



Corn and Soybean Crops Move towards the Finish Line

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After the worst start to a cropping season in decades due to the wet spring, lack of rain in parts of Illinois since early July, and season-long low crop ratings, it's time to take a look at what comes next as the 2019 cropping season moves into its final stages.

Corn

The September 1 crop production report, released on September 12 by USDA-NASS, dropped the projected 2019 US corn yield slightly, from 169.0 to 168.2 bushels per acre, and dropped the Illinois yield by 1 bushel, from 181 to 180 bushels per acre. The Illinois crop does look a little better than we thought it would by now, given that more than half of it was planted after June 1. Canopy cover and color in early July were mostly good, but lack of rainfall and a less vigorous root system on late-planted corn meant that water stress began to show up in parts of Illinois. In areas where the dryness continued through August and into September, some later-planted fields have little green leaf area left, and ear tips have dropped in drier parts of fields, signaling an end to grainfilling.

The driest part of the state has shifted south a little with some rain in September in the area near the Quad Cities; the driest band is a few counties wide on both sides of an east-west line through about Peoria, all across the state. This area shows up as being abnormally dry or in moderate drought on the current (September 12) U.S. drought map. The northern few tiers of Illinois counties are mostly wet, and southern Illinois ranges from good moisture (from August rainfall) in the region east of St. Louis, to areas that are drying out farther south. Although late planting has gotten most of the attention, rain amounts, including lack of rain in some areas and more than needed in others, will be a big part of the 2019 cropping story. Late planting made the lack of adequate water a bigger problem.

Many late-planted fields showed signs of water stress before soil moisture was depleted, and some ended up with shorter-than-normal plants. These both point to soil compaction as an issue: the smaller root systems and drying surface soils showed that access to water deeper in the soil was restricted. Earlier-planted fields showed less of this, even if they were planted into compacted soils, because their root systems were able to get deeper and develop more extensively before soils dried out. Some soil compaction is always present after tillage and planting using heavy equipment, but roots of early-planted

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corn can usually make connections to tap water from deeper in the soil, and so suffers less from compaction.

Temperatures this season have tracked very close to normal: from May 1 through September 15, the statewide GDD accumulation is about 2,880, which is 45 GDDs above normal. This total ranges from about 2,550 in northern Illinois, to 2,800 in central Illinois, to more than 3,000 GDD in the southern part of Illinois. Had the crop been planted by early May, nearly all fields in central and southern Illinois would be mature by now. According to September 15 NASS report, only 14% of the state's crop is mature, and 1% has been harvested. Corn of mid-maturity (110 days RM) planted in mid-May in the Champaign area this year has gotten enough GDDs (about 2,750) to reach maturity by September 15. Corn planted on June 1 instead of May 1 in northern and central Illinois lost about 350 and 450 GDDs, respectively, from late planting, but above-normal temperatures most days since early September have helped to recoup some of that: by September 15, June 1-planted corn in northern and central Illinois had accumulated about 2,230 and 2,380 GDDs, respectively. Corn planted on June 15 lost an additional 250 GDDs or so, and so accumulated about 1,980 and 2,130 GDDs by September 15 in northern and central Illinois.

If we assume for simplicity that hybrids grown in northern and central Illinois require 2,550 and 2,700 GDDs from planting to maturity, corn planted on June 1 still needs about 325 GDD after September 15 in order to reach maturity. With above-normal temperatures forecast for this week and near-normal temperatures for the last week of this month, GDD accumulation during the last half of September should be close to 250 GDDs—about 50 more than normal—this year, bringing June 1 to September 30 totals to about 2,500 in northern Illinois and to about 2,625 in central Illinois. That doesn't sound much different than normal, but with GDD accumulations slowing to a crawl in October, getting to within only 100-150 GDDs still needed to reach maturity by the end of September is a real positive for the late-planted crop this year. Corn planted on or after June 10 is still likely to need more GDDs to mature than it will get by mid-October, but the extra GDDs in September will help.

What if corn doesn't get enough GDDs to mature fully before its leaf area is gone due to drought, disease, or frost? According to the Iowa State University publication *Corn Growth and Development* (PMR 1009), dry matter accumulation slows considerably near the end of the grainfilling period: it takes 380 GDDs to accumulate the last 10% of kernel dry weight, and 205 GDDs to accumulate the last 3% of kernel dry weight. So having the corn stop filling with 200 GDD yet to go should not cost a lot of yield. That depends somewhat on how grainfill ends: a hard freeze (28 degrees or less) stops grainfill and starch formation in the kernels quickly, while slow deterioration of the leaf area before grainfill ends allows more sugar to move into the kernels and be converted to starch to add dry weight. Kernels that don't fill completely tend to have a constricted base where they attach to the cob, and that can mean lower test weight. If frost stops the conversion of sugars to starch, kernels remain unfilled to the tip and also accumulate sugar there, which can slow field drying and can make kernels discolor more easily during heated-air drying.

In the drier areas of Illinois we're seeing plants even in late-planted fields starting to die in patches, with ear tips dropping and leaves drying up. Such patches are typically where soils hold less water, and in some fields also in low areas where there was damage from standing water early or perhaps more compaction at planting. If other areas in the field are still green, we expect patches where the crop died early to show lower kernel weights and yields. Such fields will likely show considerable variability in kernel moisture at harvest as well.

High harvest moisture and the need to dry the crop will be major themes as we head into harvest this year, especially if October turns out to be cool and wet. Fields that are approaching maturity now are showing good loosening of the husks, which means faster drying in the field. Late-planted corn with several more weeks to go before maturity is likely to dry much more slowly, and this could mean some difficult decisions about whether to let the crop dry longer in the field or to harvest it and pay more for drying. How well the crop is standing may influence this decision. We don't have any indication that stalks are weaker than usual, and we'll cross our fingers and hope we don't get strong winds over the coming weeks that could break even sturdy stalks.

Soybeans

With 80 percent of the 2019 Illinois soybean crop planted after June 1 and some 10% planted after July 1, we set a new record for late planting of soybean in Illinois. With such late planting, flowering and pod setting took place two to three weeks later than normal. By September 15, NASS crop progress reports

had about 25% of the Illinois crop showing loss of (green) leaf color, which means that seedfilling is beginning to come to an end. That's about the same percentage of the crop that began to set pods by August 1. That's positive news: 6 weeks between the podsetting and loss of green leaf color is about what the crop averaged over the past five years, and the duration of this period is associated with yield formation. This means that at least the early-maturing crop isn't coming to a premature end.

One thing that late planting might have resulted in, at least in many areas, is lower pods numbers. Plants I've looked at certainly have some pods at most nodes, but they aren't crowded on the stem (nodes) like we saw in a lot of fields in 2018. Reasons for this include: 1) late canopy formation, which likely limited the supply of sugars needed to set pods; 2) less favorable (lighter green) canopy color in some fields; 3) lower than normal numbers of nodes with pods, especially in dry areas where plants are short; and 4) low pod numbers per node, meaning that more flowers failed to set pods. Many plants have only two or three pods per node, and only 10 to 12 nodes with pods. There seem to be more productive (pod-bearing) branches than normal in some fields, possibly because main stem growth was limited so branches had more resources, so produced more pods. We don't know if this affects yields compared to having most or all of the pods on the main stem, but given that it affects which leaves end up in full sunlight, it might mean lower rates of seedfilling in the branch pods.

Another factor that is likely to lower soybean yields in 2019 is the late start of podsetting followed by the late start of seedfilling. Even though the duration of podsetting and seedfilling is not much less than normal so far, days in September are shorter and average temperatures a little lower than in August, so there's a little less daily photosynthesis as seeds fill. This could affect plants that are still green. Based on changes in average temperatures and daylength, the amount of daily photosynthesis (on a day with full sunlight) in central Illinois drops by about 55% from September 1 to September 30. Most of this is due to lower temperatures. The fact that temperatures have been running above normal this year should help to limit this decline.

One of the difficult-to-predict differences between early- and late-planted soybeans is the timing of crop maturity. Although we've leaf color loss begin this year at a favorable interval compared to when pods began to form, we don't know if this will continue to be the case as the late-planted crops moves to maturity. We think that the signal to end seedfilling originates in the pods—plants without pods stay green, and even the leaf that feeds a single node without pods may stay green. It's possible that the timing of this signal is related to how many pods are on the plant and to what extent the seeds in these pods have filled.

Except for the ongoing dryness in some areas, warm temperatures in September are providing a positive boost to soybeans they approach the end of the season. We'll still need to wait to find out how well seeds of the late-planted fill before leaves lose their color, but soybean yields are more closely tied to seed numbers (per acre) than to seed weight, and in the parts of Illinois most affected by late planting and dry weather where seed numbers are already lower, yields are also likely to be lower. At 120,000 plants per acre and 3,000 seeds per pound, yield in bushels is the number of seeds per plant divided by 1.5. At 2.5 seeds per pod, each pod per plant would mean 1.67 bushels per acre, and 30 pods per plant would mean 50 bushels per acre. Average pod numbers per plant are less than that in many of the latest-planted fields and in fields that have been under stress due to dryness.

The August 1 Illinois soybean yield estimate of 55 bushels per acre was lowered by two bushels, to 53 bushels per acre, in the September 1 estimate. There will be both some very high and some very low soybean yields in Illinois fields this year. While the current stretch of warm, sunny weather will help to fill the green pods on green plants in many of the late-planted fields, what pod numbers are present now won't increase. While we don't expect to set many (high) yield records, yields in many fields will still be decent in 2019, and probably better than we had feared when the planters were running in late June.

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