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Spacing and Rates of Nitrogen for CORN

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SUMMARY OF RESULTS AND SPACING-NITROGEN RECOMMENDATIONS

Close spacing and high rates of nitrogen are management practices that are essential for production of high yields of corn in Alabama. Since each of these practices affects value of the other, both must be followed for highest possible returns, as shown by results of experiments at several locations of Auburn University Agricultural Experiment Station System.

Averages of data from 18 experiments show that 9-inch spacing in 42-inch rows (16,600 plants per acre) produced more corn than wider spacings tested. Since there is usually about a 15 per cent loss of stand between planting and maturity, getting the correct population requires planting at 8 inches in 42-inch rows and at 9 inches in 36-inch rows.

For most locations in Alabama, 90 to 120 pounds of nitrogen per acre is the recommended rate, based on the experiments reported. In the Sand Mountain area, rates of 120 to 150 pounds are recommended. Choices of actual rate within the ranges suggested should be made on the basis of anticipated yield. When conditions are favorable for production to surpass 75 bushels per acre, the higher rates will usually be profitable.

Spacing and Rates of Nitrogen for Corn

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CORN YIELDS are the product of many factors, such as fertility, variety, and management. Two of the most important management decisions to be made by corn growers concern drill spacing (plant population) and rate of nitrogen fertilization. These two factors must be considered together because each affects results obtained from the other. Using high rates of fertilization without adequate plant population can be a waste of fertilizer. High plant populations will not increase yield unless there are sufficient plant nutrients.

Nitrogen recommendations cannot be made for individual fields as can recommendations for phosphorus and potassium, which are based on soil test. There is no satisfactory chemical test to determine capacity of a soil to supply nitrogen for a growing crop.

Alabama soils have a low capacity to hold reserves of available nitrogen. For crops like corn, nitrogen must be applied annually near the time it can be used by the growing plant. Although the nitrogen supplying power of Alabama soils is low, it does vary. Because of this and the variation in yield from year to year and from field to field, average yield response is the logical basis for determining amounts of nitrogen to be used. Nitrogen experiments that show the yields from a range of nitrogen rates at many locations during a period of several years provide the best estimate of the most efficient rate.

HOW THE STUDY WAS MADE

Experiments on spacing and rates of nitrogen were begun in 1961 at the Brewton, Monroeville, and Prattville experiment fields and in 1962 at the Gulf Coast (Fairhope) and Sand Mountain (Crossville) substations. Spacings used were 9, 12, 18, and 24 inches in 42-inch rows. These represented populations of 16,600, 12,400, 8,400, and 6,200, respectively, Table 1. Corn was planted thick and thinned to the desired stand when about 3 to 4 weeks old.

TABLE 1. PLANT POPULATIONS AS RELATED TO ROW WIDTH AND DRILL ROW SPACINGS

Row width	Plants per acre at four drill spacings			
	9 inches	12 inches	18 inches	24 inches
	Number	*Number*	*Number*	*Number*
36 inches	19,400	14,500	9,700	7,300
38 inches	18,300	13,800	9,200	6,900
40 inches	17,400	13,100	8,900	6,500
42 inches	16,600	12,400	8,400	6,200

Rates of nitrogen were 60, 90, 120, and 150 pounds per acre for all spacings. One treatment received no nitrogen and was spaced at 24 inches. All plots were fertilized with 54 pounds of P (120 pounds of P_2O_5) and 98 pounds of K (120 pounds of K_2O) per acre.

In another series of experiments at seven locations, the same nitrogen rates were used with constant spacing of approximately 9 to 12 inches in the drill. These were conducted at the Tennessee Valley (Belle Mina), Sand Mountain (Crossville), Upper Coastal Plain (Winfield), and Wiregrass (Headland) substations and at the Brewton, Monroeville, and Prattville experiment fields. Fertilization rate for all plots was 27 pounds of P (60 pounds of P_2O_5) and 66 pounds of K (80 pounds of K_2O) per acre.

Ammonium nitrate was the source of nitrogen in all experiments. It was put on in two applications – 30 pounds of nitrogen at planting and the remainder sidedressed just ahead of the last cultivation when corn was 18 to 24 inches high. Varieties recommended by Auburn University were planted at each location. Soil types were: Decatur clay loam at Belle Mina, Kalmia fine sandy loam at Brewton, Hartselle fine sandy loam at Crossville, Marlboro fine sandy loam at Fairhope, Norfolk fine sandy loam at Headland, Magnolia fine sandy loam at Monroeville, Greenville sandy clay at Prattville, and Savannah very fine sandy loam at Winfield.

RESULTS OBTAINED AND WHAT THEY MEAN

Average yields from five locations in the nitrogen and spacing experiment show that the 9-inch spacing produced about 3 bushels more corn per acre than the 12-inch spacing at the 90-, 120-, and 150-pound rates of nitrogen, Figure 1. Yields at the 9-inch spacing were 3 to 9 bushels more than from 12-inch spacings at three of the five locations, Table 2. At the other two locations, 9- and 12-inch spacings made about the same yield. Close spacing did not increase yields at the 60-pound nitrogen rate. The 9- or 12-inch spacings gave much higher yields than the 18- or 24-inch spacings at all locations.

Close spacing did not decrease yields in the most unfavorable years of the experiments. Spacing effects were similar in the best years and poorest years, Figure 2, although yields exceeded 100 bushels in the best years and dropped to the 60-bushel range during poorest years. No extreme droughts were encountered during the 4 years. With no nitrogen applied

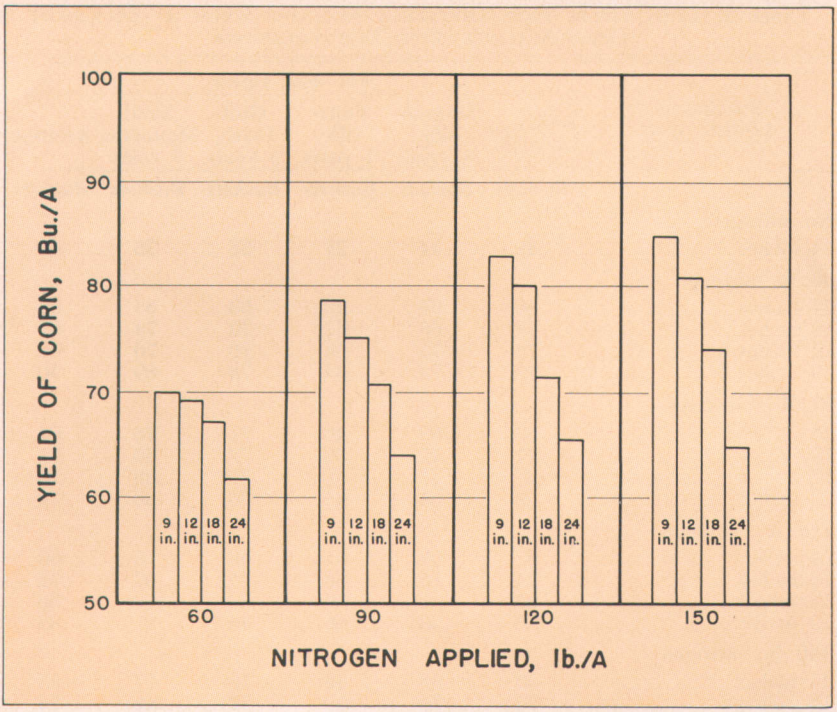

FIG. 1. Corn yields from rates of nitrogen and spacing experiments in 1961-64 are shown by the graph. Yields given are averages of five test locations.

at 24-inch spacings, yield averaged 33 bushels in poorest years and 49 bushels per acre in best years.

A plant population of 16,600 in closer rows than 42 inches can be obtained by spacing slightly farther apart in the row, Table 1. It is emphasized that spacings reported here were actual field spacings obtained by planting thick and thinning to the specified stands. To obtain these average spacings, corn should be planted about 15 per cent thicker to compensate for seed that do not germinate and for those lost to birds, disease, or other causes. Therefore, for an average of 9-inch spacing, corn should be planted 7½ to 8 inches in the drill.

Response to nitrogen varied considerably among locations, Table 2 and Figure 3. At the Sand Mountain Substation where yields were more than 100 bushels, 150 pounds of nitrogen produced a profitable response. At the Gulf Coast Substation, yield with no nitrogen applied was 54 bushels, and the most profitable rate was 60 pounds. The 120-pound rate was the highest to give a yield response at Brewton, whereas at Monroeville and Prattville it was not economical to use more than 90 pounds. These data will not support a uniform nitrogen recommendation for all soils or locations.

At both the 9- and 12-inch spacings there was an average increase of 7

TABLE 2. CORN YIELDS FROM DIFFERENT NITROGEN RATES AT DIFFERENT DRILL SPACINGS, FIVE TEST LOCATIONS

Spacing in 42-inch rows	Per acre yields					
	Brewton, 4 years	Monroeville, 4 years	Prattville, 4 years	Gulf Coast, 3 years	Sand Mountain, 3 years	Average
	Bushels	*Bushels*	*Bushels*	*Bushels*	*Bushels*	*Bushels*
No nitrogen						
24 inches	49	44	28	54	36	42
60 lb. nitrogen						
24 inches	65	64	49	69	63	62
18 inches	74	66	52	73	74	67
12 inches	73	73	54	76	70	69
9 inches	75	74	54	78	69	70
90 lb. nitrogen						
24 inches	63	66	49	71	76	64
18 inches	77	72	56	74	80	71
12 inches	77	77	58	79	88	75
9 inches	82	85	62	79	86	78
120 lb. nitrogen						
24 inches	67	68	51	69	76	66
18 inches	74	75	56	78	82	72
12 inches	83	81	59	83	100	80
9 inches	86	86	66	84	97	83
150 lb. nitrogen						
24 inches	65	65	49	72	77	65
18 inches	73	76	59	77	88	74
12 inches	84	78	64	83	102	81
9 inches	92	86	62	86	106	85

bushels of corn when the nitrogen rate was changed from 60 to 90 pounds per acre, Figure 1. The 120-pound rate produced about 5 bushels more than the 90-pound rate, but the increase from more than 120 pounds was small. Assuming that the price of corn is such that 1 bushel is equal in value to 10 pounds of nitrogen, the choice between the 120- and 90-pound rates is close at most locations. The higher rate might be profitable if moisture is sufficient for high yields, but the lower rates proved more profitable in less favorable years of the experiment, Figure 2. However, the high rates of nitrogen did not decrease yields even in the most unfavorable years.

How spacing and nitrogen affected lodging of corn was determined in the experiments at Prattville and Fairhope by counting the lodged stalks. Lodging was never serious at either location. Corn stalks were smaller in the high population treatments and would be more susceptible to lodging in case of high wind or extended wet conditions in the fall.

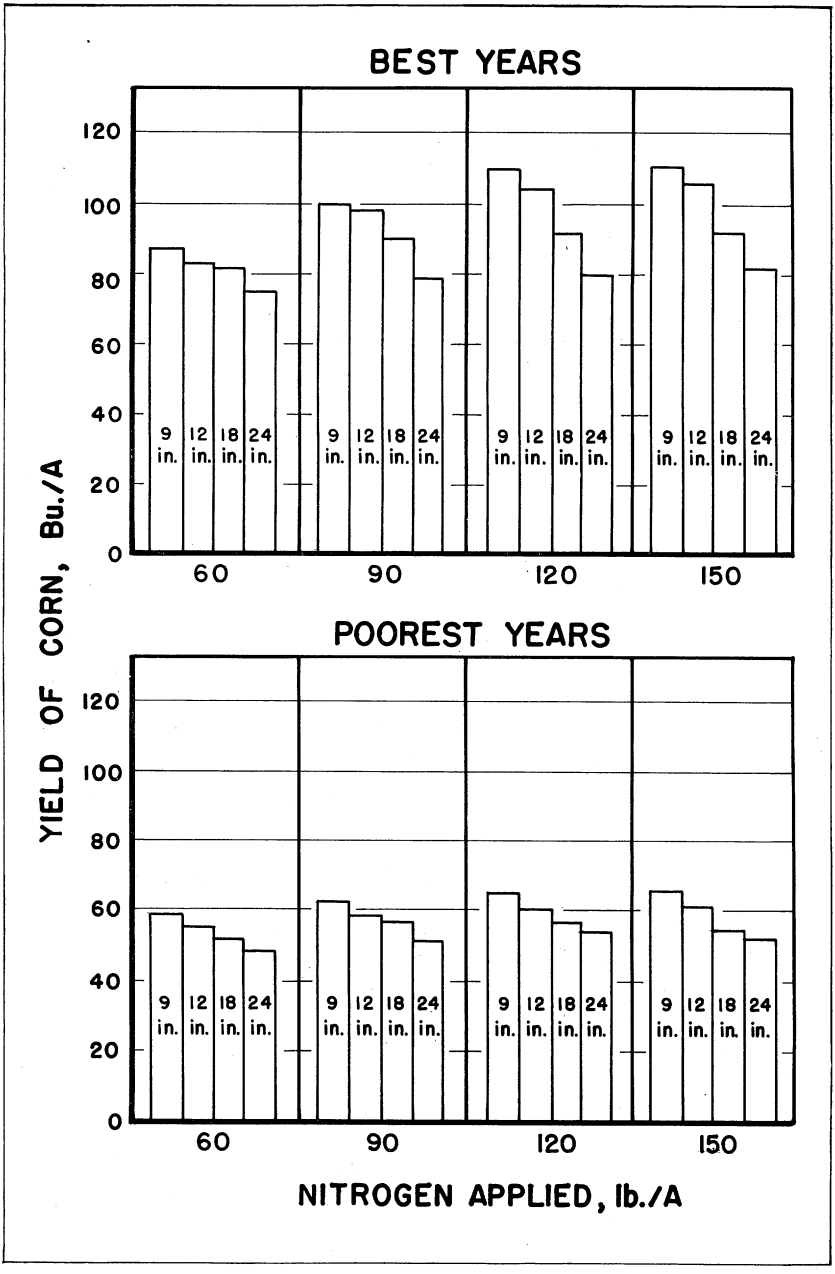

FIG. 2. Close spacing did not decrease yields even in most unfavorable years, as shown by this comparison of yields between best and poorest test years.

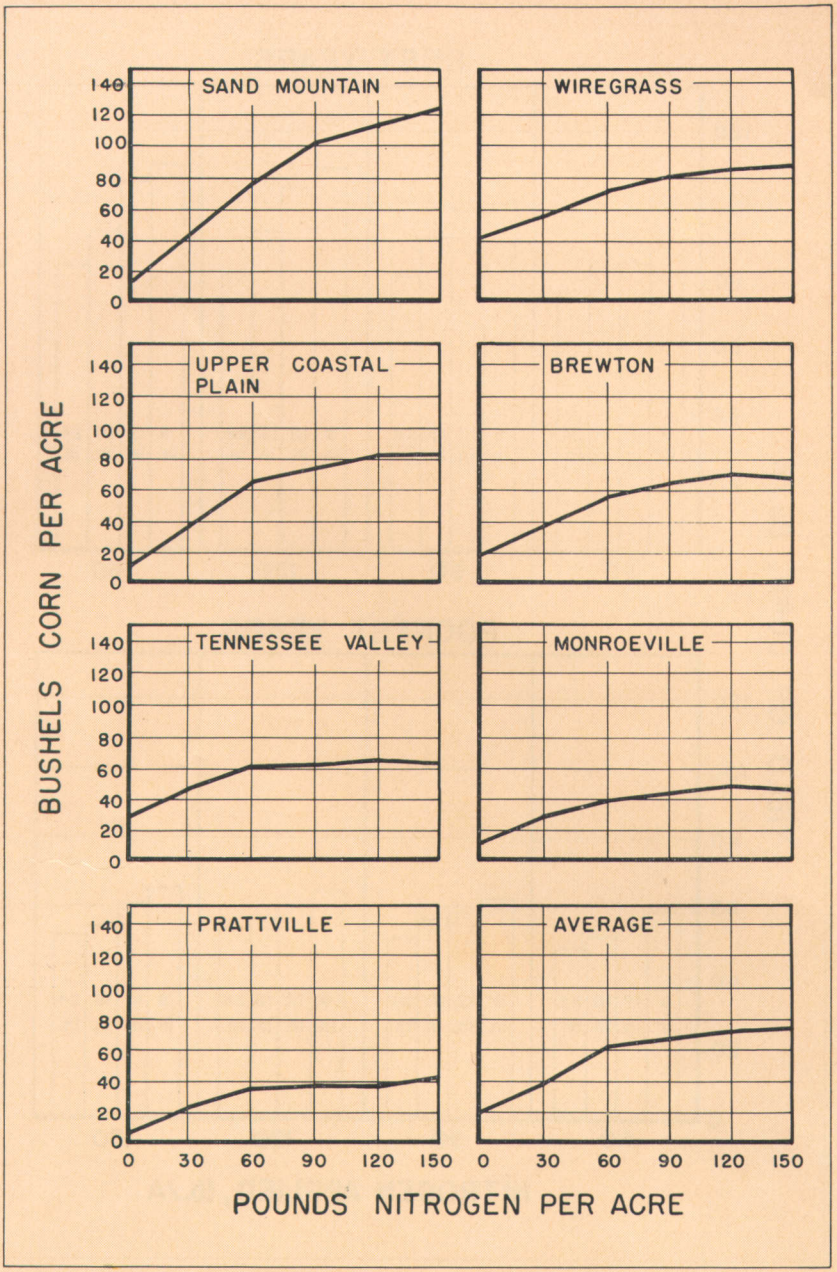

FIG. 3. Yield response to nitrogen rates varied widely among locations, as illustrated by these 3-year average yields at the seven test locations.