years and from 14,000 to 17,000 plants during the better years.

Maximum yields per acre usually occurred at nitrogen treatment levels considerably higher than yields that gave the highest profit. Thus, although corn yields continued to respond to additional nitrogen applications, the response was not sufficiently great to pay for the additional nitrogen required. Plant populations at the *maximum* yields were about the same or slightly higher than those for the *most profitable* yields.

TABLE 7. MOST-PROFITABLE AND MAXIMUM YIELDS FOR THE EXPERIMENT AT THE A. H. ORR FARM, MARSHALL, 1961-65

	1961	1962	1963	1964	1965
Yield at Highest Profit (Bushels/acre)*	106.6	107.0	77.3	119.0	154.6
Nitrogen at Highest Profit (Pounds/acre)*	75	25	0	25	100
Plant Population at Highest Profit (Plants/acre)*	14,000	13,275	9,736	12,984	17,246
Maximum Yield (Bushels/acre)	114.6	107.1	78.2	123.2	155.2
Nitrogen at Maximum Yield (Pounds/acre)	200	225	50	100	150
Population at Maximum Yield (Plants/acre)	16,000	13,275	13,082	12,984	17,246
Rainfall During Growing Season (inches)	27.63	15.78	15.71	15.30	24.59
Deviation from Normal (inches)	8.25	-3.60	-3.67	-4.08	5.21

*Profit was computed only at the discrete values of nitrogen treatments and planting rates used for the experiment. It was assumed that all costs except for seed and nitrogen were constant regardless of the level of treatment.

Bradford Farm

The results at the Bradford farm, Columbia, were too eratic to be used for generalization about yield response. In general, the effects from uncontrolled factors were so large that the effects from the treatments could not be determined. During the fourth and fifth years, however, better controls were maintained and significant results were obtained. The weather at Columbia also was variable with generally favorable conditions in 1961 and 1965 but unfavorable conditions in 1962 and 1964. Maximum and most profitable yields are shown in Table 8.

In general, response to nitrogen treatments seemed very low except in 1965. The treatment effects generally were not statistically significant and thus conclusions should not be made about yield response from the data. In 1964 and 1965 the treatments were significant. The two years were different, however, with unfavorable weather in 1964 and consequent low yield responses. With very favorable weather in 1965 yield responses were larger. However, the effects of nitrogen carryover from the preceding years of low response resulted in relatively high yields at the low treatment levels.

TABLE 8. MOST-PROFITABLE AND MAXIMUM YIELDS FOR THE EXPERIMENT AT THE BRADFORD FARM, COLUMBIA, 1961-65

	1961	1962	1963	1964	1965
Yield at Highest Profit (Bushels/acre)*	91.5	72.8	93.7	108.4	145.0
Nitrogen at Highest Profit (Pounds/acre)*	25	0	25	25	100
Plant Population at Highest Profit (Plants/acre)*	18,000	13,402	12,446	12,716	18,564
Maximum Yield (Bushels/acre)	91.5	75.5	95.0	111.0	150.6
Nitrogen at Maximum Yield (Pounds/acre)	25	225	75	50	200
Population at Maximum Yield (Plants/acre)	18,000	13,402	16,487	12,716	20,792
Rainfall During Growing Season (inches)	24.43	11.96	17.92	14.31	25.07
Deviation from Normal (inches)	6.26	-6.20	-0.25	-3.86	8.70

*Profit was computed only at the discrete values of nitrogen treatments and planting rates used for the experiment. It was assumed that all costs except for seed and nitrogen were constant regardless of the level of treatment.

Delta Research Center

The experiment in Southeast Missouri was conducted at temporary sites for the first two years until the permanent location was available in 1963. Rainfall was above normal for all five years and irrigation also was used during dry periods. The soil in the area is sandy and consequently affected by drouth unless irrigated. The maximum and most profitable treatments and yields are summarized in Table 9.

The most profitable yields were quite high at this location, as were the appropriate planting and nitrogen treatment rates. In 1963 the nitrogen requirement was low because it was the first year at the site and there was an apparent large nitrogen carryover from the cotton crop in the preceding year. In general, the most profitable nitrogen treatments are around 150-200 pounds at 20,000 or more plants per acre.

Maximum yields usually were obtained at the maximum treatment levels of 200 pounds of N and about 24,000 plants per acre. The treatments probably were not carried to sufficiently high levels to determine the actual maximum.

TABLE 9. MOST-PROFITABLE AND MAXIMUM YIELDS FOR THE EXPERIMENT AT THE DELTA RESEARCH CENTER, PORTAGEVILLE, 1961-65

	1961*	1962*	1963	1964	1965
Yield at Highest Profit (Bushels/acre)**	144.1	113.9	149.5	139.1	156.0
Nitrogen at Highest Profit (Pounds/acre)**	200	75	50	150	200
Plant Population at Highest Profit (Plants/acre)**	20,517	13,638	23,465	22,431	23,410
Maximum Yield (Bushels/acre)	144.1	117.9	153.0	144.1	156.0
Nitrogen at Maximum Yield (Pounds/acre)	225		150	200	200
Population at Maximum Yield (Plants/acre)	20,517	17,611	19,000	19,664	23,410
Rainfall During Growing Season (inches)	18.20	20.04	18.34	18.71	16.78
Deviation from Normal (inches)	1.89	3.67	1.64	3.01	1.08

*The 1961 and 1962 sites were at locations near Portageville and Sikeston, respectively.

**Profit was computed only at the discrete values of nitrogen treatments and planting rates used for the experiment. It was assumed that all costs except for seed and nitrogen were constant regardless of the level of treatment.

APPENDIX

TABLE I. ANALYSIS OF VARIANCE FOR THE EXPERIMENT AT THE NORTH MISSOURI AGRICULTURAL RESEARCH CENTER, SPICKARD, 1965

Source	d.f.	Sums of Squares	Mean of Squares
Replications	2	344	172
Plant Population	3	2237	746
Error "a"	6	2705	451
Nitrogen Treatments	6	37938	6323**
Nitrogen x Plant Population	18	2664	148
Error "b"	48	5289	110
Total	83	51177	

**Significant at the 0.01 probability level.

Table II. Analysis of Variance For The Experiment At The A. H. Orr Farm, Marshall, 1965

Source	d.f.	Sums of Squares	Mean of Squares
Replications	2	52	26
Plant Population	3	6541	2180*
Error "a"	6	1377	229
Nitrogen Treatments	6	22594	3766**
Nitrogen x Plant Population	18	5196	289**
Error "b"	48	1819	38
Total	83	37579	

*Significant at the 0.05 probability level.

**Significant at the 0.01 probability level.

TABLE III. ANALYSIS OF VARIANCE FOR THE EXPERIMENT AT THE BRADFORD EXPERIMENTAL FARM, COLUMBIA, 1965

Source	d.f.	Sums of Squares	Mean of Squares
Replications	2	698	349
Plant Population	3	701	234
Error "a"	6	1172	195
Nitrogen Treatments	6	36874	6146**
Nitrogen x Plant Population	18	6222	346*
Error "b"	48	7300	152
Total	83	52970	

*Significant at the 0.05 probability level.

**Significant at the 0.01 probability level.

TABLE IV. ANALYSIS OF VARIANCE FOR THE EXPERIMENT AT THE DELTA RESEARCH CENTER, PORTAGEVILLE, 1965

Source	d.f.	Sums of Squares	Mean of Squares
Replications	2	3829	1915
Plant Population	3	57	19
Error "a"	6	3259	543
Nitrogen Treatments	6	153505	25584**
Nitrogen x Plant Population	18	6194	344**
Error "b"	48	3833	80
Total	83	170678	

**Significant at the 0.01 probability level.