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Corn Planting Rates and Row Spacing in Missouri

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Selection of planting rates and row widths are decisions that directly affect the yield of the corn crop. Yield potential varies more with plant population than it does with row width, but differences in yield for different row widths are sizeable.

There are a number of factors that do influence response to planting rates so "pin-pointing" the rate that should give the most harvested grain from a particular field is difficult.

The corn producer does have a measure of control over some of these factors, including:

(1) The hybrid that is planted. There are differences in the way different hybrids respond to thick planting. There is strong emphasis by corn breeders toward developing hybrids that will tolerate dense stands.

(2) The amount of fertility available to the crop. More plants than will be properly nourished will reduce grain yields.

(3) The moisture supply. This involves available moisture holding capacity of the soil, expected rainfall, the time it is received, and whether or not irrigation to supplement natural rainfall is available.

(4) Production practices and treatments that contribute to higher yield levels.

Experiments in recent years by the Agronomy Department, UMC, and the Soil and Water Conservation Research Division, ARS, U.S.D.A. in cooperation with Agricultural Experiment Station, UMC under both irrigated and non-irrigated conditions have given information that can be of value in selecting row widths and planting rates under Missouri conditions.

Weir and Zuber conducted a series of experiments in 1966, 1967, and 1968 at Spickard, Columbia, Mt. Vernon, and Portageville with identical plantings in which planting rates and row widths were compared using three hybrids selected for known ability to tolerate high planting populations. Fertilization was sufficiently high to eliminate it as a limiting factor. These were non-irrigated plots, except at Portageville. The relatively poor physical characteristics of the soil for corn production at Portageville, even though irrigated, did not permit yields to exceed those from the non-irrigated locations. Eleven of the twelve tests were successful and gave meaningful results. Most of these locations had excellent corn growing seasons in 1967 and 1968, but 1966 was only a fair season.

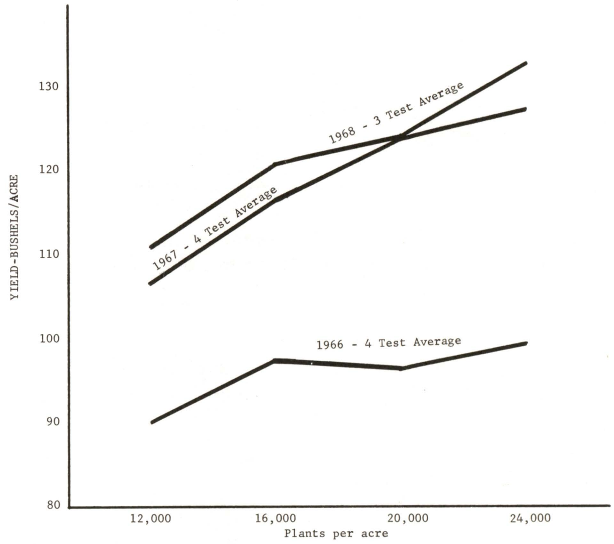

Figure 1—Average corn yields at different plant populations during 3 years at Spickard, Columbia, Mt. Vernon and Portageville.

Figure 1 gives the average yields over all row spacings at these four locations for each of the three years. Yields increased with each increase in population in the good seasons of 1967 and 1968, but there was little advantage for more than 16,000 plants in 1966. Figure 2 divides the tests on the basis of yield levels. The greatest advantage from high plant population came at high yield levels, intermediate yielding tests show a somewhat lesser advantage, and the tests with lower yields did not benefit from populations above 16,000.

Figure 3 shows the yields for different row widths in these same tests. 20-inch rows outyielded 30-inch rows, and 30-inch rows outyielded 40 inch rows each year. The differences in favor of narrower row widths were greater as yields were higher, as indicated in Figure 4.

Corn plants will be farther apart in the row in narrow rows than in wide rows if the per acre planting rate is the same. At high populations Samonte found that intensive in-row competition reduced optimum yield. This occurred when plants were closer than 8 to 11 inches, and he suggested that the hybrid he used should not be planted closer than 8 inches in the row. There is no indication that the planting rate should be increased because of changes to narrow row

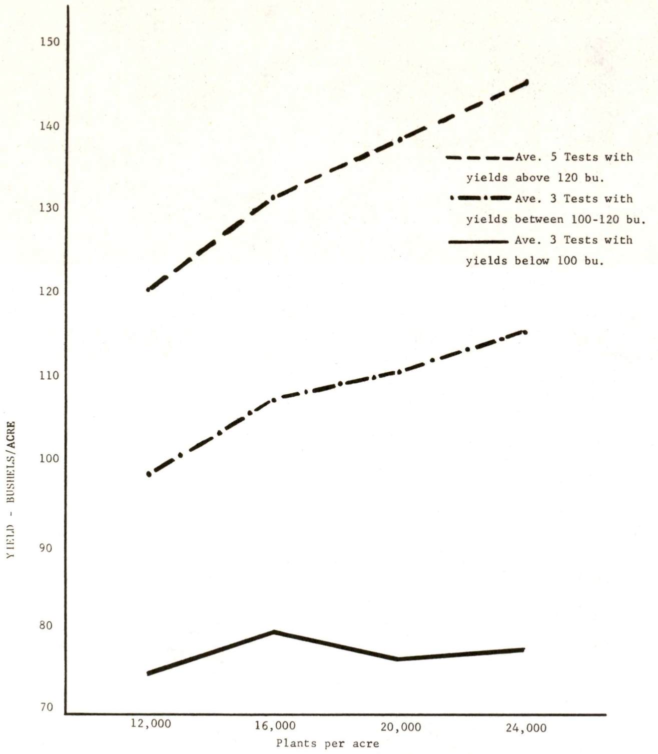

Figure 2—Average Corn Yields at different plant populations during 3 years at 4 locations in relation to yield levels.

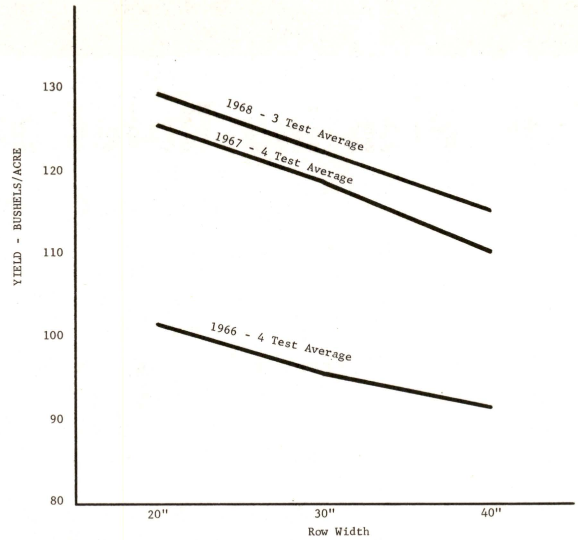

Figure 3—Average corn yields at 3 row widths during 3 years at Spickard, Columbia, Mt. Vernon and Portageville.

widths. If high populations are used there will be added advantage from using a row width that will keep away from this in-row competition. After selecting planting rate, Table 1 can be used to check for row widths that should avoid this effect.

TABLE 1 - Plants per acre at various row widths.

Inches between Plants in row	20" row	30" row	36" row	38" row	40" row
8"	39,240	26,140	21,770	20,630	19,620
9"	34,880	23,240	19,360	18,340	17,440
10"	31,400	20,920	17,420	16,510	15,700
11"	28,460	18,960	15,830	15,020	14,230
12"	26,160	17,420	14,520	13,760	13,080
13"	24,160	16,080	13,430	12,740	12,080
14"	22,440	14,920	12,450	11,790	11,220
15"	20,920	13,090	11,670	11,010	10,460
20"	15,700	10,460	8,710	8,250	7,850

Samonte's trials also confirmed the old rule that one-eared hybrids of the maturity range most commonly grown in Missouri usually give best yields when planting rates and growing conditions result in an average ear size of around ½ pound.

The pattern of planting rate and row width effects have varied little between nonirrigated trials and the irrigated tests of Gaddy, of Samonte, and of Whitaker, Heinemann and Larson - although the latter did not receive yield increases from rows less than 30 inches wide. Irrigated corn can give substantially higher yield levels, as indicated by comparing variety yield tests of Horrocks and Cloninger. In 1970 they reported on nine trials without irrigation and five that were irrigated. Although the tests are not directly comparable, the nonirrigated trials had an overall average yield for all entries of 90.9 bu/A, and the irrigated trials averaged 130.3 bu/A. Irrigated fields also have a more consistent production level from season to season, so choice of planting rate can be made with more confidence.

The importance of considering harvestable yield in making plant population and row width choices is illustrated by measurements reported by Whitaker, Heinemann, and Larson from their 1966 irrigated trial at Elsberry as shown in Figure 5. Total yield was slightly superior at the 24,000 population, but the 20,000 population level gave a bit more harvestable yield. And 20-inch rows had decidedly more yield that was not harvestable than the wider row widths. This population level is supported by Gaddy's irrigated experiments where highest yields consistent with strong stalks were achieved at 20,000 to 24,000 plants per acre. Gaddy concludes that it would be better to use around 20,000 plants per acre to avoid undue crowding stress to corn plants since yield difference between these populations was small.

There are other reasons for caution. Stalk rots, stalk lodging, and barren stalks tend to increase as plant densities increase. Thicker plantings also retain "free" moisture on plant parts longer after rainfall or dew thus providing more favorable conditions for establishment of infestations of diseases such as Southern Corn Leaf Blight and Northern Corn Leaf Blight.

Experimental trials furnish good guidelines, but adjustments may have to be made to fit individual farm and field situations. The overall results of the research discussed here, as well as that conducted in nearby states, is rather decisive in showing that a 20-inch row width can often be expected to grow more corn per acre than 30-inch rows. This is not likely to be true for harvested corn on most Missouri farms. Thirty-inch rows now seem near the practical minimum in

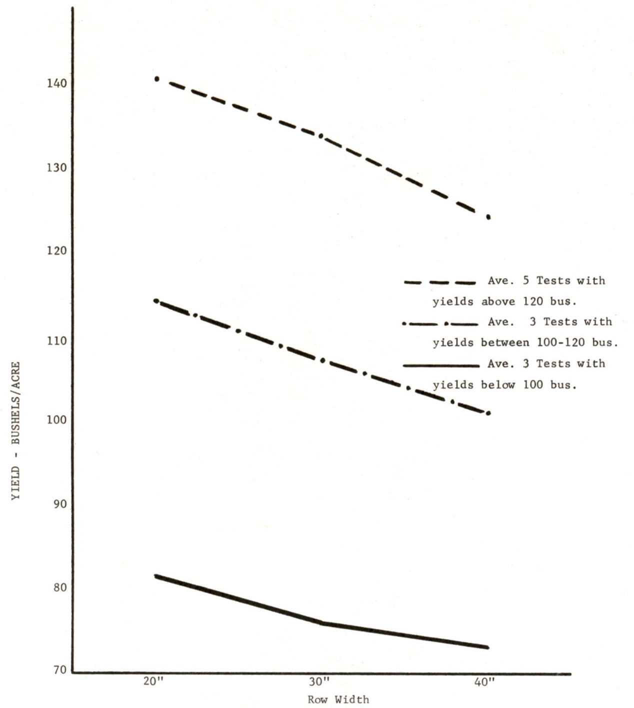

Figure 4—Average corn yields at 3 row widths during 3 years at 4 locations in relation to yield levels.

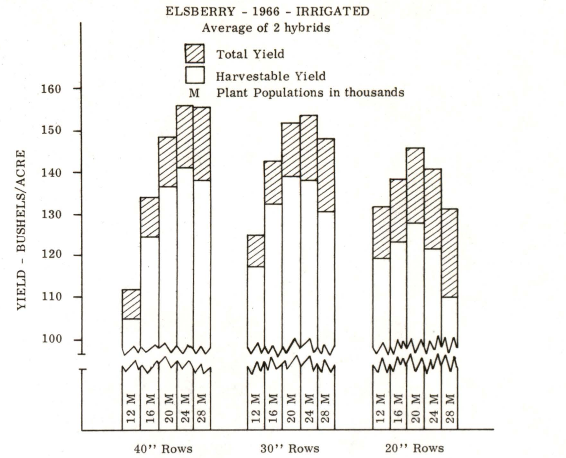

Figure 5—Total and harvestable yield at different plant populations and row widths.

most instances, considering difficulty of weed control in the narrower rows when mechanical cultivation is needed, and added problems in harvesting the crop.

Planting rates will need to vary because of expected differences in production levels on farms, and ofttimes by fields on those farms. The following steps are suggested for use in determining planting rates:

1. Set a yield goal for the field to be planted.

It is usually practical for the producer who is striving to increase yields to set a yield goal some 10 to 15 bushels above average production obtained on that and similar fields in recent years, discounting abnormally good or poor years. When making drastic changes in production practices, the yield goal should reflect expected improvement from the change.

2. Use soil tests as a guide to supply sufficient plant food to meet this yield goal.

3. Calculate number of plants per acre needed at harvest to meet this goal.

The use of ear size, trying for the ½ pound size mentioned previously as most efficient, seems to be a practical method. Some variation may exist among hybrids, as well as at different population levels. But, in general, with one-eared hybrids a yield goal of 100 bushels/acre would call for around 14,000 plants with ears at harvest; a 125 bushel goal would require some 17,500 plants; and a 150 bushel goal suggests 21,000 plants per acre. Early maturing naturally smaller eared hybrids might be more efficient at a smaller ear size.

4. Increase number of seeds per acre enough to obtain desired stand.

One usually expects 85 to 90 stalks at harvest per 100 kernels planted when using treated seed with good germination, application of a soil insecticide, moderate planting speed, optimum planting depth, and moderate planting rates in warm soil in a good seedbed. Early planting, planting under a mulch, planting at heavy rates, or in less than an ideal seedbed could reduce this to 75 to 80 stalks per 100 kernels. But at times one may obtain an almost perfect stand, so it seems unwise to increase kernels planted by more than 10% above the desired stand.

It is better to underplant than to overplant. Corn that is overplanted will have more barren stalks, more lodged corn, more field loss from small ears that do not get in the combine, and poorer quality. Corn that is underplanted will make up part of the loss in yield by producing larger ears.

5. Select a hybrid that has ability to perform well at this stand count.

Hybrid seed corn company representatives can usually give information as to the adaptability of their various hybrids to different population levels. Missouri Hybrid Corn Yield Trial results published annually by the UMC College of Agriculture also contain information on some hybrids planted at "normal" as compared to "high" rates.

ACKNOWLEDGEMENT

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University of Missouri Agronomy Department and Plant Science Research Division, ARS, USDA, - Unpublished results, N. G. Weir and M. S. Zuber, 1966, 1967, 1968; Masters Thesis, UMC, H. C. Gaddy, 1969, Corn Grain Yield as a Function of Plant Spacing; 1970 Missouri Crop Performance, R. D. Horrocks and F. D. Cloninger, Special Report 129, UMC, Jan. 1971.

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