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Managing When Planting Is Delayed

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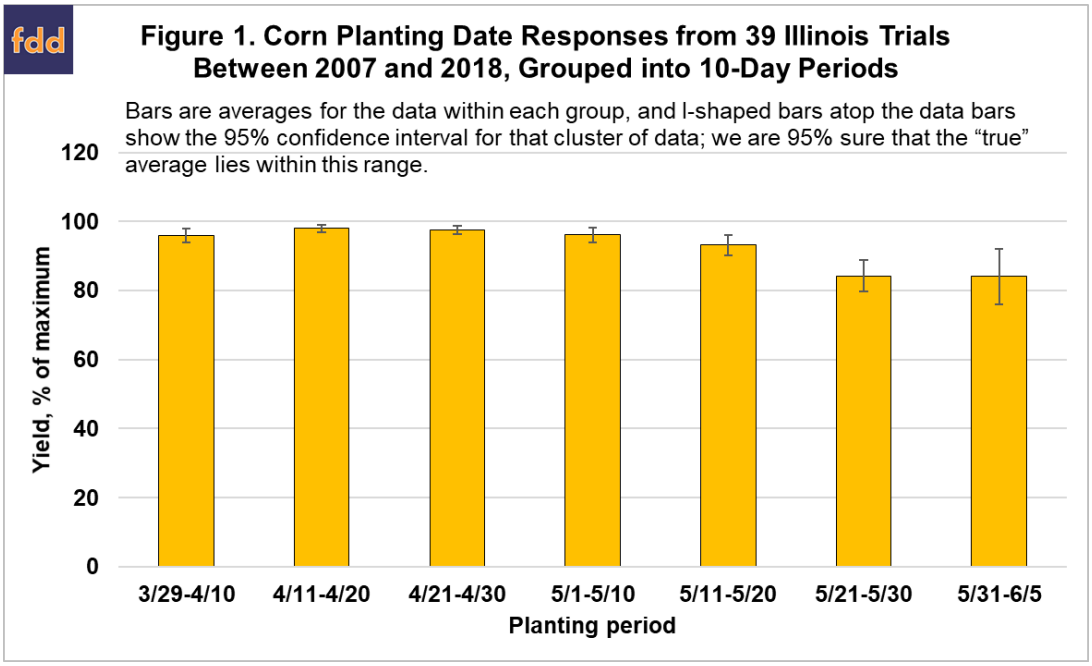
With only 9% of the Illinois corn crop planted by April 28 and with 3 to 5 inches of rain this past week in the northern half of the state, and above normal just about everywhere else, there has been little further progress. The start in 2018 wasn't much earlier than this, but planting was very fast once it started, and we finished earlier than normal. That will not repeat in 2019. In fact, the progress report released today (May 6) shows that corn went from 9 to 10% planted over the past week (it was 68% one year ago), and soybean planting remained unchanged at 3%. There might be a little less rain this week than had been forecast, and we hope to see some fieldwork where rainfall amounts last week were lower.

Scott Irwin and Todd Hubbs summarized the corn planting date data that we've generated over the past decade in an April 24 *farmdoc daily* article, which they followed by an analysis of this year compared to previous years with wet weather early and a slow start to planting. Even though it's only early May, the weather forecasts are not promising an early end to the current pattern. And while late planting doesn't always mean lower yields, it takes unusually favorable conditions the rest of the growing season for yields of corn planted in late May to be as high as those from planting in late April. In 2017, a lot of the Illinois corn crop was replanted or planted late, and later-planted corn often yielded more than early-planted corn. That has also happened in a few of our planting date trials. Still, averages tell us that this is not something we should expect.

As I did with soybean planting date response data in the Bulletin on April 12, I grouped the corn planting data we have (from 39 trials over the past 12 years) in order to take a closer look at responses. Each trial had four planting dates, ranging from early April to late May or early June. For analysis, yield data were converted to % of the yield at the highest-yielding planting date for that site. Figure 1 shows the data grouped by 10-day planting periods, along with "95% confidence intervals" on each average—these provide an indication of how variable the data are within each range.



Even though we can see yield declining as planting is delayed, the confidence intervals overlap for all of the planting dates groups through the May 11-20 group; in other words, yields (as percentages of the trial yield maximum) were not statistically different between any of the groups from late March/early April through May 20. Even though each of the last two bars are the same height, the data for each of these was variable, as indicated by the wide confidence intervals. Both included a few points at 100%, meaning that corn planted late yielded more than corn planted earlier in a few trials. Unlike soybean, which yielded 100% for all planting dates through April 20, each planting period for corn included some points less than 100%. This was not related to low stands, but seems to have been a physiological effect, perhaps brought on by cool temperatures at some point during early growth.

Corn or Soybean First?

Our date show that corn and soybean yields decline about the same, on a percentage basis, as planting is delayed; that's about 3 bushels of corn for each bushel soybeans lost due to late planting. In April, the decision on which to plant first should be based on which crop is likely to emerge to best in cool soils to form a stand, so is less likely to need replanting. Replant seed cost might play a part in this decision, as well as crop insurance considerations. Neither crop is likely to emerge very well when heavy rain falls right after planting. All seeds need oxygen to germinate, and so when soils are warm enough for germination to begin but the soil is saturated, seeds die from lack of oxygen. So it's likely that fields or parts of field planted to either crop before the end of April and where inches of rain fell soon after planting will need to be replanted. Given the nature of the soybean seed and the quality of the 2018 soybean seed crop, the chances of needing this are a little higher for soybeans.

Corn will generally survive cool, wet soil conditions a little longer than soybeans, in part because its germination temperature is a little higher, and slower germination in cool soils might allow enough time for oxygen to get to seed depth, compared to soybean. Shallower planting of soybean might eliminate this advantage, and the fact that we need more than 90 to 95% of corn seeds to emerge but only 80 to 85% of soybean seeds to emerge is also in favor of soybeans. By the time a lot of fields dry out, soils should be warm enough so that both corn and soybean emerge well (unless heavy rain falls again after planting), and so the answer to the question of whether to start planting corn or soybean first in May is "both." If it's possible to put an additional planter into service to help get this done, that might pay, especially if we get past mid-May before planting can begin.

Variety and Seeding Rate

Corn plant development follows reasonably well the accumulation of "modified" growing degree days (MGGD), which is the number by which the average of the high and low air temperatures for a day exceeds 50 degrees. The modification consists of assigning a low temperature of 50 if the daily minimum

is less than 50 degrees, and a high temperature of 86 if the daily high exceeds 86 degrees. The low cutoff prevents negative MGGD—plant growth can be zero but not negative—and the high cutoff is because high temperatures in the 90s tend to be accompanied by plant stress that keeps development rates from continuing to increase along with temperature when it's already hot.

The maturity rating of a corn hybrid is related to the number of MGGD that the hybrid needs to go from planting to maturity (black layer.) There isn't a set conversion factor for this, but as a rough guideline, a 100-day relative maturity (RM) hybrid might require about 2,500 MGGD, and the MGGD increases by 20 to 25 for each day later in maturity. So a 105-day RM hybrid may require 2,600 and a 110-day RM hybrid may need 2,700 MGGD. Most companies assign an MGGD number to each hybrid.

When planting is delayed, we can use historical MGGD accumulation numbers to estimate the chances that an individual hybrid, when planted late, still should accumulate enough MGGD to mature before frost. Table 1 below gives normal (averaged over a lot of years) MGGD accumulations from May 1, May 15, and May 30 to the end of September for different regions of Illinois. Using September 30 as the last day is a little conservative: the average date of first frost ranges from about October 10 on northern Illinois to October 20 in southern Illinois, so some MGGD can accumulate in October. Such accumulations are often slow, though, and frost occasionally occurs as early as late September.

Table 1. Modified Growing Degree-Day (MGGD) Accumulations From Early, Mid-, And Late May Through September 30 for Northern, Central, and Southern Illinois

	MGGDs to September 30 from:		
	May 1	May 15	May 30
Northern IL	2,765	2,624	2,420
Central IL	3,002	2,839	2,609
Southern IL	3,248	3,064	2,806

Over the past six years in Illinois, MGGD accumulations have averaged about 90 MGGD above normal for May 15 to September 30, and about 70 MGGD above normal for the period May 30 to September 30. Over those years, though, this difference has ranged from about 100 MGGD less than normal (in 2014) to some 280 MGGD above normal (in 2016). So above-normal temperatures can allow a hybrid planted late to mature, but depending on when they happen, high temperatures can also lower yields by increasing stress. Today's hybrids are much better able to tolerate stress than older hybrids, and this means less yield loss from late planting that we might have seen 20 or more years ago.

Even though good yields are possible when we plant late, and we can get lucky by having high temperatures just at the right time (early or late in the season) that speed development without costing a lot of yield. Bob Nielsen at Purdue and Peter Thomison of Ohio State also showed in their research that late-planted corn can require fewer MGGDs than hybrids are rated for, although this effect wasn't very consistent over years, and lower MGGD accumulations tended to be associated with lower yields. So it might make sense to replace a fuller-season hybrid with a shorter-season one if planting is delayed to the end of May this year. That's mostly an issue in northern Illinois, and where the initial hybrid chosen (with the hope that planting could be done early) was later than about 108 days RM. In central Illinois, hybrids later than about 112 days RM might have an issue getting mature if planted as late as the end of May, but the risks of this are not high. There's little issue in southern Illinois unless the first-choice hybrid was unusually late in maturity.

We know no good reason to adjust corn planting rates as planting is delayed. If planned rates are too high or too low, adjusting them is probably a good idea regardless of planting date. But with an expectation of slightly more risk of mid-season stress due to lack of adequate soil moisture when planting is late, and with the expectation that later planting into warmer soils tends to produce better stands, small downward adjustments in seeding rate might not hurt, especially if planned rates initially were above 36 thousand seeds or so per acre. Today's hybrid don't go barren under stress like hybrids once did, but they also tend to produce maximum returns at seeding rates less than 40,000.

For soybean, there's no need to consider adjusting maturity or seeding rate when planting is delayed. As I wrote in the Bulletin on March 11, maturity has little effect on the response to planting date. Joshua Vonk and Vince Davis did a seeding rate x planting date study at a number of Illinois sites in 2009 and 2010,

and saw no consistent benefit to changing the seeding rate as planting was delayed. The former "conventional wisdom"—that late planting means smaller plants and so the need for more plants—has not been validated by recent research in other places, either. Later-planted soybeans tend to emerge better when soils are warmer, at least when there's no heavy rainfall right after planting.

Nitrogen Management

Managing nitrogen fertilizer is one of the biggest challenges in establishing the 2019 corn crop. As I wrote in the Bulletin on March 26, fall N application was limited by wet soils; that is accurate regarding spring application as well, which lags far behind normal, and far behind what most Illinois producers had planned and hoped for.

I won't rerun here the scenarios from that article—some are no longer relevant—but will emphasize only the fact that we need to avoid having corn plants emerge and start to grow with their nodal roots growing into soil with very low levels of N. We've seen in recent research a number of cases when waiting to apply N until plants are at V5 stage or later can lower yields, even when enough N is applied later. We have also found that applying low rates of N at planting with the bulk of N applied during sidedress tends to produce lower yields compared to applying most of the N at planting and the rest as sidedress.

With a lot of fields still without any fertilizer N, and the pressure to plant the crop increasing as time goes on, how do we get fertilizer N on the crop this year? With the inches of rainfall in recent days, we can be fairly sure that a lot of nitrate-N has moved down in the soil, at least to below the rooting zone for small plants. Fields that have not gotten any fertilizer probably didn't have much nitrate present anyway, but April was warmer this year than in 2018 (even if it didn't feel like it) and bare-soil temperatures at 4 inches deep have been ranging between 50 and 60 degrees for the past week. So some mineralization is taking place, and by the time planting can begin, there should be more soil N than there is now. That means that we should be able to get by with less of the fertilizer N applied by the time the crop emerges than if we were planting into colder soils.

Or those who plan to stay with planting-time applications of UAN as a carrier for herbicide, then coming back with ammonia, UAN, or urea to apply the rest in-season, it's probably best to apply a third or so of the N fertilizer with the first application. That can include N from MAP or DAP, especially if that was applied this spring, and any N to be applied with the planter. For most people, the source of this N will UAN with herbicide, broadcast before planting and worked in, or broadcast after planting. With one-fourth of its N present as nitrate that can move readily down into the rooting zone, UAN may be a better source for getting N into the soil quickly than sources like urea. Ammonia can work for this, but we can't place ammonia very close to the row without some risk of root damage in the event that soils dry out after application. And it will take the roots some time to get to the N in the ammonia band, especially if that band is small due to wet soils at the time of application, and if it's 15 inches away from the row.

If it's not possible to use broadcast UAN to supply the early needs of the crop, more creative ways might be considered. I responded to an email last week about a field where cereal rye cover crop had been sprayed right before planting corn. The main reasons to plant cereal rye is to take up soil N, and it does this very well; when allowed to grow up to planting time, it will strip nearly all of the nitrate from the top foot of soil. It's most likely this—not allelopathy—that makes it so risky to plant corn into recently-killed cereal rye. In order to get some N to the roots, I suggested streaming or dribbling maybe 20 gallons of UAN right on top of the planted rows, if that can be done before emergence. Urea can be dropped onto the rows instead, and won't injure plants if they've emerged, but it won't get N down into the soil as quickly. If there's no cover crop, a lower rate of UAN can be streamed or dribbled on top of planted rows, because it will concentrate N in the row.

Another way to get N on the crop is to use broadcast urea or urea-based N fertilizers. Those may be easier to get applied early, and unlike solution N, they are safe for the crop after it emerges. Whether or not to protect surface-applied urea with a urease inhibitor depends on the weather after application, but with moderate temperatures and a rainfall pattern that has been on the "abundant" side, inhibitor may not be needed. If urea is worked in after application, any ammonia released by urease activity will dissolve in soil water, so the inhibitor is unnecessary.

In-row application of UAN with a split-tube setup provides N closer to the plants than between-row injection, and can be used in larger corn than most injection implements. We have not found an

advantage to repeated application—in fact, applying N once, near the time of planting, often produces the same yield as splitting the N into two applications. We'll watch this year to see if we have conditions that suggest applying supplemental (extra) N, but with corn prices like it is now, this may not be the year for adding any expense that isn't needed.

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