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Replanting Corn and Soybeans

Emerson Nafziger

Department of Crop Sciences
University of Illinois

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Both corn and soybean planting have progressed at about normal rates in Illinois this spring, with 68 percent of the corn crop and 43 percent of the Illinois soybean crop planted by May 10. Both of these numbers are higher than the 5-year averages. But cool weather over the past month has slowed emergence: emergence by May 10 was only 23 percent for corn and 6 percent for soybeans, both less than the 5-year average. Large amounts of rainfall in much of central Illinois has produced additional stress.

So far in May we've accumulated less than 80 growing degree days, less than half of normal, and less than during the second half of April. Corn requires about 115 GDDs from planting to emergence, and so corn planted on April 15 emerged in early May, but corn planted on April 22 is just now emerging, if conditions allow.

If a field was planted more than 120 GDDs ago and plants don't seem to be emerging, dig up some seeds and see if they're close to emerging, or if they might have stopped developing at some point. Seeds that have spent time under water or in saturated soils may be at risk. Cool soils may have prolonged their life long enough so they'll struggle up eventually, but such fields may not be very pretty. Frost on May 9 may have done some further damage, possibly enough to kill small plants, especially if temperature dropped to below 30 degrees. Frost in early May in 2005 killed some emerged plants, and those that survived did not produce full yields under dry conditions that growing season.

Soybeans that were just emerging or had just emerged could have been killed by frost as well: I've seen some photos that suggest that's the case. The cool temperatures this past week have delayed regrowth, making it difficult to tell whether damaged plants survived. Blackened stems are not a positive sign. There is also a question about whether damaged plants will grow to produce full yields.

If more than 140 or GGDs have accumulated since planting, it's time to evaluate the stand and to decide if it warrants replanting. Hardly ever are stands decreased uniformly over an entire field, so while it's helpful to count stands in several places across the field, it's also necessary to get an idea of how much of the field consists of patches with no plants at all. A drone may be helpful in doing this. If the stand is good in places and missing in other places, calculating a (weighted) average stand doesn't help, other than to suggest how much of the field might need to be planted again.

Corn Replanting

Back in the 2000s we generated data to update a replant decision tool for corn, by planting at different dates and establishing a range of plant populations within each planting. That tool remains available in the Illinois Agronomy Handbook. But I do not believe that the data used to produce that tool is valid for current hybrids, which lose yield more slowly as planting is delayed, and that also, compared to older hybrids, show less yield loss as plant population decreases.

We found little interaction between planting date and plant population in the earlier sets of data used to formulate replant guidelines: that is, population responses didn't change much as planting date changed. We think that's still the case, which means that we can combine planting date and plant population data from different trials without producing big inaccuracies. Based on that, I used our most recent planting date and plant population response data to generate Table 1 below.

Table 1. Corn Yields (Percent of Maximum) for Different Combinations of Planting Date and Plant Population. Derived from the Results of 39 Planting Date and 44 Plant Population Trials in Illinois

Planting date	Plant stand, 000/acre						
	20	23	26	29	32	35	38
	----------expected yield, % of maximum----------						
Apr 1-10	84	88	91	94	97	98	99
Apr 11-20	84	89	92	95	97	99	100
Apr 21-30	84	88	92	95	97	99	99
May 1-10	83	87	90	93	95	97	98
May 11-15	81	85	89	91	93	95	96
May 16-20	79	83	87	90	92	93	94
May 21-25	78	82	85	88	90	91	92
May 26-31	75	79	82	85	87	88	89
June 1-5	73	76	79	82	84	85	86

If lower stands are mostly from random skips down the row rather than from larger spots without plants, use the table above to help decide whether or not replanting will pay for itself. Use the original planting date and existing stand to estimate expected percentage of maximum yield if the early-planted stand is kept. Then move to a later planting date range and expected plant stand from replanting to determine expected yield if the field is replanted.

As an example, if a field planted on April 15 has 26,000 healthy plants per acre, we would expect it to yield 92% of maximum. If we can replant on May 15 at 35,000 plants, we would expect 95% of maximum yield, for an increase of 3 percent, or 6 bushels if we initially expected the field to yield 200 bushels per acre. Note also that unless replanting can be done (in this case) by May 20, there's little chance that replanting will result in more yield than keeping the current stand.

An adjustment to this may be in order this year. Corn planted after April 10 has made so little growth up to now that we should consider adding 15 or even 20 days to the original planting date for purposes of deciding whether to replant. So in the example above, we might consider the "adjusted" planting date to be April 15 plus 20 days, or May 5, which at 26,000 would produce a predicted yield of 90 percent of maximum. That effectively lengthens the replanting period, which will also allow an evaluation of how well the plants begin to grow once warm weather returns.

Depending on replanting costs, it might or might not make sense to replant for 6 bushels per acre; this is where judgement comes into play. If the stand that's there is uneven and it looks like some plants might not survive to thrive, or if there are many spots (more than one row wide) without any plants, then it's entirely possible that the original stand will yield less than 92 percent. Crop insurance and seed company policy on replant seed also come into play. And some prefer to replant "ratty-looking" fields just because they don't want to look at them all season and wonder if they should have replanted. Keep in mind that

replanted corn will usually have higher grain moisture at harvest, which should be counted in the replant cost.

Are there any adjustments we should make if we decide to replant? If all of the N has been applied, the replanted crop may not need any more, given that we haven't had warm soils that enhance losses. But where there's been a lot of rain since N was applied, nitrate-N has been moved down into the soil, and it might pay to apply some N with the planter to make sure there is some there after the crop emerges, especially if soils are still cool (meaning low rates of mineralization) at the time of replanting. There's no reason to change plant population or hybrid maturity from what was planted originally, although actual hybrid may have to change depending on seed supplies.

It can be difficult and frustrating to "repair-plant" partial stands, but if nearly all the missing plants are in spots rather than scattered down each row, and you can find a 4- or 6-row planter to minimize the area that ends up with twice too many plants, that can save costs. In any corn replanting operation, leaving existing plants to grow along with the plants from replanting is often disastrous: hybrids tolerate high populations, but not double what they should be. Using trash movers to dislodge existing plants might work OK in some cases. But in many cases, especially when replanting whole fields, existing plants should be sprayed out with herbicide, or even tilled, so they don't compete with later-planted plants.

Replanting Soybeans

Evaluating soybeans stands is a little more "complicated" than evaluating corn stands, although the same problem of uniformity of (remaining) stand occurs in both crops. It does make it easier when conditions are such that few soybean plants emerge, and given that we consider 80% stand establishment to be acceptable in soybean, we expect, and more often see, stand reductions in soybean that are more uniform than those we see with corn. An adage that we might apply to soybean is, "When plants are easy to count without bending over, there aren't enough of them."

One concern is that those who advocate for lower seeding rates and early planting may encourage stands to be kept even when that is likely to result in a yield loss. We have learned that stands that may look inadequate when plants are small usually fill in nicely and produce high yields. This has taught us to be patient when growth starts slow and not to let emotions guide replant decisions. Still, staying with stands that are too low to produce maximum yields should not be done just to "prove a point."

Instead of laboriously counting the number of plants in a hoop or 3 ft of row, it might be faster and accurate enough to use a scale of 0 to 4, with each number the approximate number of plants per square foot. On this scale: 1 (43,560 plants per acre) would be too low; 2 (about 87K/acre) would be probably be acceptable if plants are healthy; 3 (131K) is a full stand; and 4 (174K) is more than enough. One plant per square foot is a plant every 4.8 inches in 30-inch rows, and every 9.6 inches in 15-inch rows. With a little practice, it should be possible to get close-enough stand counts with a relatively quick glance at the ground. Getting quick counts in more places is usually preferable to getting counts that are more accurate but taken in fewer spots.

I took the same approach to estimating expected outcomes from replanting soybeans (Table 2) as I described above for corn. We do not have much data from recent studies that included both planting date and seeding rate, so our conclusion that soybeans respond similarly (on a percentage basis) to seeding rate at different planting dates is not well supported. Joshua Vonk did some studies that included both seeding rate and planting date in 2010 and 2011 and found no interaction between these two factors across sites. But as others have found, he didn't see much response to seeding rate, so not finding such an interaction was expected. Those studies also didn't include planting quite as early or quite as late as the table includes, and so the indication that 50,000 plants will yield only 10 percent less than 130,000 plants when planted in mid-June isn't as solid as we'd like. The fact that planting that late should produce good stands means this isn't a big issue.

Table 2. Soybean Yields (Percent of Maximum) for Different Combinations of Planting Date and Plant Population. Derived from the Results of 29 Planting Date and 25 Seeding Rate Trials in Illinois

Planting date	Plant stand, 000/acre										
	50	60	70	80	90	100	110	120	130	140	150
	----------Expected yield, % of maximum----------										
Apr 10-20	89	91	93	95	96	97	98	98	99	99	99
Apr 21-30	88	90	92	93	94	95	96	97	97	98	98
May 1-10	86	88	90	91	92	93	94	95	95	95	96
May 11-18	83	85	87	89	90	91	91	92	92	93	93
May 19-26	81	83	84	86	87	88	88	89	89	90	90
May 27-Jun 3	78	80	81	82	84	84	85	86	86	86	86
June 4-11	74	76	77	79	80	81	81	82	82	82	83
June 12-19	70	72	73	74	75	76	77	77	78	78	78

According to Table 2, as much yield will be lost from planting after May 20 as from losing nearly half the stand from April-planted soybeans. As suggested above for corn, I propose that we modify the numbers on Table 2 this to reflect that fact that soybeans got off to such a slow start, with frost on May 9 adding to their delay in development. For soybean, I suggest adding 20 days to the actual planting date if planting was done between April 11 and April 30. In evaluating stands, we should only count those plants that are showing enough new green tissue to show that they will probably regrow into productive plants.

Unlike corn, there's no need to destroy existing soybean plants when replanting. In a study we did some years ago, supplementing low plant stands with a reduced amount of seed or destroying the low stand and planting a full rate of seed produced the same yield. That means that there's no need to incur the expense of destroying existing plants when replanting. It also means that replant seeding rates need only be high enough to restore final stand (including plants killed when driven over) to 120,000 or so per acre.

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