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Dealing With Very Late Planting

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Few people thought we'd see so little planting progress by now, but only 45% of the Illinois corn crop and 21% of the soybean crop were panted by June 2. Planting is going on in some places the first week of June, but rain remains in the forecast, so progress is unlikely to speed up, and some "progress" may be the result of a decision not to plant some fields. We'll consider a number of management aspects as the planting season continues to stretch out.

Q: How bad is it?

A: The entire state of Illinois received above-normal rainfall in May, ranging from 1 to 2 inches above normal in the southeastern edge of the state to as much as 8 inches above normal (12+ inches total) in northwestern Illinois, from the Quad Cities to the south and east. That area had some planting days early—some of the corn at our Monmouth research center was planted in April—but that has been hammered by inches of rain. Some areas west and southwest of Illinois are even worse, with some rainfall amounts more than 12 inches above normal for May.

Q: Won't driving on soils that are still wet 4-6 inches deep compact the soil so badly that yields will suffer?

A: We've consistently said that "mudding in" corn or soybeans in April does more harm than good. But that's because planting in early April tends to produce yields no higher than planting in late April or early May; there's no reward for aggressive planting that early. Once we get to late May, things change. We don't want to get stuck in the field or to plant where the seedbed soil is too wet to crumble, but the need to get crops planted means that it makes sense to start even though we know that heavy equipment will (as always) cause compaction. Compaction from heavy equipment moving down the field (not directly on top of the row) typically does not lower yields appreciably in many of our more productive soils. While the formation of a physical barrier (if soils dry out after compaction) is a problem, pressing soil particles together as air is expelled can increase capillarity some, helping water to move to the roots from deeper in the soil. The most visible signs of compaction—plants stunted and with leaves showing drought stress symptoms—is typically on endrows, where equipment moves at right angles to rows and thus limits rooting ability more than it improves capillarity.

Q: Should we "open up" soils by tilling them when they're wet so that the surface dries out faster?

A: This is not an uncommon practice in the claypan soils in southern Illinois. The capillary rise of water from deeper layers to the surface is broken up by surface tillage, and that means slower water movement to the surface and faster drying of the surface soil. Of course, that also means that deeper layers stay wetter. The claypan is already a compacted zone, so driving on it may not do much damage. Doing surface tillage in already-tilled soil or in deeper soils may make some cosmetic improvement—the surface will look drier making us believe it's in better shape to plant—but is unlikely to do much real good.

Q: How will yields respond to very late (June) planting?

A: We don't have recent data on corn planted after early June, but in a recent paper from Iowa State [Baum et al., Agronomy Journal 111:303-313 (2018)], researchers reported yield losses of about 25% (55 bushels) by June 10, 40% (88 bushels) by June 20, and 61% (133 bushels) by June 30. So planting corn on the last insurable date (June 25) would be expected to produce about half the normal yield. There's a good chance that yields could be better than that, but for now that's the best guess we have.

Based on experiences with doublecropped soybeans in the southern half of the state, we expect yield declines to be less steep for soybean than for corn after early June, reaching 50% only by early July in south-central and southern Illinois. There is a large effect of latitude with late-planted soybeans, though, and yields of soybeans planted in late June in central Illinois are very much affected by the growing season weather, and so can be expected to vary widely. Soybeans planted after mid- or late June in northern Illinois may not mature early enough to avoid frost.

Q: Should I change corn hybrids and soybean varieties to ones with earlier maturity?

A: Maybe. Many people in northern Illinois have probably done this by now, or at least have lined up seed to do so if planting stretches out much longer. The Corn Growing Degree Day decision support tool can help with this question, but can't answer it very precisely. That tool allows one to choose any Corn Belt county, enter the planting date and hybrid maturity, and generate a graph that shows projected GDD accumulations through the season, including the date on which you can expect that hybrid, planted on that date in that county, to mature.

As an example, a 108-day RM hybrid (which the tool estimates will need 2,600 GDD from planting to maturity) planted on June 1 in Woodford County, IL is projected to mature on October 10. Because October 10 is a 12 days before 50% chance of frost there, I would not hesitate to plant this hybrid if I were able to do so by June 5. That same hybrid, though, if planted on June 1 in DeKalb County, does not project maturity until the beginning of December, or about 6 weeks after the 50% frost date. Changing to a 100-day hybrid there would move projected maturity to October 9.

One important adjustment missing from this tool is the fact that planting corn late usually lowers the GDD needed to get a hybrid from planting to maturity. In an article on his website, Dr. Bob Nielsen at Purdue includes a calculator that uses data he and Dr. Peter Thomison at Ohio State University collected to adjust the GDD requirement downward based on how late planting actually is. This is not a trivial adjustment: planting a hybrid on June 1 lowers the GDD requirement by more than 200 GDD. So a hybrid that needs 2,650 GDD to mature if planted on May 1 will require an estimated 2,439 GDD if planted on June 1. The revised GDD number can be manually entered into the GDD tool instead of days RM for the hybrid.

The downward adjustment in GDD with late planting is not a chiseled-in-stone number; in fact, if growing season temperatures are on the cool side, planting late may not lower the GDD requirement at all. We saw this in 2009, when some corn in northern Illinois did not mature by November. There are two main reasons why late planting might lower GDD requirement. One is that the crop develops under higher temperatures, and the high-temperature "cutoff" of 86 degrees may actually be higher than 86; that is, corn may grow faster at 90 degrees than at 86 degrees. The other reason is that late-planted corn tends to have more limited root growth, which adds to any stress from periods of hot, dry weather. Late-planted corn also finishes in September or October, when days are shorter and temperatures are often lower than ideal during late grainfilling.

The outcome of all this is that reduction in GDD requirements when corn is planted late is almost always accompanied by a reduction in yield. Still, if the crop ends up needing fewer GDD to mature, it's better

that this come with a longer-season hybrid than with a shorter-season hybrid, which might mature earlier but at even more cost to yield. Adding to this is the fact that 100-day RM or shorter hybrids were not really developed to be planted in Illinois, and they may not bear up very well under Illinois conditions when planted late.

Because soybean flowering responds to photoperiod, varieties of typical maturities will flower at about the same time if planted in the second half of June. So there is little need to change soybean varieties to ones with earlier maturity, except that north of I-80 in Illinois, varieties no later than MG 2.8 or 2.9 should be used if planting is delayed past mid-June. If July temperatures are normal this might prove to be unnecessary, but cool weather (especially nights) in July could delay flower to late July, and that could substantially delay maturity and push seedfilling into less favorable conditions.

Q: What do we do about nitrogen fertilizer for corn?

A: This is one of the really tough challenges, with such a wet May following a wet fall with limited N application and limited ability to apply N this spring. As with other things, we're in uncharted waters here: we have done a lot of N research over the past five years, but have had no conditions like this, and so we need to do a lot of guessing, of which only some will be "well-educated."

If a producer was "lucky" enough to get be able to apply N last fall, how much is still in the soil to be available for this year's crop, once it's planted? We can be sure that nearly all of the N applied last fall or before May this spring is in the nitrate form by now, whether or not N-Serve was used. Nitrate moves with water, and with so much rainfall and no chance for the soil to dry to halt movement, there's a good chance that most of the N has moved down into the soil, well below where the crop needs it to be once growth begins. While some of this N has likely reached the lines by now, we would expect that most of it is still in the soil, and capable of moving back up towards the roots zone when (if) water stops moving down. Where water has stood in fields for a week or more, we can expect that, at least by the time the soils there dry out, as much as half of it may be gone, lost to leaching and to denitrification. Some of the most persistent water holes won't likely be planted, which will make the need for additional N there moot.

On the positive side, with soil temperatures in the 60s and 70s now, mineralization has kicked in, and this will be an important source of N as crop growth gets underway. That takes some of the urgency away from having to apply N right at planting. Even with the soil N supply kicking in now, it will be important to get fertilizer N on by the time growth gets underway, in order to avoid deficiency. Broadcast UAN used as herbicide carrier or N applied with the planter will boost the short-term N supply and postpone the need to apply in-season N. It will help a great deal if soils dry out at some point in order to stop the downward movement of N and to allow the roots to grow and take up N, and the plants to take on the darker green color that says they are not lacking in N. This won't happen until the water coming into the plant carries with it more N than it is carrying today.

Any corn planted will likely benefit from some additional N, regardless of what's been applied up to now. With so much water moving into and through the soil, we can't count on full availability to the crop even of N applied a month ago in preparation for planting that didn't happen then. How much N we should apply once the corn crop is planted, including how much to credit already-applied N, are tough questions.

If we applied 180 lb N in the fall following soybean harvest, let's guess that 150 of it is still in the soil, and we'll further guess (hope) that rainfall will slacken enough that, at some point before tasseling, soils will dry enough so that roots can take up some of this 150 lb of N. In such a case, we should still consider applying 10 gallons of UAN (about 30 lb N) at or after planting; if not before emergence, then dribbled near the row soon after emergence. The idea is to sustain the crop as it establishes itself, with additional N coming from mineralization until the roots begin to reach and take up the N from the fall application.

If less than the full amount of N planned for application was applied in the fall or early spring, then we might similarly discount that amount—by a fourth to a third—when determining how much more to apply. If corn was planted in mid-May with only 25 or 30 lb N applied then, we should apply the rest of the N as soon as we can reasonably do so in order to ensure a good N supply as growth gets underway. How we apply this N may not matter much, as long as we get it on in a way that keeps it relatively safe from immediate loss.

Although many may be shying away from anhydrous ammonia due to the need to apply before soils dry out, remember that ammonia injection provides better retention of applied N than does any other form or

method of application. The addition of stabilizer to ammonia for in-season application is not recommended. If ammonia can be applied before the crop is more than a few inches tall, injecting it closer to the row than 15 inches can help improve access by the roots to the N. Once the crop has more than 4 leaves, application should be moved to the row middle to avoid damage to the roots.

If the main source of fertilizer N will be UAN, it should be applied using method other than surface broadcast. That means shallow injection; broadcast followed by incorporation by tillage; or dribbled, streamed, or surface-banded (all mean more or less the same thing) on the soil surface. The idea with streaming UAN is to concentrate the application so that some of the UAN moves down into the soil, where any ammonia released from urea (by urease enzyme) is captured by dissolving in soil water. Even so, applying a band of UAN in the surface leaves some of it without much protection from loss. Using a urease inhibitor may limit volatilization some, but when surface soils are warm, this won't prevent all loss. Injection is a safer method, and dribbling UAN near the row, especially once the crop has 4 or more leaves, can get the N into the crop more quickly than if the UAN is midway between the rows. If rainfall continues, the concern will shift from urea volatilization loss to movement of the N deeper in the soil.

Broadcast urea can also be a good source of N, with the advantages of rapid application and the ability to broadcast by ground or by air onto the emerged crop without damage. A disadvantage is the potential for volatilization loss, as we discussed above. Urease inhibitors like Agrotain can be used to limit such loss, but rain within a few days effectively limits losses. Controlled-release forms should be used with caution, as we are interested in having the N from urea get into the soil and to the root quickly once the crop starts to grow.

If we get lucky and rainfall returns to more normal patterns in June, we should be OK using the MRTN rates for N, which in round numbers are about 180 lb N/acre for corn following soybean in southern and central Illinois, and about 170 lb N/acre in northern Illinois, with ammonia at $600 per ton and corn at $4.00 per bushel. Rates for corn following corn are 200 to 210 lb N per acre. If June is wet like May, then we may want to go back with another 30 to 50 lb N in the two weeks before tasseling. I don't know of a good way to be sure whether this will be needed or not, but as a general guideline, having the crop take on a dark green color in mid-vegetative stages would tend to indicate that it isn't needed, while getting a lot of rain during June but still having good crop growth and apparent yield potential might be a signal to go ahead.

Q: Should we change anything regarding other nutrients?

A: When we plant into warm soils, we tend not to see, and crop plants don't experience, temporary nutrient deficiency symptoms related to having cool soils early. Any planned applications of P and K this spring that didn't get done should be delated until fall.

Q: Should we adjust seeding rates or make other agronomic changes when planting this late?

A: Probably not for corn, although seeding rates should not exceed 38,000 or so. For soybeans, there is a sense that narrow rows and higher seeding rates will help compensate for smaller plants when planting is late. That hasn't been fully supported by research, but it certainly makes sense to avoid low stands and the potential for incomplete canopies during seedfill. Dr. Shaun Casteel at Purdue suggest increasing the seeding rate more the later the crop is planted. Our research has shown that we should have 115,000 to 120,000 plants in any case, and the important things is to make sure stands are at least that high.

Q: What about switching from corn to soybeans?

A: This is less an agronomic question than a matter of crop insurance, how much has already been invested in fields that were to be planted to corn, and current crop prices. For those with an optimistic mindset, corn prices relative to soybean prices, the fact that corn will not be planted as intended in some places (such as flooded river bottoms), and the fact that in some places in recent years (Ohio is one such place), June-plated corn has yielded well may mean sticking with corn. It's not an automatic decision to switch to soybeans when planting is so late, like it might have been a few decades ago.

Q: Is there any possibility that we could end up with good yields despite the start?

A: Trendline yields for corn and soybean in Illinois in 2019 are about 190 and 67 bushels per acre, respectively. It's too much even for an optimist to hope that actual yields will reach those levels, but if we

get the best weather possible—no temperatures above normal (and not too many days much below normal, to get the crop to maturity)—and no lack of soil moisture on a single day during the growing season, we might hope to see yields in the vicinity of 90% of those trendline yields. Even that's an audacious hope, but we haven't tested today's hybrids and varieties under such conditions in the past five years, and I'm hoping we'll be surprised at what they can do in 2019.

This article is modified from one that appeared in the Bulletin May 31, 2019.

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