



Joe Lauer

Corn replant/late-plant decisions in Wisconsin

Farmers are faced with corn replanting or late-planting decisions every year. Cold temperatures, wet or crusted soils, and/or pesticide or fertilizer injury may reduce seed germination and seedling emergence. After emergence, stands may be further reduced from insects, diseases, wind, frost, hail, and/or flooding. Stands too dense or non-uniform because of planter malfunctions or variable seeding depth may warrant replanting. Machinery breakdowns or wet soils may delay planting to where corn may not be economically produced and an alternative crop must be grown.

The major decision facing the corn farmer is whether it is more profitable to keep the original stand using a full-season hybrid or replant. Replanting may result in an optimum stand, but it would be planted at a later-than-desired date using a shorter-season hybrid. This publication describes how to make economically sound replanting or late-planting decisions.

Table 1. Length of row equal to $\frac{1}{1000}$ acre at various row widths.

row width	row length for $\frac{1}{1000}$ acre
15"	34' 10"
20"	26' 1"
22"	23' 10"
26"	20' 1"
30"	17' 5"
36"	14' 6"
38"	13' 10"
40"	13' 1"

Replanting—the decision-making process

Poor seed germination or seedling emergence may necessitate replanting the field. To minimize losses, information must be collected and evaluated quickly. You'll first need to estimate three factors: stand population, plant health, and evenness of spacing. Then compare the yield potential of the existing stand to the yield potential of a late-planted stand. When deciding whether to replant, you'll also need to consider replanting costs, seed availability, rotation restrictions from previous herbicide applications, and possible alternative crops. Each step of the decision process is described below. Base your replant decision on proven agronomic facts rather than emotion.

1 Determine plant population

To determine the number of plants in an acre (plant density), count the plants in a row length that is equal to $\frac{1}{1000}$ of an acre. This row length will vary depending on the width of the rows, so consult table 1 for the row length equivalents. To get a reliable average, sample 15 to 20 representative areas per 40 acres. If the stand is poor in spots, treat these areas separately from the rest of the field. Once you know the average number of plants per $\frac{1}{1000}$ of an acre, multiply by 1000 to calculate the number of plants per acre.

How many plants? To estimate the number of plants in a 40-acre field planted in 30-inch wide rows, count the plants in row lengths measuring 17 feet 5 inches (from table 1). This gives the number of plants in $\frac{1}{1000}$ acre. Sample 15 to 20 representative areas. If the average number of plants is 26.5, then the number of plants per acre is 26,500 (26.5 x 1000).

2 Evaluate plant health

At the same time that you're estimating the number of plants in the field, you should also evaluate the overall health of the plants. In each area you sample, examine 2 to 3 plants closely. Also try to determine the reason for the reduced stand so that you can avoid the problem in future plantings.

It is easier to judge a reduced stand of healthy plants than one with weakened or partially damaged plants. When hail, frost, or other damage occurs, wait 2 to 4 days with temperatures above 70°F before assessing the stand. If the growing point is not damaged, plants will usually recover and perform better than replanted corn.

The growing point of the corn plant remains protected below ground 2 to 3 weeks after emergence (figure 1). To evaluate the condition of the growing point, split the stem down the center with a knife. A healthy growing point will be yellowish-white and firm. Decayed, discolored tissue indicates a dead plant. Plants that are of questionable health should be counted as a half-plant when assessing the stand.



Figure 1. On healthy plants, the growing point is yellowish white.

3 Assess the unevenness of stands

As you're determining plant population, also look at the number and size of the gaps in the field. If the stand has several small gaps of 1½ to 3 feet, deduct 2 to 10% from the yields listed in tables 2 and 3; if the field has numerous 4- to 6-foot gaps, deduct 10 to 20%.

4 Compare the yield potential of a reduced stand to that of a replanted stand

Knowing the difference between the yield potential of the remaining stand and what you can expect from a new stand will help guide your decision to replant. To make this comparison, use figure 2 to find out which relative maturity zone you're in. If you live in northern Wisconsin, with a relative maturity zone of 95 days or less, refer to table 2 for grain yield information; in southern Wisconsin, refer to table 3. To use these tables, read down the left column for the plant population at harvest. Then read across for the appropriate planting date.

To estimate the yield potential of a replanted stand, refer to the bold-faced columns. Note that full-season hybrids produce best yields at early planting dates. Shorter-season hybrids perform better than full-season hybrids in late plantings.

5 Calculate replanting costs

Replanting decisions must include the costs of extra tillage (equipment, fuel, and labor), planting, seed, and additional pesticides, if required. These expenses often amount to \$20 to \$40 per acre. Late-planted corn for grain will also have the cost of extra drying.

Replanting costs can be reduced by replanting at a low seeding rate alongside or over the original row to "fill in" the stand without tearing it up. However, although this option saves costs, maturity differences can be a problem at harvest due to wet grain. Also, since the younger plants are at a competitive disadvantage, they will yield considerably less than corn from the first planting.

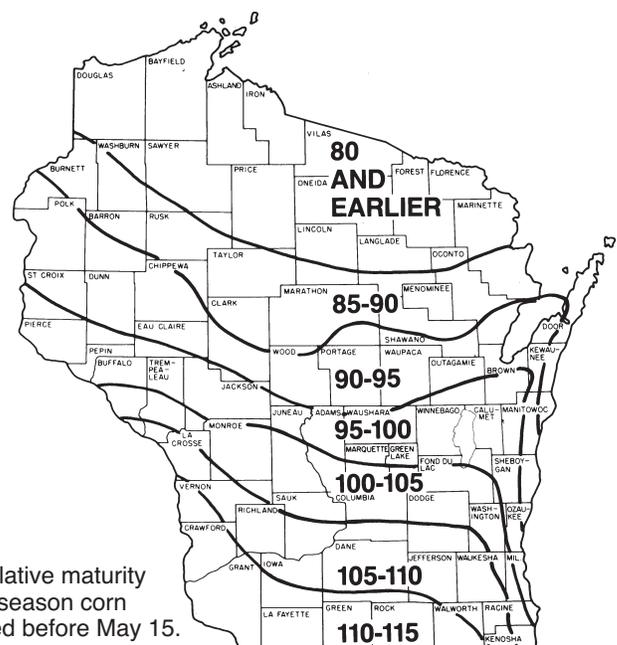


Figure 2. Relative maturity zones for full-season corn hybrids planted before May 15.

6 Factor in risks of replanting

There is no guarantee that replanting will produce a full stand. If the factors that reduced the initial stand—such as diseases, insects, or herbicide injury—are still present, the replanted corn will likely also suffer. In addition, untimely rains may delay replanting and poor growing conditions for the remaining season may lower grain yields more than indicated in tables 2 and 3.

Remember, the information in tables 2 and 3 can only provide guidelines to help you make decisions about replanting—it will not apply to all situations. Each case must be evaluated individually.

Late planting

Whether you're replanting or late planting, the following information will help you make the best management decisions.

Hybrid maturity

When planting corn later than May 15 to May 20, use shorter-season hybrids. To determine the best relative maturity for your situation, refer to table 4. For additional information on hybrid selection and performance, consult Extension publication *Selecting Corn Hybrids* (A3265).

In most years, corn planted after June 5 in northern and central Wisconsin and after June 10 in southern Wisconsin will not mature with reasonable grain yield and moisture content. However, corn silage from shorter-season hybrids may still have acceptable quality when corn is planted by June 10 in northern Wisconsin and by June 20 in southern Wisconsin. Corn planted after this time will likely contain little or no grain, producing only stover (stems and leaves).

Deciding whether to replant—a case study

A full-season hybrid was planted on May 10 near Oshkosh, Wisconsin with a desired harvest population of 28,000 plants per acre. By the end of the month, the 40-acre field had produced only a marginal, uneven stand. Would there be enough of a yield gain to justify replanting the field to a short-season hybrid on June 1?

1. Determine plant population. Sampling in 20 areas shows a plant population of 14,000 plants per acre.

2. Evaluate plant health. Examining the growing point of 2 to 3 plants in each sampling area reveals little damage from disease or insects.

3. Assess the unevenness of the stand. The field has several small gaps in it which would reduce yield by about 2%.

4. Compare yield potentials. Oshkosh, Wisconsin has a relative maturity zone of 95 to 100 days (figure 2). Using table 3, we learn that the full-season hybrid can produce only 72% of the yield (May 10 planting; 14,000 plants). Deducting an additional 2% from the yield due to uneven distribution, leaves a maximum yield potential of 70%. By comparison, a field replanted on June 1 at a rate of 28,000 plants per acre would have a yield potential of 71% (table 3).

5. Calculate replanting costs. The difference in yield potential is only 1% (71% versus 70%). Assuming an expected yield of 130 bushels per acre, this difference translates to an increase of only 1.3 bushels per acre. In this case, the gain is not enough to offset the time and costs involved in replanting.

6. Factor in replanting risks. The risk of untimely rains and increased insect pressure combined with the possibility of an early fall frost diminish the already marginal gains from replanting this field.

In this case study, the original planting would be better left to mature, despite the reduced yield potential.

Northern Wisconsin—relative maturity zone, 70–95 days

Table 2. Expected corn grain yield for various planting dates and harvest populations in relative maturity zones of 70 to 95 days.

harvest pop'n	planting date						
	April 20	May 1	May 10	May 20	June 1	June 10	June 20
	—% of expected yield—						
36000	96 82	100 89	97 89	86 82	63 65	39 46	5 18
34000	95 81	99 88	96 88	85 81	63 65	39 46	5 18
32000	94 80	98 87	95 87	85 80	62 64	38 45	5 18
30000	93 79	97 86	94 86	83 79	61 63	38 45	5 18
28000	91 78	95 85	92 84	82 78	60 62	37 44	5 18
26000	89 76	93 83	90 83	80 77	59 61	37 43	5 17
24000	87 75	91 81	88 81	79 75	58 59	36 42	5 17
22000	85 73	89 79	86 79	76 73	56 58	35 41	5 16
20000	82 70	86 76	83 76	74 70	54 56	34 40	4 16
18000	79 68	83 74	80 73	71 68	53 54	32 38	4 15
16000	76 65	80 71	77 70	69 65	50 52	31 37	4 15
14000	73 62	76 67	74 67	65 62	48 49	30 35	4 14
12000	69 59	72 64	70 64	62 59	46 47	28 33	4 13
10000	65 55	68 60	66 60	58 56	43 44	27 31	3 13

Figures for shorter-season hybrids are bold. The actual relative maturities of short- and full-season hybrids vary with location and soil type. See table 4 for more specific relative maturity values.

Southern Wisconsin—relative maturity zone, 95–115 days

Table 3. Expected corn grain yield for various planting dates and harvest populations in relative maturity zones of 95 to 115 days.

harvest pop'n	planting date						
	April 20	May 1	May 10	May 20	June 1	June 10	June 20
	—% of expected yield—						
36000	96 91	99 95	95 93	85 87	63 71	40 55	8 32
34000	97 92	100 96	96 94	85 87	63 72	40 56	8 32
32000	97 92	100 96	96 94	86 87	63 72	40 56	8 32
30000	96 92	100 96	96 94	85 87	63 72	40 56	8 32
28000	96 91	99 95	95 93	84 86	63 71	40 55	8 32
26000	94 89	97 93	93 92	83 85	62 70	39 54	8 31
24000	92 87	95 91	91 89	81 83	60 68	38 53	7 31
22000	89 85	92 88	89 87	79 81	58 66	37 51	7 30
20000	86 82	89 85	85 84	76 78	56 64	36 49	7 29
18000	82 78	85 81	82 80	72 74	54 61	34 47	7 27
16000	78 74	80 77	77 76	68 70	51 58	32 45	6 26
14000	73 69	75 72	72 71	64 65	47 54	30 42	6 24
12000	67 64	69 66	67 65	59 60	44 50	28 38	5 22
10000	61 58	63 60	60 59	54 55	40 45	25 35	5 20

Figures for shorter-season hybrids are bold. The actual relative maturities of short- and full-season hybrids vary with location and soil type. See table 4 for more specific relative maturity values.

The limiting factor of late-planted corn is the yield loss from early fall frosts. Yield is decreased if late-planted corn does not reach physiological maturity before plants are damaged by a freeze. Grain from corn plants killed by a freeze before maturity may be slow to dry down, and it tends to be brittle after drying—making it more likely to break during handling. Test weight also will be lower when corn is prematurely killed.

Even if late-planted corn matures before a killing frost, the grain will still be wet and will probably have to dry down in weather less favorable for drying. Table 5 describes grain characteristics and management considerations for corn killed at various growth stages.

Table 4. Relative maturity of adapted corn hybrids for different planting dates and relative maturity zones in Wisconsin.

full-season relative maturity zone ^a	relative maturities ^b for late planting			
	May 20	June 1	June 10	June 20
85 and earlier	75-80	75-80 (silage)	—	—
85-90	80-85	75-80 (silage)	—	—
90-95	85-90	75-80	75-80 (silage)	—
95-100	90-95	80-85	75-80 (silage)	—
100-105	95-100	85-90	75-80	75-80 (silage)
105-110	100-105	90-95	80-85	75-80 (silage)
110-115	105-110	95-100	85-90	75-80 (silage)

^aUse figure 2 to determine the full-season relative maturity zone for your location.

^bThese relative maturities are for grain unless silage is indicated. If planting the field for silage, add 5 days to the relative maturities listed for grain.

Table 5. Grain characteristics and management considerations of late-planted corn killed by frost at various growth stages.

stage of growth	grain characteristics	management considerations
dough	<ul style="list-style-type: none"> ■ Kernels contain about 70% moisture. ■ About 45% of mature kernel dry weight has accumulated. ■ Grain will not achieve maximum yield potential unless stalk, ear, and some lower leaves survive. 	<ul style="list-style-type: none"> ■ Corn can be used for silage, but entire plant must be allowed to dry to about 65% moisture.
early dent	<ul style="list-style-type: none"> ■ Kernels contain about 55% moisture and are 3 to 3½ weeks from maturity. ■ About 50 to 60% of mature kernel dry weight has accumulated. ■ Grain yields will be reduced by 40 to 50% and test weights will be low. ■ If plants are only partially killed, yield loss will be 25% and test weight will be lower than normal. 	<ul style="list-style-type: none"> ■ Corn will make good silage when harvested at a whole plant moisture content of 65%. ■ Can be harvested for grain after long field-drying period.
late dent	<ul style="list-style-type: none"> ■ Kernels contain about 40% moisture ■ Yield is within 12% of final mature dry weight. ■ Grain yields will be reduced and test weights low. ■ If plants are only partially killed or if the crop is close to physiological maturity before the freeze (kernel milk line half-way or closer to tip), yield loss will be 5%, and test weight will be slightly lower than normal. 	<ul style="list-style-type: none"> ■ Corn will make best silage when harvested at a whole plant moisture content of 65%. ■ Can be harvested for grain after long field-drying period.
black layer (physiologically mature)	<ul style="list-style-type: none"> ■ Kernels contain 28 to 35% moisture depending on hybrid. ■ Killing freeze will not affect grain yield or quality. 	<ul style="list-style-type: none"> ■ Dry-down rate of grain depends on hybrid and environment. ■ Can be harvested for high-moisture grain or for grain after field drying.

For a detailed description of the growth stages of corn, see Special Report 48, *How a Corn Plant Develops*.

Pest control

It is usually easier to control weeds in late corn plantings than in early plantings. Late tillage kills many germinated weeds. In addition, crop seedlings are more competitive due to warmer temperatures. Note that if you're replanting the field, your weed control decisions *must* take into account any previous herbicide applications. The effectiveness of preemergence and preplant-incorporated herbicides may be reduced by the time corn is replanted, especially if you till the field before replanting.

Insects normally are a greater threat to late plantings than weeds. Later plantings may have more feeding damage from second-generation European corn borers; silk feeding by corn rootworm beetles may also be more severe. Soil rootworm insecticide will need to be applied if the field was tilled since the initial planting application. For more information on these pests, see Extension publications *The European Corn Borer* (A1220) and *Corn Rootworms* (A3328).

Crop choice

If planting is delayed past the time acceptable corn production can be expected, consider planting an alternative crop. Compare the relative yield potential and current price of an alternative crop for a given date with that of late-planted corn.

For example, the yield potential declines faster for late-planted corn than for soybeans. After June 1, it may be advantageous to plant soybeans, instead of corn, if this fits your rotation. Sunflowers and buckwheat are other grain crops that can be planted very late. Forage sorghum, sorghum-sudan crosses, or sudan-grass can help boost forage supplies and can be planted into July.

When choosing an alternative crop, be sure to consider prior herbicide and fertilizer applications, desired rotation, livestock feed requirements, and the possibility of erosion on slopes. For more information on herbicide rotational restrictions, see Extension publication *Pest Management in Wisconsin Field Crops* (A3646).



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Author: Joseph G. Lauer is professor of agronomy, College of Agricultural and Life Sciences, University of Wisconsin-Madison and University of Wisconsin-Extension, Cooperative Extension. Produced by Cooperative Extension Publishing, University of Wisconsin-Extension.

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