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Pest&Crop newsletter

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In This Issue

Armyworm, an Unwanted Concern in This Delayed Season

(John Obermeyer)

Armyworm moth captures have varied throughout the state, with some being quite impressive this spring (see "Armyworm Pheromone Trap Report"). The beginning of armyworm damage is just being noticed in Tippecanoe County; when larvae are small, their damage is negligible and easily overlooked. High-risk crops should be monitored for the next several weeks. Moths prefer to lay their eggs on dense grassy vegetation (e.g., wheat, grass hay, and grass cover crops). Larval development, has been slow with recent cooler temperatures, but will quicken with the current warming trend. Larger worms, >0.75 inch, mean bigger mouths and appetite!

Corn – Corn that has been no-tilled into, or growing adjacent to, a grass cover crop (especially cereal rye) should be inspected immediately for armyworm feeding. Hatched larvae will move from the dying grasses to emerging/emerged corn. Armyworm feeding, done at night, gives corn a ragged appearance, with feeding extending from the leaf margin toward the midrib. When larvae are numerous and/or large, damage may be so extensive that most of the plant, with the exception of the midrib and stalk, is consumed. A highly damaged plant may recover if the growing point has not been destroyed. If more than 50% of the plants show armyworm feeding, and live larvae less than 1-1/4 inches long are numerous in the field, control may be necessary. Larvae greater than 1-1/4 inches consume a large amount of leaf tissue and are more difficult to control. If armyworm are detected migrating from border areas or waterways within fields, spot treatments in these areas are possible if the problem is identified early enough. Seed-applied insecticides provide no protection from this pest, and some Bt-corn may suppress small larvae, but not once the worms are "marching."

Wheat & Grass Pasture – Examine plants in different areas of a field, especially where plant growth is dense. Look for flag leaf feeding, clipped heads, and armyworm droppings on the ground. Shake the plants and count the number of armyworm larvae on the ground and under plant debris. On sunny days, the armyworm will take shelter under crop residue or soil clods. If counts average approximately 5 or more per linear foot of row, the worms are less than 1-1/4 inches long, and leaf feeding is evident, control may be justified. If larvae are present and they are destroying the flag leaves or the heads, treat immediately.

Addendum: as this edition of the Pest&Crop was ready to be sent, I received an armyworm update from Gene Flaningam, crop consultant in southwestern Indiana. As the included picture shows, armyworm larvae are large and beginning to feed on wheat heads. Too, he indicated that armyworm are "marching" across the neighboring road. This should be a further encouragement for scouting high-risk crops!

Young armyworm larva and early corn leaf damage.

Degrees of armyworm feeding on small grain leaves, notice the window-pane damage from very small larvae.

Armyworm feeding on wheat heads, May 23, Knox County. (*Photo provided by Gene Flaningam*)

Switching to Hybrids Without Rootworm Protection

(John Obermeyer)

Desperate times calls for desperate measures. As delayed planting conditions persist and the calendar approaches June, we can't anticipate all likely miscues that will play out in the next few weeks. One brought to mind, prompted by Bob Nielsen, is that some producers may be attempting to switch to shorter day hybrids, those without desired insect traits, especially rootworm. What is the rootworm risk, especially to central and northern Indiana fields? Bottom line, if one did NOT scout corn fields during corn pollination last year, or sample soybean fields during August for the presence/absence of rootworm beetles, then the localized risk is unknown. However, Indiana as a whole, has seen lower rootworm beetle populations for several years.

First, the worst-case scenario. 2002 had a horrendous start to the growing season, first planting was delayed by excessive rains, followed by a long, hot dry spell. That year, producers pushed the window and planted into wet soil creating side-wall compaction. Producers were so hurried that inputs such as soil insecticides for rootworm protection were neglected in some cases. When drying finally occurred, the top inches of soil baked, becoming rock hard. The end result was that even a rootworm population that was not excessive caused high levels of damage by feeding upon puny, misshapen, and slow-growing roots causing "floppy corn," "small corn-tall corn," and sometimes plant death. Meaning, it took very few rootworm larvae to cause devastating damage to these already challenged root systems.

Best-case scenario. Today, seed-applied insecticides (SAIs) are applied to virtually all corn seed, though rates vary. Low and moderate rates are not labeled for corn rootworm control, but this year, because of the close proximity in timing to rootworm hatch they will likely help. Rootworm egg hatch typically begins in later May in central counties, plus or minus several days for soil temperature differences from one end of the state to the other. Although egg hatch occurs over multiple weeks, lower rates of SAIs may help long enough to protect early root development. Too, the statewide risk today from rootworm is not like it was back in 2002.

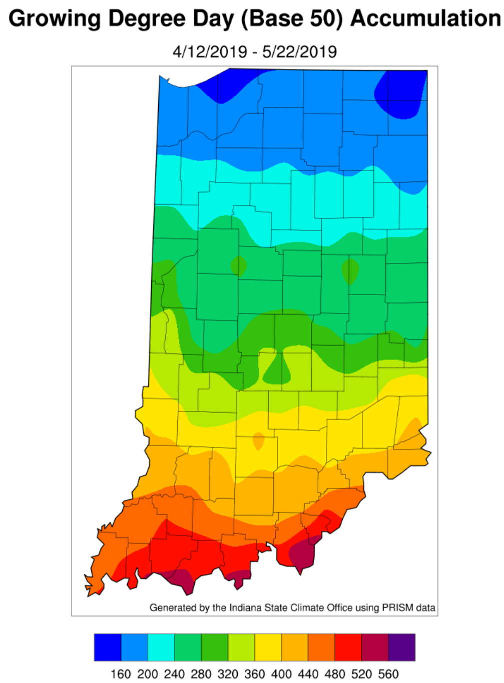
To put a positive spin on the extreme delays in planting this season, rootworm larva hatching today (May 23), or before, will likely starve to death in fields yet to be planted.

Rootworm damage to challenged root systems in 2002.

Black Cutworm Development

(John Obermeyer)

The following map, based on GDD50, is provided to assist in timely scouting of emerged cornfields for black cutworm damage. Those areas of the state that have accumulated, or exceeded, 300 GDDs since the second week of April (multiple, significant moth flights into the state) should be monitored, especially if weedy before/during planting. Because black cutworm moths were present before that time, and they continue to arrive, it is not uncommon to find larvae of varying sizes in fields. Happy Scouting!



Predicted black cutworm development, 300 or more indicates time to scout.

Armyworm Pheromone Trap Report – 2019

(John Obermeyer)

County/Cooperator	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10
Dubois/SIPAC Ag Center	5	24	91	74	8	3	77			
Jennings/SEPAC Ag Center	0	2	9	11	6	1	0			
Knox/SWPAC Ag Center	105	34	78	200	185	43	42			
LaPorte/Pinney Ag Center	0	127	312	52	51	39	186			
Lawrence/Feldun Ag Center	148	60	124	327	376	29	134			
Randolph/Davis Ag Center	0	193	183	420	446	236	162			
Tippecanoe/Meigs	8	5	127	120	361	82	291			
Whitley/NEPAC Ag Center	4	191	384	392	1222	739	1349			

Wk 1 = 4/4/19-4/10/19; Wk 2 = 4/11/19-4/17/19; Wk 3 = 4/18/19-4/24/19; Wk 4 = 4/25/19-5/1/19; Wk 5 = 5/2/19-5/8/19; Wk 6 = 5/9/19-5/15/19; Wk 7 = 5/16/19-5/22/19; Wk 8 = 5/23/19 – 5/29/19; Wk 9 = 5/30/19-6/5/19; Wk 10 = 6/6/19-6/12/19

How Bad Will Crop Diseases be in 2019 with all of the Delayed Planting?

(Darcy Telenko) & *(Damon Smith)*

We keep getting this question, because as we write this, it is storming yet again in many locations in the Midwest. Rain, rain, and more rain has pushed back timely planting everywhere. Concern is starting to mount about not only yield loss simply from delayed planting, but what increased risk of yield loss due to disease there might be in 2019. As we consider this issue, we will use tar spot of corn and white mold of soybean as just two examples of where this could be an issue.

The Plant Disease Triangle. Remember that the plant disease triangle is the foundation for understanding how plant diseases develop and how to manage them. In order for a plant disease to occur you must have a virulent pathogen, a susceptible host plant, and favorable weather conditions to coincide at the same time. If any one of these three components is missing (or we implement a management strategy that removes or reduces one component) then a plant disease will not occur. When it comes to the host component, it not only matters that the host is generally susceptible but is also at a susceptible growth stage. Consider white mold of soybeans for a minute. All stages of soybean are susceptible to infection by the white mold fungus, but most infections occur through open flowers. Thus, the **disease triangle** is met when you have (1)white mold fungal spores flying around at the same time that (2)soybean flowers are open (susceptible stage), during, (3) cool and wet weather (favorable environmental condition)completing the triangle.

The same is true for tar spot of corn. From we know so far about this new disease all stages of corn are susceptible to infection by the tar spot fungus as long as there is living, green tissue to infect. For tar spot, the **disease triangle** will be met when you have (1)tar spot fungal spores being ejected or moving around in the air, at the same time that (2)corn leaf tissue is green, during (3)cool (60-70°F) and wet weather (favorable conditions) completing the triangle (Figure 1).

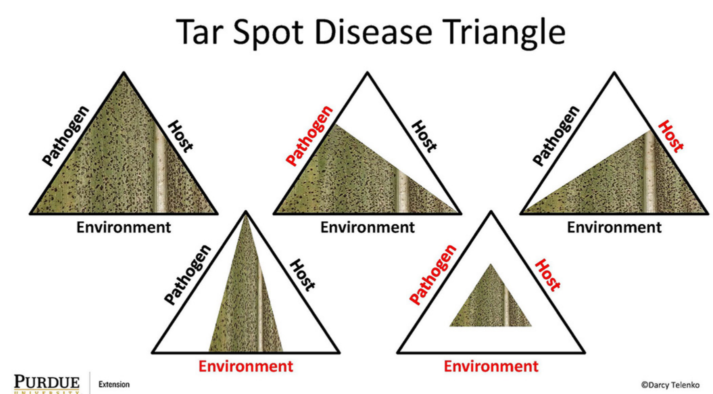


Figure 1. The tar spot disease triangle is influenced by the interaction of the pathogen (Phyllachora maydis), host (corn) and environment. If one of these components is modified the resulting disease incidence and severity will change. RED = component modified in the triangle, such as reduced pathogen inoculum, less susceptible host, and/or unfavorable environment for disease.

The point here is that if we continue in a cool wet pattern, and delayed planting continues, we may quickly find ourselves with crops at susceptible growth stages when the weather is very conducive to disease.

Delayed Planting and White Mold of Soybean. In 2017, we had an epic epidemic of white mold on soybean across the upper Midwest (Figure 2). One of the main reasons that the epidemic was so bad is that it was generally cool for a large portion of the season. This resulted in soybeans that moved very slowly from one growth stage to the next. When it came to flowering, soybeans bloomed for an extended period of time. This left them in a susceptible growth stage for about twice as long as normal. These cool conditions also coincided with wet weather that was favorable for the pathogen. In 2018, planting occurred reasonably on-time and we accumulated heat units quickly. Bloom started early in the season and was about half as long as it was in 2017. This meant that soybeans “escaped” infection in large portions of the upper Midwest. Fast-forward to 2019. If this cool rainy cycle persists, and planting is further delayed, then soybeans may again have an extended period of bloom that occurs during wet/humid weather conditions. Keeping an eye on weather before and during the soybean bloom period along with consulting the Sporecaster smartphone app (https://ipcm.wisc.edu/apps/sporecaster/) can help you make the educated decision to spray fungicide or not.

Figure 2. White mold in a soybean field. (*Photo credit: Damon Smith*)

Delayed Planting and Tar Spot of Corn. In 2018 Tar spot of corn (Figure 3) created quite a stir. The epidemic was widespread and caused some significant yield losses in areas that it occurred. The tar spot fungus is residue-borne. There is also decent evidence that it can survive over-winter on corn residue (Figure 4). Our laboratories have been investigating tar spot fungal survival on corn residue collected after snow-melt in Wisconsin and Indiana. Regardless of whether there was fall tillage performed or not, survival of tar spot fungal spores (ascospores) on the residue collected ranged between 15 and 40%, with an average around 20%. These are VERY preliminary findings (and the numbers might change once we finish counting and analyzing data), but the point is that there is viable tar spot fungal inoculum present in Midwest corn fields. Therefore, one component of the triangle is met! As for the other two components, corn is being planted later than normal and conditions are cool and wet. Again, if this cycle of cool and wet holds, conditions will be favorable for the fungus. Delayed planting of corn will also push corn into conducive growth stages for the fungus to infect and cause heavy yield losses (although, we have seen infection at all growth stages as long as there was green tissue available). One of the reasons that the 2018 tar spot epidemic was so significant, was that many areas of the upper Midwest had cool and excessively wet conditions around the V6 growth stage and again near or after the VT growth stages. When foliar diseases of corn start at early growth stages (V6 or V8) the risk for yield loss can be much higher than if they start after R2 or brown silk. Keep an eye on the weather between the V6 and R2 growth stages and consult with your local extension personnel to decide if a fungicide might be warranted for corn to prevent tar spot, or other foliar diseases.

Figure 3. Tar spot on symptoms and signs on corn leaves. (*Photo credit: Damon Smith*)

Figure 4. Signs of tar spot fungus on corn residue.

Scouting and Watching Weather Reports Might Pay in 2019. Once corn and soybeans are planted, take the time to scout and pay attention to the weather. While thorough scouting can take time, it may be worth it in 2019. Catching a plant disease early can be the difference in being successful in managing it or not. Pay attention to the weather leading up to, and during, the critical crop growth stages. This can also help you make an educated decision about in-season application of fungicides. If it is cool and humid/rainy, and the crop is at a susceptible growth stage, then a fungicide application might be warranted. If it is hot and dry and the crop moves quickly through susceptible growth stages, then a fungicide might not be warranted. Study the disease triangle and use it to your advantage. The 2019 field season could be a year that this knowledge might be handy!

For in-season updates follow us on Twitter and Consult our websites at the links below:

Dr. Darcy Telenko

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https://extension.purdue.edu/fieldcroppathology/

Dr. Damon Smith

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For More information about tar spot, white mold, and fungicide information, consult the following resources:

Tar spot Fact sheet – https://crop-protection-network.s3.amazonaws.com/publications/tar-spot-filename-2019-03-25-120313.pdf

Short Tar Spot Video – https://www.youtube.com/watch?v=uLygYjMkXQE

Tar Spot Webinar – https://www.youtube.com/watch?v=bY4ICwsyP28&t=15s

White Mold Fact Sheet – https://crop-protection-network.s3.amazonaws.com/publications/cpn-1005-white-mold.pdf

Short White Mold Video – https://www.youtube.com/watch?v=mOZUQpcIR7s

White Mold Webinar – https://www.youtube.com/watch?v=2Oc_pEAHkRM&t=91s

Corn Fungicide Efficacy Table – https://crop-protection-network.s3.amazonaws.com/publications/cpn-2011-corn-fungicide-efficacy-for-control-of-corn-diseases.pdf

Soybean Fungicide Efficacy Table – https://crop-protection-network.s3.amazonaws.com/publications/fungicide-efficacy-for-control-of-soybean-foliar-diseases-filename-2019-03-25-121546.pdf

To Quicken Corn Planting, Should Starter Fertilizer Be Skipped?

(Jim Camberato)

To facilitate speedy planting between rain showers many growers are skipping starter fertilizer. What might be the consequences?

Our recent research has shown in continuous corn (CC) that 25 lb/acre each of N and P_2O_5 in 2×2 placement increased yield at ⅓ of the site-years by an average of 8 bushels per acre. In corn rotated with soybean (CS) increased yield occurred at ½ the site years and averaged 7 bushels per acre. Pop-up, 3 gallons 10-34-0 per acre, had little benefit in CC and was not tested in CS. Most of the yield responses to 2×2 in CC were in no-till fields, but yield increases occurred with different tillage practices in RC. Averaged over both non-responsive and responsive site-years, yield increases were less than 3.5 bushels per acre for either crop rotation. Early planting and cool soils were not related to whether or not a site responded to starter fertilizer. We found yield response to vary considerably from year to year for the same field. For example, at the most responsive field, yield increases ranged from 0 to 17 bushels per acre. In contrast to yield, starter consistently increased the rate of crop development so maturity was reached sooner. Grain moisture was less with starter than without starter – 1.2 and 0.6% for CC and CS, respectively.

If the rain stopped today and all the corn could be planted before the next rain, the earlier maturity and potential for a small increase in yield might be more beneficial than the slightly lengthier time it takes to plant. If planting continues to progress in fits and starts between rain events (which is likely given the forecast), then planting without starter may be the better decision.

Late Planting of Soybean

(Shaun Casteel)

Soybean planting progress (or the lack there of) for Indiana and much of the Midwest is one of the slowest on record. Indiana soybeans normally reach 50% planted by May 20th, but we are only at 6% by the same period. Over the past 25 years of records, we have experience similar delays in 2011, 2009, 2002, 1996 and 1995 (Figure 1). Four of those five years reached 50% planted by May 30 to June 5, while 1996 did not reach 50% planted until about June 20th.

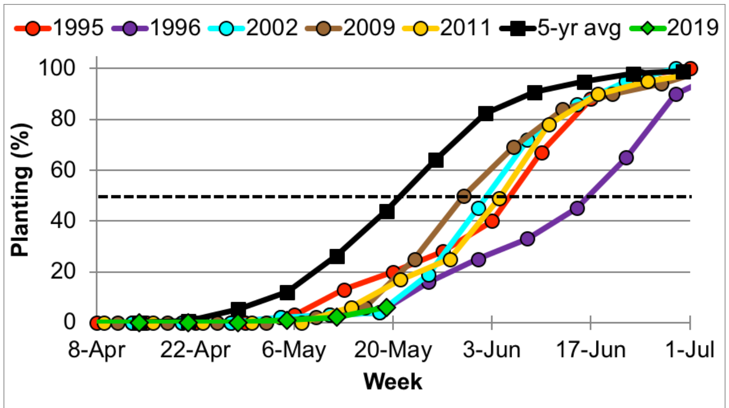

Figure 1. Late planting progress for Indiana over the past 25 years of records. As of May 19, Indiana has 6% of its soybeans planted (USDA-NASS).

Planting date is major factor in setting the yield potential of soybean. We typically see our greatest yields with late April to early May planting, which are long passed. In a given year, the yield potential will often decline ~0.4 bu/ac/day beyond mid-May.

It is difficult to predict the final yield of 2019, but let's look at the past years at the state level (Figure 2). We typically go below the yield trend potential in the last week of May. However, soybeans do have an amazing ability to attain respectable yields under stressful conditions. In the late planting years alone, yields were only 5.5 to 10% below yield trends with 1996 being the largest departure. Whereas, Indiana soybean yield in 2009 was ~2% above yield trend. Your upcoming management decisions and the rest of the growing season will dictate the final outcome.

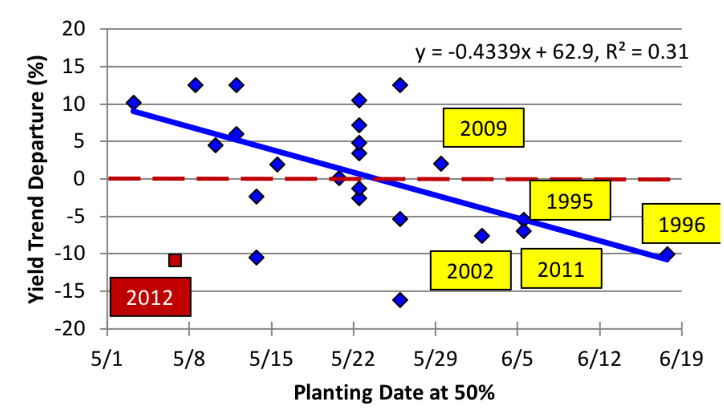

Figure 2. Indiana soybean departure from yield trend as compared to 50% planting date over the past 25 years (USDA-NASS). The drought of 2012 was omitted from the regression, and late planting years of 2011, 2009, 2002, 1996, and 1995 are noted.

Current field conditions and the forecast does not look to promising for major progress in the last week of May. With this trajectory, I would like to provide some guidelines as we will likely be planting a lot of soybeans in June. You need to consider your seeding rates, row width, and maturity group. Soybeans trip their reproductive trigger (flowering) as the day length shortens, which occurs much quicker with delayed plantings.

SEEDING RATE – Planting in the first weeks of June require ~10% increase in seeding rates (10,000 to 15,000 seed/acre increments for each week of delay). The higher seeding rates will help to facilitate quicker row closure and higher pod height with fewer days to flowering.

My starting recommendations for normal planting operations in April and May are: 120,000 to 140,000 seeds/acre for planters (15 to 30”), 140,000 to 160,000 seeds/acre for air seeders (~15”), and 160,000 to 180,000 seeds/acre.

If you typically plant 140,000 seeds/acre in 15-inch rows, you need to bump the seeding rate to 150,000 to 155,000 seeds/acre in the first week of June then to 165,000 to 170,000 seeds/acre in the second week of June, so forth and so on. Soybeans will produce fewer main-stem nodes (attachment points of trifoliates and ultimately pods) as planting is delayed, so the increasing seeding rates will also help to overcome the shortfall in node production.

ROW WIDTH – If you plant 30-inch rows, you need to look into the possibility of planting narrower rows with the limited time to flowering. We typically see a yield advantage of 5 to 10% for soybeans planted in narrow rows (15 inches or less) compared to 30-inch rows, and this difference will be even more prominent in late planting situations. Wide rows (30-inch) take nearly 25 days longer and 40 days longer to canopy compared to 15-inch and 7.5-inch rows, respectively. This delay will certainly decrease the yield potential as canopy closure would occur well after reproductive initiation.

MATURITY GROUP – Full-season varieties for your respective regions should be planted until June 15 for the northern quarter, June 20 for the central half, and June 25 for the southern quarter of Indiana. Varieties should be dropped a half maturity group after these dates and planted for another two weeks before we consider other alternatives. If you are in a very late planting situation, I suggest back-dating 90 days from the typical fall freeze in your region to determine if you have enough growing season to mature a soybean crop. My hope is that you will not need to make that determination, but I will follow up if discussion is needed.

Table 1. General dates to maintain full-season variety planting based on geography followed by timelines for maturity group switches.

Action	Northern IN	Central IN	Southern IN
Stay the course until:	June 15	June 20	June 25
Then, drop 0.5 MG and plant until:	June 30	July 5	July 10

Maximum Weekly Planting Progress for Corn and Soy in Indiana: Has It Increased

Over Time?

(Bob Nielson)

The number of 30-, 40-, and 60-ft wide (or larger) field crop planters across the U.S. Midwest is greater today than, say, twenty years ago. Certainly, individual farmers can plant more acres of corn and soybean per day with today's large field equipment than they could twenty years ago. This fact encourages optimism that planting season delays can be overcome by the capability of today's modern planters to plant a greater percent of the state's crop per week when "push comes to shove."

As is often the case with "logical conclusions", the historical data do not necessarily support the logic. Historical planting progress data suggest that the maximum number of acres of corn and soybean planted per week has not changed much over the past 20 years. The accompanying figures illustrate the number of acres and percent of total acres planted during the respective weeks of maximum planting progress for corn (Fig. 1), soybean (Fig. 2), and the two crops combined (Fig. 3) for Indiana during the past twenty years.

The greatest number of corn acres planted in a single week in Indiana during the past twenty years occurred in 2001 when 2.9 MILLION acres or 50% of the total acreage for that year were planted in a single week (Fig. 1). To most of us, such a planting pace borders on phenomenal. Since 2001, the closest Indiana farmers have come to matching that progress was during the 2014 planting season, when 41% of the total crop or 2.4 million acres were planting during a single week.

The most soybean acres planted in a single week in Indiana during the past twenty years also occurred in 2001 when 2.4 million acres or 42% of the total acreage for that year were planted in a single week (Fig. 2). Since then, the closest Indiana farmers have come to matching that progress was during the 2016 planting season, when 32% of the total crop or 1.8 million acres were planting during a single week.

Looking at the historical planting progress of each crop individually (Fig's 1 and 2) suggests that little improvement has been made in our ability to plant a lot of crop acres quickly. Some have countered that the potential TOTAL number of combined crop acres planted per week has increased because farmers are increasingly planting soybean at the same time as they are planting corn, when historically soybean planting occurred near the end of corn planting. Well, that turns out to be a bit of "fake news", also.

During the past twenty years in Indiana, the greatest number of corn AND soybean acres planted in a single week was also 2001 (no surprise), when 5.25 million acres of the two crops were planted in a single week, or 46% of the total number of corn and soybean acres planted that year (Fig. 3). During the past 20 years, the historical planting progress data suggests that the combined maximum weekly planting progress of the two crops has increased slightly, but not to any appreciable degree.

So, given the realities of ever larger planting equipment and the fact that farmers are frequently planting both crops at the same time these days, the conundrum is this… Why has the actual weekly planting progress of the two crops changed very little over the past 20 years? The answer does not appear to be related to changes in total crop acres planted in Indiana because that number has remained fairly constant in during that time period (Fig. 4).

One answer to the large planter vs. planting progress conundrum may be the fact that the number of corn and soybean growers in Indiana has decreased over time and those remaining are farming more acres than they did twenty years ago. Even though farm machinery is larger today and cover more acres per day than twenty years ago, fewer farmers are farming more acres and so total planting progress in terms of percent of total acres per week remains fairly unchanged. Coupled with that thought is the reality that weather and soil conditions dictate the number of days available during any given week for field work and planting.

For what it's worth, that's my opinion and you are entitled to it.

Related reading

Irwin, Scott and Todd Hubbs. 2019. How Many Days Does It Take to Plant the U.S. Corn Crop? farmdocDAILY, Univ. of Illinois. https://farmdocdaily.illinois.edu/2019/04/here-we-go-again-how-many-days-does-it-take-to-plant-the-u-s-corn-crop.html [URL accessed May 2019].

Nielsen, RL (Bob). 2019. The Planting Date Conundrum for Corn. Corny News Network, Purdue Univ. http://www.kingcorn.org/news/timeless/PltDateCornYld.html [URL accessed May 2019].

USDA-NASS. 2019. Quick Stats. USDA Nat'l Ag. Statistics Service. http://www.nass.usda.gov/Quick_Stats [URL accessed May 2019].

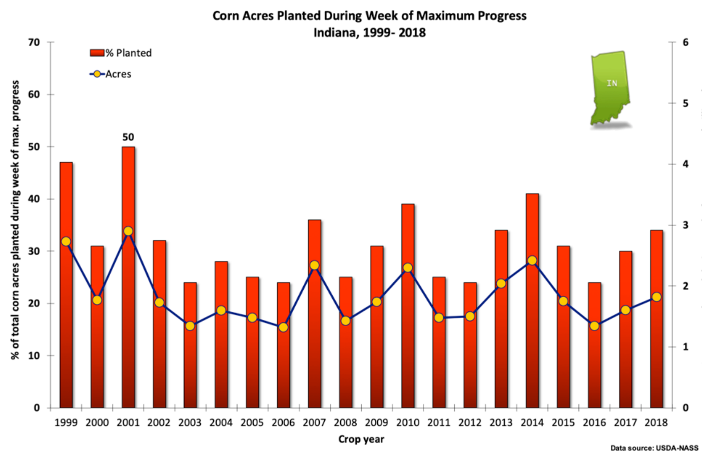

Fig. 1. Acres (actual and percent of total) of field corn planted during the week of maximum planting progress in Indiana, 1999 – 2018. Data source: USDA-NASS. Note that the exact weeks of maximum soybean planting progress may not be the same weeks as those of maximum corn planting progress.

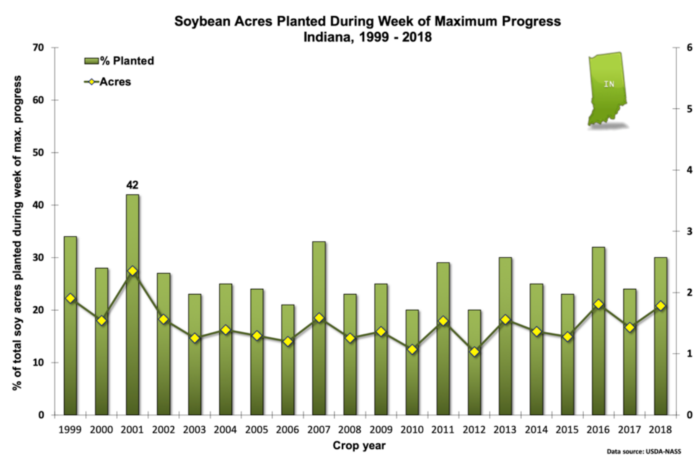

Fig. 2. Acres (actual and percent of total) of soybean planted during the week of maximum planting progress in Indiana, 1999 – 2018. Data source: USDA-NASS. Note that the exact weeks of maximum soybean planting progress may not be the same weeks as those of maximum corn planting progress.

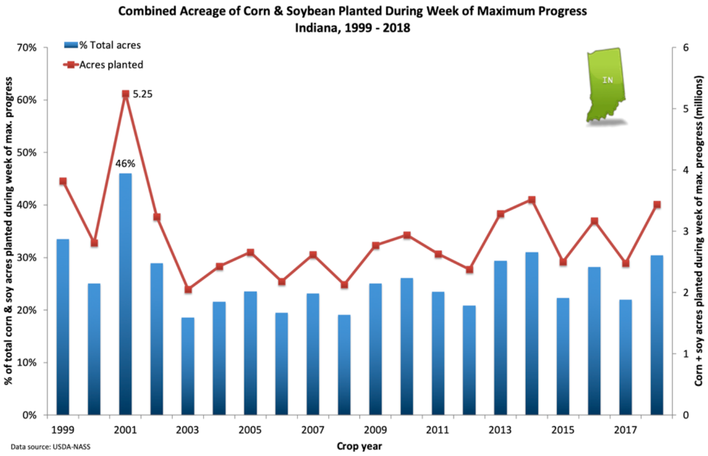

Fig. 3. Acres (actual and percent of total) of field corn plus soybean planted during the week of maximum planting progress (both crops total) in Indiana, 1999 – 2018. Data source: USDA-NASS. Note that the exact weeks of maximum single crop progress may differ from the weeks of maximum two-crop progress.

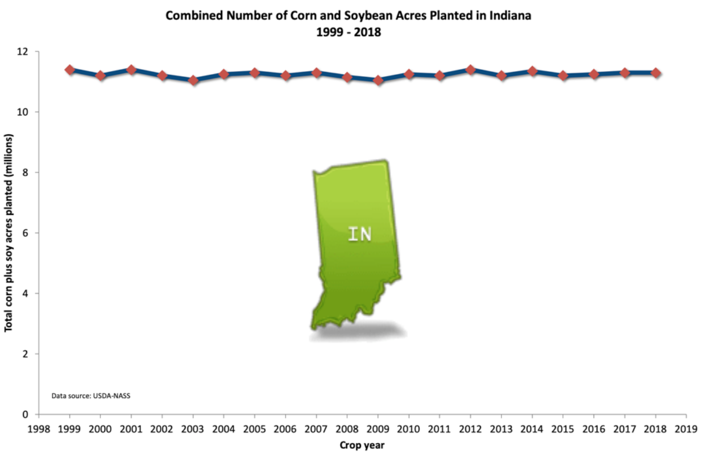

Fig. 4. Combined number of acres planted to corn and soybean in Indiana, 1999 – 2018. Data source: USDA-NASS.

Predict Leaf Stage Development in Corn Using Thermal Time

(Bob Nielson)

Being able to predict when a field of corn will reach particular leaf stages can be useful for scheduling post-emergence applications of certain herbicides and sidedress N fertilizer, especially if your farming operation is so large that regular field inspections are difficult to work into your busy schedule. Leaf stage can be predicted on the basis of heat unit accumulation (aka growing degree days) from planting to the date in question.

Review of Concepts. For a refresher on how to leaf stage corn plants, see my article *"Determining Corn Leaf Stages"*. Another topic that probably needs reviewing is the concept of heat units (HUs) or growing degree days (GDDs). The concept is important because corn phenology is very dependent on temperature. Heat unit or GDD calculation for corn phenology is described in another article *"Heat Unit Concepts Related to Corn Development""*.

Predicting Corn Phenology. Once you understand corn leaf stage development and heat unit calculation, you can predict the leaf stage of development for a particular field given its planting date and temperatures since planting. It is useful if you know when the crop emerged, but if not you can estimate that event also. Corn emergence typically requires from 100 to 120 GDDs from planting.

Useful Tip: One online source for accessing current GDD accumulations and estimating future GDD accumulation for specific locations, planting dates, and relative hybrid maturities is the **Corn GDD Tool** located at https://mrcc.illinois.edu/U2U/gdd/.

Previous research by one of my graduate students (Wuethrich, 1997) documented that corn leaf development rates can be accurately described by separate linear response curves for early and late vegetative development. From emergence to leaf stage V10 (ten visible leaf collars), leaf collar emergence occurs at about one leaf every 82 GDDs (Wuethrich's data suggested 85 GDDs, but 11 years of plot data since suggests closer to 82 GDDs). From leaf stage V10 to the final leaf, leaf collar emergence occurs more rapidly at approximately one leaf every 50 GDDs.

Useful Tip: From planting to about V6, the rate of plant development, including emergence, responds more closely to soil temperatures than to air temperatures. This time frame corresponds to the period when the main growing point (apical meristem) of the corn plant is located below the soil surface. Elongation of stalk internodes after V6 rapidly elevates the growing point (actually the tassel at the point in time) above ground. From that point forward, plant development is affected more directly by air temperature. Consequently, leaf stage prediction up to about V6 is more reliable if soil temperatures are used to calculate daily GDDs. After V6, air temperatures are the more predictive basis for GDD calculations.

Example 1: A field was planted on April 28 and emerged on May 5. Since May 5, approximately 535 GDDs have accumulated. Based on our research data, the estimated leaf stage for the crop (without looking at the field, mind you) would be between V6 and V7 (6 leaves x 82 GDDs = 492 GDDs; 7 leaves x 82 GDDs = 574 GDDs).

Example 2: A field was planted on April 28, but you do not know exactly when it emerged. Since planting, approximately 785 GDDs have accumulated. If you assume that the crop emerged in about 120 GDDs, then the estimated leaf stage for the crop would be about V8. This estimate is calculated by first subtracting 120 from 785 to account for the estimated thermal time to emergence, then dividing the result (665) by 82 (equal to 8.1).

Example 3: A field was planted on April 28 and emerged on May 5. Since May 5, approximately 1220 GDDs have accumulated. Your familiarity with these calculations tells you that the crop is likely beyond V10 (equal to 10 x 82 or 820 GDDs since emergence). So, first subtract 820 from 1220 (knowing the crop is at least at V10). Divide the result (400) by 50 to equal 8 additional leaves; for a total estimated leaf stage of V18.

Keep in mind that estimates of leaf stage development are only that… Estimates. One of the factors that most influences the accuracy of these estimates is the existence or not of other growth-limiting stresses. Severe plant stress will generally retard stem and leaf sheath elongation, thus delaying the appearance of leaf collars. However, what I have described here will put you in the proverbial ballpark in determining which fields are at which leaf stages on a given day.

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Visual Indicators of Germination in Corn

(Bob Nielson)

Understanding the sequence of the visual indicators of germination in corn can help troubleshoot emergence problems.

Germination is the renewal of enzymatic activity that results in cell division and elongation and, ultimately, embryo emergence through the seed coat. Germination is triggered by absorption of water through the seed coat. Corn kernels must absorb (imbibe) about 30 % of their weight in water before germination begins. Less than optimum absorption of water (perhaps due to a rapidly drying seed zone) may slow or stop germination. Repeated wetting and drying cycles can decrease seed viability.

Seedling emergence 5 days (114 GDD) after planting.

By comparison, soybeans must imbibe about 50 % of their weight in water. But since soybeans are approximately 2/3 the weight of corn kernels, the total amount of absorbed water required for germination is relatively similar.

The visual indicators of germination occur in a distinct sequence and are strongly influenced by soil temperature. Germination and emergence will occur in fewer calendar days when the seed is planted into warm soils than in cold soils. However, the **thermal time** from planting to emergence is fairly predictable, especially if estimated using soil temperature (Nielsen, 2017). Measured in terms of Modified Growing Degree Days (GDD), corn typically emerges in 115-120 GDD (equivalent to about 65 GDD Celsius) after planting.

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Indiana Climate and Weather Report – 5/20/2019

(Austin Pearson)

So far for the month of May, temperatures across the state vary by nearly 2˚F above normal in the southeast and almost 3˚F below normal in the extreme northwest. Similarly, the same trends can be seen in the Modified Growing Degree Days as they are based on temperature (Fig 1).

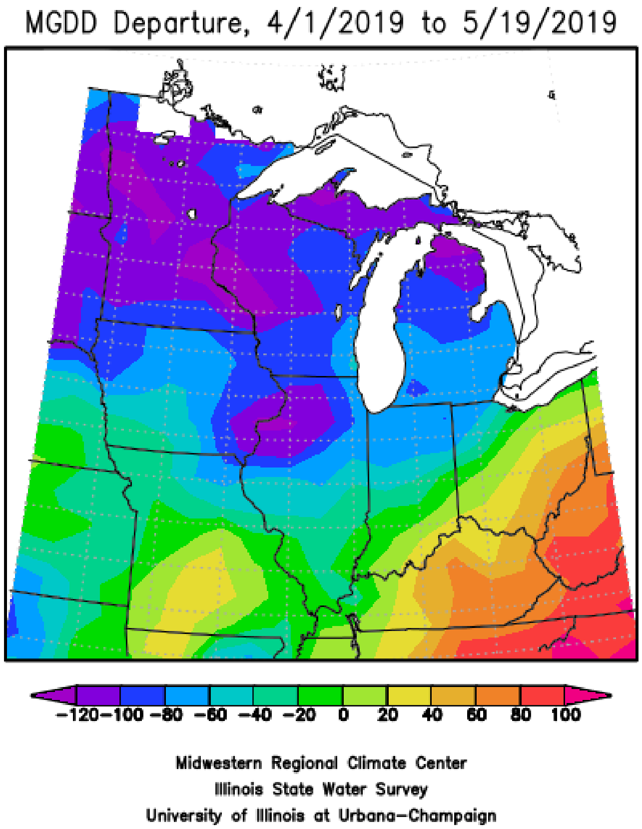

Fig. 1. Modified Growing Degree Days

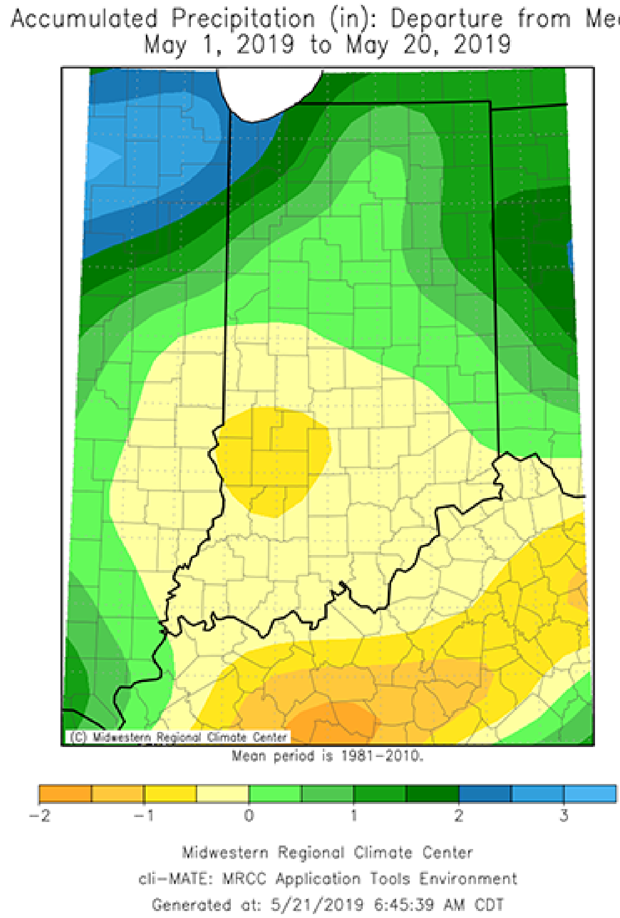

Fig. 2. May Precipitation Deviation from Normal

The main story continues to be the precipitation for most of the state. Since January 1, precipitation is between 3 to 9 inches above normal in spots. Adding observed near normal to slightly above normal precipitation for the month in some areas is really delaying folks in the agriculture industry (Fig 2). Looking at the short term outlook from the Climate Prediction Center (Fig 3 & 4), much of the state has above normal chances for seeing above normal temperatures and precipitation over the 6 to 10 day and 8 to 14 day outlooks. Our active weather pattern doesn't look to change at least within the next couple of weeks. One good thing is that temperatures look to rebound to the 70s and 80s which may help with the drying process. Any windows that do open for agricultural activity appear to be limited in the short term.

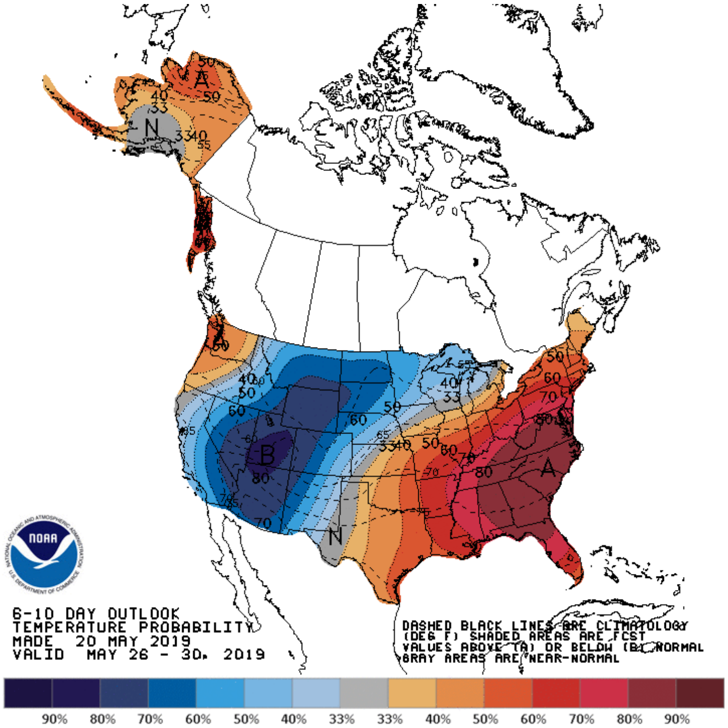

Fig. 3. 6-10 Day Temperature Outlook (https://www.cpc.ncep.noaa.gov/)

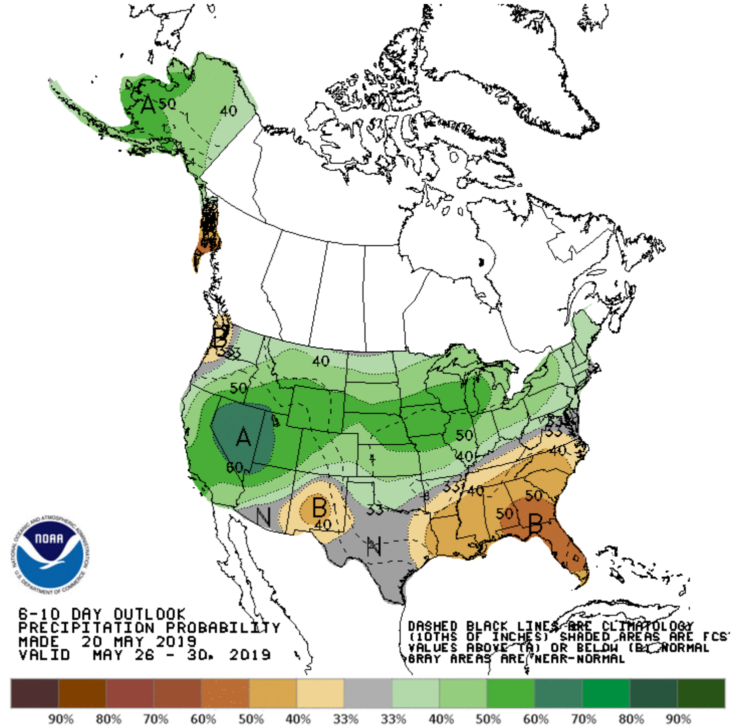

Fig. 4. 6-10 Day Precipitation Outlook (https://www.cpc.ncep.noaa.gov/)

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