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Department of Agricultural and Consumer Economics, University of Illinois Urbana-Champaign

Corn and Soybean Crops at Mid-Season, 2019

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July 26, 2019

***farmdoc daily* (9): 137**

Recommended citation format: Nafziger, E. "Corn and Soybean Crops at Mid-Season, 2019." *farmdoc daily* (9): 137, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, July 26, 2019.

Permalink: https://farmdocdaily.illinois.edu/2019/07/corn-and-soybean-crops-at-mid-season-2019.html

The 2019 Illinois corn crop reached 50% planted during the first week of June, more than a month later than the average of the past five years. The soybean crop reached 50% planted a few days later than corn, and more than three weeks later than the average of the past five years. That makes late July "mid-season" this year.

May rainfall was above normal over almost all of Illinois, and June rainfall was near normal over much of the state. Still, the late planting coupled with too much or too little rainfall since planting in many areas produced July crop condition ratings of only about 40% good + excellent for both crops, compared to an average of some 70% over the past three years.

Corn

While corn crop condition ratings haven't improved over the past month, the warm temperatures and good sunlight have resulted in good growth of the crop in most fields, except in low, wet spots. Leaf color of the crop has also improved, as soils have dried enough to allow the roots to reach N from both fertilizer and from mineralization. This has helped the crop plants and crop canopy to recover some from the rough start.

The 20% of the corn crop planted between mid-April and mid-May has completed pollination, in line with growing degree day accumulations: at Champaign, about 1,400 GDDs accumulated between May 15 and July 15, enough to get a 110-day RM hybrid to pollination. That number was only about 1,140 at DeKalb, where little corn was planted by mid-May in any case. With little disease or insect pressure and with dark green leaves, most of the fields that have finished pollination should have high kernel counts, which means high yield potential.

Most of the Illinois corn crop was planted form late May to mid-June, and much of this late-planted crop has yet to reach pollination: only 19% of the Illinois crop pollinated by July 14, and 36% by July 21; these correspond to the amount of corn that had been planted by about six weeks earlier. June 1 through July 15 GDD accumulations totaled about 930 at DeKalb, and about 1,060 at both Champaign and Mt. Vernon, in southern Illinois. At recent GDD accumulation rates of 25 to 30 GDD per day, corn planted in early June is at or near the start of pollination. Corn planted after June 10 may not pollinate until early August, although early hybrids—we can estimate about 10-11 fewer GDD for each day earlier in RM, or

about 2 days earlier for each 5-day drop in RM—may pollinate by the end of July. Late pollination means that objective yield estimates, which use kernel counts, will be difficult to make before August in late-planted fields.

There is ongoing concern about how the season will end for the late-planted crop, including whether or not it will mature before frost. If fall frost comes at or after its 50% date, which is October 15 to 20 depending on location in Illinois, the late-planted crop should be at or close to the GDD needed to mature by that time, as long as the maturity of the hybrids planted was adjusted for very late planting. June 1 through September 30 GDD accumulations for northern, central, and southern Illinois average about 2,400, 2,600, and 2,800, respectively. Including October 1 to 15 adds about 150 GDD to these totals, or 10 GDD per day. But delaying planting from June 1 to June 15 subtracts about 300 GDD, or about 20 GDD per day of delay. So in northern Illinois, corn planted on June 10 is expected to accumulate only about 2,350 GDD by the average date of first frost. That's enough to get a 95-day RM hybrid close to maturity, but not a 110-day hybrid. While a decrease is the number of GDDs required for a hybrid when it's planted late has been noted, we have not seen a decrease in the number of GDDs needed to get the crop to its current stage so far this year, and any decrease in the number of GDDs required from now to maturity will come from late-season stresses that limit the length of the grainfilling period, thereby lowering yield.

The main challenge facing the corn crop at this point, especially the late-planted crop, is having enough water to maintain growth and to set, retain, and fill enough kernels to reach its yield potential after the difficult start to the season. While there is enough soil moisture to maintain the crop in most Illinois fields now, the late-planted crop in parts of Illinois that have received less than normal rainfall in July has been showing increasingly severe symptoms of water stress when afternoon temperatures are high. To some extent this is because the root system of the late-planted crop is somewhat limited, both due to compaction from planting into wet soils and because late-planted corn that develops under high temperatures tends to favor top growth over root growth. So even though the late-planted crop has used less water up to now than the early-planted crop and so has more water in the soil, access to this water is somewhat limited, and the result is leaf-curling by early or mid-afternoon. In drier areas, even the early-planted crop is showing some afternoon stress, especially on slopes where the soil holds less water. After pollination there is less leaf-curling, but leaf surfaces take on a silvery-gray appearance as stress increases.

The cylinder formed by a curled corn leaf under water stress cuts the windspeed across the leaf surface and lengthens the distance the water vapor has to move once it exits the leaf, so greatly decreases the rate of water loss. That might seem like a good thing, but leaves that aren't losing water very fast also aren't taking in carbon dioxide very fast—that is, their photosynthetic rates are low. Low photosynthetic rates mean slow growth, and while a few days of water stress before pollination won't lower yield potential by very much, a week or more of decreased photosynthesis will often decrease kernel number, and so will lower yield potential. If such stress continues after pollination, more kernel abortion will lower yield potential even more.

Although the yield potential in early-planted fields without standing water damage appears to be high now, getting the crop to reach the potential represented by kernel counts of 16 to 20 million kernels per acre will, by 10 days after pollination, require about 8 more inches of water. Depending on soil texture and current soil water supplies, perhaps half of that amount of water will need to come from rainfall over the next 40 days or so. The late-planted crop is likely to set somewhat fewer kernels, but it will likely need 10 or 11 more inches of water in order to pollinate and fill kernels successfully. Rain in the places this past week might have helped to increase the size and competency of the root system and so help the late-planted crop better extract water that's in the soil. But as pollination approaches, the plant shifts its allocation of sugars (from photosynthesis) away from roots and stalks to development of the ear and to completion of the pollination process. So in fields where the crop is under water stress now, the chances of getting good yields will continue to diminish the longer it goes before rain arrives. Cooler temperatures this week slowed the rate of this decrease by slowing the use rate of water, but in fields that are under stress now, it will take rain before pollination in order for the late-planted crop to regain some of the yield potential lost with late planting.

Especially in the late-planted crop, there is some talk about needing to apply foliar fungicide and, in some cases, perhaps more N fertilizer. If enough N was applied earlier, there should be no need to apply more, especially if the upper leaves have a dark green color in the morning before stress begins to show. Some

have suggested that late-planted corn will more likely need foliar fungicide, with the idea that protecting the canopy is more important when (with late-planted corn) there is less leaf area, or perhaps with the expectation that fungal diseases will more likely attack corn that pollinates late. We have had foliar fungicide applied at pollination as a treatment in our planting date studies since 2010, and even though we did not plant as late as some of the 2019 crop was planted, we have not found that fungicide increases yield of late-planted corn more than it does of early-planted corn. Averaged across 21 trials in the northern half of Illinois, foliar fungicide increased the yield of corn planted in early April by 7 bushels per acre, and increased yield of corn planted in late May by 6 bushels per acre. Across 12 trials in the southern half of the state, fungicide increased the yield of corn planted in mid-April by 7 bushels, and increased the yield of corn planted in late May to early June by only 2 bushels per acre. With corn crop prospects so closely tied to the water supply for the rest of this season, spending money on additional inputs (besides irrigation) may not be very helpful to the bottom line.

Soybeans

Most of what I mentioned about corn crop condition and planting above applies to soybean as well, with even fewer soybean acres planted early (in April) this year. Even if soybeans were planted early and produced good stands, wet, cool weather in May limited growth. In a planting date study at Monmouth this year, soybeans planted on April 9 were about 18 inches tall on July 17, and, in 15-inch rows, they had formed a near-complete canopy. Most of the soybeans in Illinois, though, are “canopy-challenged” this year, and it’s likely that some of the 30-inch rows will never form a complete canopy. Late planting also resulted in a slow start to flowering—only 30 percent of the crop flowered by July 21 this year, compared to 87% on the same date in 2018, and a 5-year average of 72%.

Like corn, late-planted soybeans in the drier parts of Illinois are showing symptoms of water stress. These aren’t as noticeable as they are in corn, but are mostly seen as a slight drooping of leaves in the afternoon as the stress intensifies. The result is the same, though—plants under stress for much of the day do not do photosynthesize very well, and so they cannot growth very fast. This is compounded by the fact that late-planted soybeans have small root systems that can’t get access to very much soil water, and as a result, leaf area and plant height are increasing slowly. Root damage from wet soil conditions after planting also contributed to this in some places, and growth has been slow in these fields or parts of fields as well. As we know from past experience, soybeans are likely to “come around” and make good growth once they get past their initial period of slow growth, but it’s certainly better when that happens in late June than when it happens in late July.

While we’ve historically said that soybeans are less sensitive to late planting than corn, that is more true when soybeans yield 40 to 50 bushels per acre than when they yield 70 or 80 bushels per acre, as they have done in many Illinois fields in recent years. Rapid early growth and canopy formation is the key to high soybean yields, and this has not happened—and will not happen—in Illinois in 2019. With only about 20% of the Illinois soybean crop emerged by two weeks before the longest day of the year (June 21), the hours of sunshine during the longest days of the year did little for the crop. The only path to good yield potential this year will be through a turn to unusually favorable weather, with good rainfall and temperatures in August and good rainfall and above-normal temperatures in September. We know from doublecrop soybeans that yields of 50 bushels per acre or more are possible when planting is late, but that does not tend to happen when growth through mid-July is as limited as it is in many field this year. We don’t have much information on how soybeans planted in late June or early July will do in central Illinois, but the limited growth of the late-planted crop so far is not very promising.

Along with symptoms of water stress in some soybean fields is a lightening of canopy color that may indicate lack of adequate nitrogen. In fact, the N fixation process is sensitive to plant stress, and this could be a factor. It’s also the case that soybean leaves tend to give up their N (that is, break down proteins and export the N to the rest of the plant) as stress continues, in some cases even dropping leaves like they normally do at the end of the season. There are two reason why loss of leaf color is a concern. One is that soybean plants store significant amounts of N in their leaves by the time podsetting starts, and how much N is stored this way is a major factor how many pods set and how well seeds fill. The other concern is that paler leaves means lower current photosynthesis, and so slower growth. The “dark green blanket” of plants and leaves that we saw in nearly every field in mid-July in 2018 is not present in very many fields this year, and the time left in which to form such a canopy is growing short as August approaches.

As with late-planted corn, some have proposed adding N or using foliar fungicides as a way to lower the stress on soybean plants and to increase yields this year. But when growth is limited by the amount of water available, either because soils are dry or because roots don't have access to the water in the soil, then adding other inputs is unlikely to add much yield. In the soybean planting date studies we conducted since 2012, we included a treatment comparing foliar fungicide (usually with an insecticide as well) with no fungicide at each planting date. Over six trials in southern Illinois, foliar fungicide produced an average yield increase of 4.1 bushels per acre when planting was in mid-May, and of 3.7 bushels per acre when planting was in mid-June. Across 17 trials in central and northern Illinois, foliar fungicide increased yield by 2.5 bushels per acre when planting was in late April, and by 1.7 bushels per acre when planting was in early June. We have not done similar studies using fertilizer N, but have found such limited response to using N on soybeans that it's unlikely that it will ever pay on soybeans, especially on soybeans with limited early growth.

As I've often stated, the crop canopy will "tell the tale" of this year's corn and soybean crops better than any other thing we can look at. If in mid-August we see fields with dark green leaves, we can have hope for good—if not great—yields.

This article is slightly revised from the article published in the UIUC Bulletin on July 19, 2019:
http://bulletin.ipm.illinois.edu/?p=4830