Planting Practices

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Planting Date

Planting corn early in Kentucky is not as important as it is in states farther north. Kentucky's growing season is long enough that corn may be planted from early April to mid-May in most years and still obtain high yields. Optimal planting dates usually range from April 1 to May 1 in Western Kentucky and April 15 to May 15 in Central and Eastern Kentucky. In some years, corn is planted in March, but often it must be replanted because of poor stands due to cold soil. The most critical factor in determining when to start planting corn is the soil temperature. Planting when soil temperatures are above 50°F at a 2-inch depth for three or four days appears to be an excellent guide. A soil temperature of 50°F at 7:00 a.m. or 55°F at 1:00 p.m. should assure that temperatures are suitable for germination and growth for at least several hours during the day. Because of residue cover, soils for no-tillage planting usually do not warm up as early as tilled soils. If using no-till, planting may have to be delayed by four to seven days.

Earlier planted corn has usually had fewer insect and disease problems. For maximum yields, corn should be planted before May 1 in extreme Western Kentucky, by May 10 in west-central Kentucky, and by May 15 in Eastern Kentucky. If corn planting is delayed past June 5, an earlier-maturing hybrid should be planted. Several years of research have shown that a 1 percent per day yield loss can be expected in corn planted after May 10-15.

Planting Depth

The speed of germination and uniformity of plant emergence depend not only on soil temperature but also on planting depth. Under good conditions of temperature and moisture, a 1 1/2- to 2-inch depth is ideal. Some research in the Midwest has shown that 2 inches is the best depth for highest yields. For early planting, especially when the soil is cooler, plant at a slightly shallower depth of 1 to 1 1/2 inches. If the soil is dry, which is sometimes the case when planting late, you may need to plant 2 1/2 to 3 inches deep to get the seed to moisture. Soil temperatures in the upper 2 inches are greatly influenced by air temperature and solar radiation and can fluctuate as much as 10°F during a single day.

Planting too deep or too shallow can adversely affect corn performance. Early in the season, soils are colder at deeper depths and may slow germination and subject the seed to disease or insect injury. A seed treatment for insects is recommended with early planting. Planting depths greater than 2 inches may result in seedlings with less vigor, slower growth and development and lower yield. Planting corn seeds too deep can result in the coleoptile growth ceasing below the soil surface leaving the tender shoot to grow unprotected toward the soil surface. An unprotected shoot would be damaged and leaves unfurled before it emerges. Planting depths over 3 inches should not be considered under any soil conditions because of emergence problems. Conversely, planting too shallow can lead to poor nodal root development, shallow rooting depth, and poor drought tolerance. Do not plant less than 1 inch deep under any circumstances because poor nodal root development (permanent root system) may occur, which can result in plants falling over, known as suicidal corn.

Depth is particularly critical in no-tillage planting. For germination to occur rapidly and uniformly, the seed must be at a uniform depth and surrounded by soil. Some types of seed firmers may improve uniform planting depth. Careful control of planting depth improves stands and uniform emergence.

Plant Populations

The optimum plant population depends on the yield level that a particular environment (soil, moisture) permits. Average corn plant populations have gradually increased over the years as have corn yields. These increases can be attributed to improvements in production technology as well as genetic improvement in yield potential, standability, and stress tolerance. Today's corn hybrids have higher yield potentials because of greater yield stability over a wider range of environments, superior stalk strength and standability, and better tolerate competitive stress (less barrenness) at high plant densities than previous hybrids. If a stressful environment occurs under recommended high populations with modern-day hybrids, extremely high yields will not occur, but, it is less likely that a significant yield decrease will occur unless the population has greatly exceeded the recommended optimum range.

Recent studies at the University of Kentucky have shown trends for maximum yields at higher plant populations. In the 3 year study (Table 1), corn yields increased significantly at each increased level of plant population. In the 2-year study with two hybrids (Table 2), there were no significant increases in yields with increased plant populations; however, there was a trend toward slightly higher yields at 28,000 plants per acre.

Corn can compensate for low populations by producing larger ears or additional ears. However, most hybrids today produce only one ear. Hybrids also respond differently to plant populations. When the population is too high, some hybrids may have barren stalks and lodging potential tends to increase. Consult seed company recommendations for desired plant populations of specific hybrids.

Using the data from Tables 1 and 2 and data collected by R. Barnhisel, University of Kentucky Agronomy Department, during the last five years of variable rate seeding studies, the recommended corn seeding rates for Kentucky are presented in Table 3. Corn planted on low yielding soils should not be seeded above 22,000 seeds per acre, and on high yielding, uniform soils, top yields are obtained with seeding rates of 28,000 to 30,000 seeds per acre. For intermediate yields (120 to 175 bushels per acre), use intermediate populations. Many times yields close to 200 bushels per acre can be achieved at 26,000 to 28,000 seeds per acre. Excessive populations can lead to more lodging, more disease pressure, and lower yields in most years. The final population should be approximately 85 to 90 percent of the seeding rate as shown in Table 4.

Table 1. Effect of plant population and row width on corn yields in Kentucky (eight-location average, 1995-97). Bitzer and Herbek.

Treatment		Yield (bu/ac)
Plant population	22,000	164a*
(Plants/acre)	26,000	171b
	30,000	178c
Row width	20 inch	170b
	30 inch	175a
	36 inch	169b

*Means followed by different letters are significantly different at 0.05 level of significance.

Table 2. Effect of plant population and row width on corn yields in Kentucky (four-location average, 1998-99).

Treatment		Yield (bu/ac) 1998	1999	Ave.
Plant population	24,000	167	130	149*
(Plants/acre)	28,000	174	129	152
	32,000	172	126	149
Row width	20 inch	171	126	148
	30 inch	171	131	151

* There were no significant differences among means at 0.05 level of significance.

Row Width

Studies in Kentucky during the 1970s and 1980s showed no advantage in yield for corn planted in rows narrower than 36 inches. However, by the early 1990s, a large percentage of the corn was grown in 30-inch rows because producers had switched to narrower rows for soybean and were using the same equipment for corn. In the early 1990s, much interest was generated for using 20-inch rows for corn. However, research from most of the states surrounding Kentucky did not show any advantage for 20-inch rows over 30-inch rows. Research was started in the mid-1990s comparing 20-inch, 30-inch, and 36-inch row width for corn in Kentucky (Table 1). These data showed an advantage for 30-inch over 36-inch row widths but that there was no advantage for 20-inch rows over 30-inch rows. Actually, 20-inch rows were no better than 36-inch rows. In Table 2, two more years of research on row width gave the same results. Consequently, the recommended row width for corn production in Kentucky is 30-inch rows.

Any consideration for a change in row spacing must take into account the economic return of that change. Most economic analysis comparisons indicate that a yield increase of at least 6 to 8 percent on large acreages (>500 acres) over a seven to 10 year period is needed to cover expenses incurred when switching row widths unless new equipment is needed to replace old equipment.

Replanting Corn

If a corn crop has been damaged or the stand is poor early enough to consider replanting, there are several factors that need to be considered. Some of these factors are seeding rate and expected plant stand, plant stand after damage or loss of stand, uniformity of plant stand being considered, replanting date and seed costs to replant, and potential pest problems with replanted corn. Whether to replant or not comes down to deciding whether the replant-crop yields would be sufficient to cover the costs of replanting and net enough to make it worth the effort. The key factor to consider is found in Table 5. This table will help you decide if replanting will yield more corn than leaving the present stand. The information in this table was obtained and adapted from the *National Corn Handbook*, NCH-30, "Guidelines for Making Corn Replanting Decisions." Refer to this

Table 3. Recommended corn seeding rates for Kentucky.

	Seeding rate* (seeds/acre)
Grain	22,000 - 30,000
Silage	24,000 - 30,000
Irrigated	26,000 - 32,000

* Range depends on potential yield of soil ranging from less than 100 bu/ac for the low range to more than 200 bu/ac for the high range.

Table 4. Corn population planting guide.

Harvest population[1]	Required planting rate	Inches between kernels when planting at various row widths 20"	30"	36"	38"
16,200	18,000	17.4	11.7	9.7	9.2
17,100	19,000	16.5	11.1	9.2	8.7
18,000	20,000	15.7	10.5	8.7	8.3
19,800	22,000	14.3	9.5	7.9	7.5
21,600	24,000	13.1	8.7	7.2	6.9
23,500	26,000	12.1	8.1	6.7	6.4
25,200	28,000	11.2	7.5	6.2	5.9
27,000	30,000	10.5	7.0	5.8	5.5
28,800	32,000	9.8	6.5	5.4	5.2

[1] Allows 10 percent stand loss.

publication for a much more detailed explanation of making a replanting decision, or contact your state corn specialist.

Table 5 contains the percentage of expected corn yield for planting date and harvest populations. Optimum population is considered to be 25,000 plants per acre with the optimum planting date to be the first week to 10 days of May. Information in this table along with consideration of the above-mentioned factors should aid in making a replanting decision. To use this table, consider this example: Suppose a field was planted on May 1 with an expected harvest population of 25,000 plants per acre. Later, the stand was reduced to 14,000 plants per acre; the yield loss penalty for the reduced population would be 17 percent (100 percent minus 83 percent). If it was decided to replant the field on May 21 to obtain a desired population of 25,000 plants per acre, a yield of 95 percent of optimum could be expected; for a net gain of 12 percent (95 percent minus 83 percent). Thus, replanting should be profitable in this case. However, if the stand was reduced to 16,000 plants per acre on May 31, a decision to replant would not be profitable, as an expected yield of only 87 percent would be realized as compared to an 88 percent yield if the stand was left standing. This is simply a guide to help you make a decision concerning replanting. Table 5 takes into account the loss of yield at later plantings but does not take into account non-uniform stands. All these factors must be weighed against expected replanting yield gains. If after considering all the factors, there is still doubt as to whether a field should be replanted, it will probably be correct more often if the field is left as is.

Table 5. Grain yields for various planting dates and population rates, expressed as a percent of optimum planting date and population rate (uniformly spaced within row).

	Plants per acre at harvest						
Planting date	**12,000**	**14,000**	**16,000**	**18,000**	**20,000**	**22,500**	**25,000**
	(% of optimum yield)						
April 15	70	76	81	85	88	91	93
April 20	72	78	83	87	90	93	95
April 25	75	81	86	90	93	96	98
May 1	77	83	88	92	95	98	100
May 6	78	83	88	92	95	98	100
May 11	77	83	88	92	95	98	99
May 16	75	81	86	90	93	96	98
May 21	73	78	83	87	91	94	95
May 26	69	75	80	84	87	90	92
May 31	64	70	75	79	82	85	87
June 5	59	64	69	73	77	80	81
June 10	52	58	63	67	70	73	75

Cropping Rotation Benefits

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There are many cropping sequences that can be used for growing corn in Kentucky. Economically and agronomically, it is difficult to justify growing corn in a monoculture instead of using a rotation. Data from many states have shown that a yield loss up to 10 percent occurs when corn is grown two or more years in succession. Most of that loss occurs in the second year.

There are several benefits from growing corn in rotation. With less pressure from disease, insects, and weeds, production costs are lower and profits are higher due to higher corn yields. Rotation studies in Kentucky have shown a yield increase of about 10 bushels per acre for corn grown in a rotation with soybean or soybean and wheat. Rotations also improve the use and availability of nutrients, and with the proper selection of a rotation crop, the productivity of the complete cropping system. Corn fits well into most crop rotations. The corn/soybean or corn/wheat/double-cropped soybean (three crops in two years) cropping sequences are commonly used in Kentucky.