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Pest&Crop newsletter

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In This Issue

Western Bean Cutworm Update and VIDEO

(John Obermeyer) & *(Christian Krupke)*

As you can see from the Western Bean Cutworm Pheromone Trap Report, a considerable number of male western bean cutworm moths have emerged and been captured in the last week. Some pest managers have reported finding egg masses. As previously mentioned, the female moths seem to have a preference for depositing eggs on the upright leaves just before tasseling. The hatched larvae will crawl immediately to the whorl or leaf axils, depending on corn's growth stage, for protection while feeding on leaf tissue and/or pollen.

The following video, showing early infestation and damage, will be a helpful reminder.

2020 Western Bean Cutworm Pheromone Trap Report

(John Obermeyer)

County	Cooperator	WBC Trapped Wk 1 6/18/20-6/24/20	Wk 2 6/25/20-7/1/20	Wk 3 7/2/20-7/8/20	Wk 4 7/9/20-7/15/20	Wk 5 7/16/20-7/22/20	Wk 6 7/23/20-7/29/20	Wk 7 7/30/20-8/5/20
Adams	Roe/Mercer Landmark	0	0	0	0			
Allen	Anderson/NICK	0	0	2	1			
Allen	Gynn/Southwind Farms	0	0	0	2			
Allen	Kneubuhler/G&K Concepts	0	0	4	0			
Bartholomew	Bush/Pioneer Hybrids	0	1	2	0			
Boone	Emanuel/Boone Co. CES	2	1	1	0			
Clay	Mace/Ceres Solutions/Brazil	0	0	1	1			
Clay	Fritz/Ceres Solutions/Clay City	0	1	0	0			
Clinton	Emanuel/Boone Co. CES	0	3	0	1			
Dubois	Eck/Dubois Co. CES	0	0	0	0			
Elkhart	Kauffman/Crop Tech Inc.	0		2	8			
Fayette	Schelle/Falmouth Farm Supply Inc.	0	0	0				
Fountain	Mroczkiewicz/Syngenta	0		10	47			
Fulton	Jenkins/Ceres Solutions/Talma	0			95			
Hamilton	Campbell/Beck's Hybrids	0	0	0	0			
Hendricks	Nicholson/Nicholson Consulting	0			0			
Hendricks	Tucker/Bayer	1	0	0				
Howard	Shanks/Clinton Co. CES	0	0	0	0			
Jasper	Overstreet/Jasper Co. CES	0		15	327			
Jasper	Ritter/Dairyland Seeds	3	7	25				
Jay	Boyer/Davis PAC	0	0	2	0			
Jay	Shrack/Ran-Del Agri Services	0		1	0			
Jennings	Bauerle/SEPAC	0	0	0	0			
Knox	Clinkenbeard/Ceres Solutions/Freelandville	0	0	0	0			
Lake	Kleine/Rose Acre Farms	0	0	1	3			
Lake	Moyer/Dekalb Hybrids/Shelby	0	8	8	21			
Lake	Moyer/Dekalb Hybrids/Scheider	0	8	17	86			
LaPorte	Rocke/Agri-Mgmt. Solutions	0	0	38	68			
Marshall	Harrell/Harrell Ag Services	0	0	0	26			
Miami	Early/Pioneer Hybrids	0	0	3	14			
Montgomery	Delp/Nicholson Consulting	0	0	0	0			
Newton	Moyer/Dekalb Hybrids/Lake Village	0	1	0	36			
Porter	Tragesser/PPAC	1	0	0	7			
Posey	Schmitz/Posey Co. CES	0		0	0			
Pulaski	Capouch/M&R Ag Services	1	4	4				
Pulaski	Leman/Ceres Solutions	0	0		49			
Putnam	Nicholson/Nicholson Consulting	0	0		0			
Randolph	Boyer/DPAC	0	0	3	0			
Rush	Schelle/Falmouth Farm Supply Inc.	2	4	0				
Shelby	Simpson/Simpson Farms	0	0	0				
Starke	Capouch/M&R Ag Services	1	0	9				
St. Joseph	Battles/Mishawaka	0	0	0	11			
St. Joseph	Carbiener/Breman	0	1		5			
St. Joseph	Deutscher/Helena Agri-Enterprises, Trap 1	0	0		8			
St. Joseph	Deutscher/Helena Agri-Enterprises, Trap 2	0	0		5			
Sullivan	Baxley/Ceres Solutions/New Lebanon	0	0	0	1			
Sullivan	McCullough/Ceres Solutions/Farmersburg	0	1	4	1			
Tippecanoe	Bower/Ceres Solutions	0	32	61	40			
Tippecanoe	Nagel/Ceres Solutions	0	0	0	0			
Tippecanoe	Obermeyer/Purdue Entomology	0	0	0	3			
Tippecanoe	Westerfeld/Bayer Research Farm	0	0	2				
Tipton	Campbell/Beck's Hybrids	0	0	0	0			
Vermillion	Lynch/Ceres Solutions/Clinton	0	0	0	0			
White	Foley/ConAgra	0	0	1	1			

* = Intensive Capture…this occurs when 9 or more moths are caught over a 2-night period

Weird Beetles Feeding on Corn and Soybean

(John Obermeyer)

As often happens, when weed control is delayed in fields, previously unseen insects become nuisance pests for the growing crop. This week, agronomists in central and northeastern Indiana, sent pictures with the "What is this bug?" question. We've had similar encounters with the redheaded flea beetle in past years. They have been observed feeding on corn leaves and silks, as well as soybean foliage. The redheaded flea beetle (*Systena frontalis*) normally feeds on weed species, especially giant ragweed. When weeds are burned down the beetles look no further than the crop for food, and will feed on leaves to a small extent. Plants near the field edge where non-crop plants will also be damaged, one of the common "edge effects" we see in many cropping systems. This feeding, while it catches attention, is nothing more than superficial, won't affect pollination or yield and certainly doesn't warrant treatment. But it's worthwhile to know what this insect is, and why it's suddenly feeding on corn.

Redheaded flea beetles feeding in silks


Close-up of redheaded flea beetle feeding in silks


Redheaded flea beetle and damage to soybean leaf


Close-up of redheaded flea beetle and soybean feeding scars

Grasshoppers, Another Planting Green Concern

(John Obermeyer) & *(Christian Krupke)*

Reports of grasshoppers within fields have been received. The pictures and videos included with the emails showed numerous grasshopper nymphs severely defoliating soybean that were planted into a standing cereal rye cover crop. The soybean plants were delayed in growth, as they were shaded by the dying rye. Grasshoppers, as the name suggests, love feeding on a range of grasses but are certainly not limited to this group of plants.

Eggs, laid in the soil last fall, normally hatch from late May through July. After the nymphs hatch, they normally feed for 2 to 3 weeks near the area where the eggs were laid. When their food source becomes scarce or when their early feeding sites are mowed or otherwise destroyed (i.e. burndown with herbicide), the nymphs move to other feeding sites, including nearby crops.

As we often point out, a small insect is easier to manage (i.e. kill) than a larger one. The best time to manage threatening grasshopper populations is when they are still in the nymphal stage (wingless). Besides being smaller, they are easier to control at this time since they are less mobile. However, you should not apply a control whenever you see nymphal grasshoppers – you can find grasshopper nymphs in most any field if you look hard enough, and as a result we advocate for the use of an economically damaging population to justify treatment.

To determine the need for grasshopper control, check crop and non-crop areas to pinpoint infestations. In at least 5 random locations within each infested area, estimate the number of grasshoppers within approximately one square yard. A sweep net may be helpful for this, but certainly not necessary. Grasshoppers are active by day and quite visible. Determine the infestation level for each sample area, and for each crop and non-crop area as a whole.

Treatment of field margins is probably justified if counts exceed 15 or more nymphs or 8 adults (winged) per square yard. In soybean fields, control may be needed if defoliation levels exceed 40% prior to bloom or 25% from blooming to pod fill. In corn, it may be advisable to treat if an average of 3 or more grasshopper nymphs per square yard are counted. In most cases, spot treatment may be sufficient to control the grasshoppers.

Recommended control materials can be found HERE.


Grasshopper damage to podded soybean plant in a terminated grass cover


Grasshopper nymph and soybean feeding damage

Update on Indiana Foliar Disease Risk in

Soybean and Corn

(Darcy Telenko)

Recent rains and increased humidity across Indiana have increased the risk for foliar diseases to develop in both corn and soybean. Much of the corn has begun to tassel and soybeans have begun to flower. We are starting to see common diseases in the lower canopy of corn, as we were out scouting this past week. A few diseases that I have seen included gray leaf spot, northern corn leaf blight, common rust, Physoderma brown spot and northern corn leaf spot in corn (Figure 1).

Figure 1: Gray leaf spot, northern corn leaf blight and Physoderma brown spot on corn.

Diseases in soybean have been extremely low – I found a few frogeye lesions this past week. Since we are at R1 it is time to scout your soybeans for frogeye leaf spot. Management practices for frogeye are aimed reducing soybean susceptibility and inoculum availability. Infected debris from previous crops is the primary source of inoculum for this disease. Any practice that helps reduced or bury the infected residue will help reduced inoculum in a field such as fall tillage or soybean- corn crop rotation. There are a number of varieties available with frogeye resistance. Fungicide spray application after growth stage R1 can reduced severity, while applications made at R3 are considered most effective for frogeye. There are number of fungicides available to use for frogeye management see links below).

In addition, we are also tracking the activity of tar spot (map – see figure 2). On the map you can see gray areas where we have detected the disease in past seasons. The three yellow counties, Porter, LaPorte and St. Joseph are the areas where we have found active tar spot this season. Tar spot is still at a low incidence and severity in these fields. We are continuing to monitor them – as the hot, dry weather most likely slowed it down, but now that we have had some rain and long morning dews along with irrigation there is potential for the disease to start.

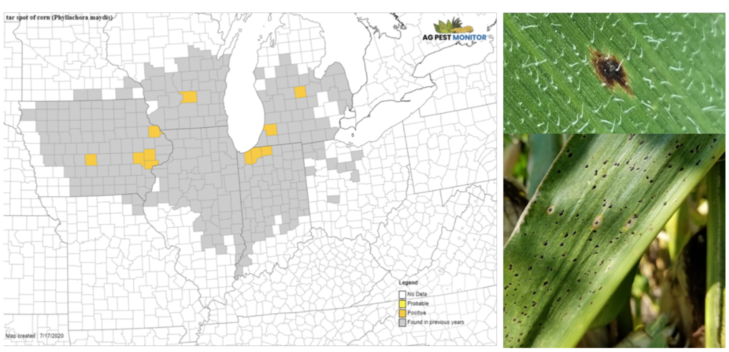


Figure 2. 2020 map of tar spot activity. Source https://corn.ipmpipe.org/tarspot-2/ and images of tar spot on corn.

Continue to scout your field to determine if any of these diseases are present. Gray leaf spot, northern corn leaf blight and tar spot are the diseases that are most commonly managed by fungicides in Indiana. For gray leaf spot and northern corn leaf blight fungicides applied at VT-R1 are most effective at preventing yield loss. Scouting will help determine the level of disease pressure in a field.

To make a decision for applying a fungicide there are four things I consider – 1. Disease risk in a field – do you have a previous history of the disease; 2. Current disease activity – do you find the disease in the lower canopy while scouting; 3. Weather conditions – will there continue to be favorable weather moisture and rain for foliar diseases? And 4. Return on investment – will the yield protected by a fungicide cover the additional cost of the application?

For fungicide recommendations please see the 2020 fungicide efficacy tables developed for both corn and soybean foliar diseases can be found at the following links:

- https://crop-protection-network.s3.amazonaws.com/publications/fungicide-efficacy-for-control-of-corn-diseases-filename-2020-03-18-150007.pdf
- https://crop-protection-network.s3.amazonaws.com/publications/fungicide-efficacy-for-control-of-soybean-foliar-diseases-filename-2020-03-18-150123.pdf

Field Crop Disease Samples Needed in Indiana

(Darcy Telenko)

The field crop pathology research program is tracking the distribution of corn and soybean field diseases in Indiana. We are predominantly interested in the following samples (but always keeping an eye out for others):

1. Corn: tar spot, northern corn leaf blight, and southern corn rust
2. Soybean: frogeye leaf spot

In order for an official designation of the field crop disease in a county for tar spot or southern corn rust – myself or the Purdue Plant Pest Diagnostic Lab needs a physical sample. Therefore, we are asking for your help. T

Ideally, the Purdue Plant Pest Diagnostic lab would like to receive fresh samples as soon as possible, but I know at this time of the year you may be scouting various field and on the road long hours. Therefore, to encourage you to send samples for both southern corn rust and tar spot we are going to give some pointers on how you can collect corn leaf samples and ship them weekly. We do not want them to sit over the weekend so it is suggest you ship samples **Monday through Wednesday**.

How to collect foliar disease leaf samples:

Items to have on hand in your truck or car: cooler with ice pack, gallon plastic bags, marker, notebook paper, and newspaper.

1. When scouting a field and you identify a potential sample please try to grab 4-6 leaves from that field that are exhibiting the symptoms.
2. Take a quick image of the diseased leaf to document (most images will also give you a GPS location if turned on)
3. Document field location (address, county and GPS location), in addition if possible hybrid/variety, other management practices and or field comments. Fill out a sample submission form https://ag.purdue.edu/btny/ppdl/Documents/Forms/PPDL-Form_

13MAY15FILLABLE.pdf
If you have multiple samples please try to include as much information as possible to help us distinguish between samples.

4. Either fold or wrap the corn leaves flat in a piece of newspaper (this will keep the sample from molding especially if waiting to send for a few days).
5. Once wrapped in the newspaper you can place in a plastic bag. It is possible to layer leaves from different fields into on bag. *Please note this on the sample bag if it does contain multiple locations.* (See images below).
6. These samples then can be stored in a cool place (cooler with ice packs) or refrigerator until shipped.
7. Make sure to include your contact information in case we have further questions about the sample.
8. Mailing samples: The PPDL is not open on the weekend. Ship early in the week (Monday-Wednesday) using a next day deliver option to make sure you sample gets to us before the For Thursday shipments DO NOT use USPS overnight delivery. Your package may arrive at Purdue's central receiving dock by Friday but will not get to our lab by close of business on Friday. Instead use only UPS or FedEx if shipping on Thursday.

Ship sample to: Plant and Pest Diagnostic Laboratory
LSPS-Room 116, Purdue University
915 W. State Street
West Lafayette, Indiana 47907-2054

Figure 1. An easy way to send corn or soybean leaves to the Purdue Plant Pest Diagnostic Lab (PPDL), lay the leaf sample flat between a few pages of newspaper, fold, place in plastic bag, and place in a small box to send to the clinic.

Grain Fill Stages in Corn

(Bob Nielsen)

The grain fill period begins with successful pollination and initiation of kernel development, and ends approximately 60 days later when the kernels are physiologically mature. During grain fill, the developing kernels are the primary sink for concurrent photosynthate produced by the corn plant. What this means is that the photosynthate demands of the developing kernels will take precedence over that of much of the rest of the plant. In essence, the plant will do all it can to "pump" dry matter into the kernels, sometimes at the expense of the health and maintenance of other plant parts including the roots and lower stalk.

A stress-free grain fill period can maximize the yield potential of a crop, while severe stress during grain fill can cause kernel abortion or lightweight grain and encourage the development of stalk rot. The health of the upper leaf canopy is particularly important for achieving maximum grain filling capacity. Some research indicates that the upper leaf canopy, from the ear leaf to the uppermost leaf, is responsible for no less than 60% of the photosynthate necessary for filling the grain.

Kernel development proceeds through several distinct stages that were originally described by Hanway (1971) and most recently by Abendroth et al. (2011). As with leaf staging protocols, the kernel growth stage for an entire field is defined when at least 50% of the plants in a field have reached that stage.

Delayed planting of corn decreases the apparent thermal time (GDDs) required between planting and physiological maturity (Nielsen, 2019). A large proportion of that decrease occurs during grain filling and may be partially related to shorter and cooler days in late September and October that naturally slow photosynthesis and encourage plant senescence.

Silking Stage (Growth Stage R1)

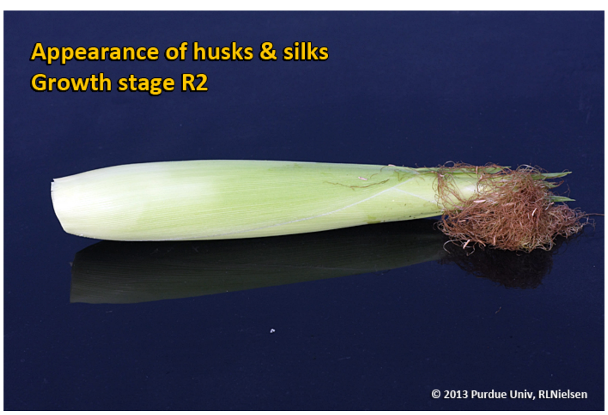
Silk emergence is technically the first recognized stage of the reproductive period. Every ovule (potential kernel) on the ear develops its own silk (the functional stigma of the female flower). Silks begin to elongate soon after the V12 leaf stage (12 leaves with visible leaf collars), beginning with the ovules near the base of the cob and then sequentially up the cob, with the tip ovules silking last. Consequently, the silks from the base half of the ear are typically the first to emerge from the husk leaves. Turgor pressure "fuels" the elongation of the silks and so severe drought stress often delays silk elongation and emergence from the husk leaves. Silks elongate about 1.5 inches per day during the first few days after they emerge from the husk leaves. Silks continue to elongate until pollen grains are captured and germinate or until they simply deteriorate with age.

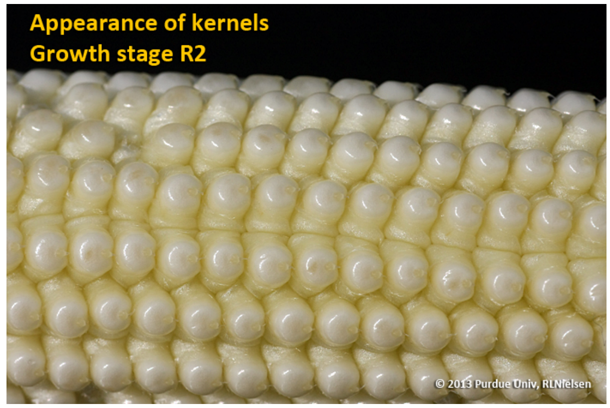
Silks remain receptive to pollen grain germination for up to 10 days after silk emergence (Nielsen, 2016b), but deteriorate quickly after about the first 5 days of emergence. Natural senescence of silk tissue over time results in collapsed tissue that restricts continued growth of the pollen tube. Silk emergence usually occurs in close synchrony with pollen shed (Nielsen, 2016c), so that duration of silk receptivity is normally not a concern. Failure of silks to emerge in the first place (for example, in response to silkballing or severe drought stress) does not bode well for successful pollination.

Pollen grains "captured" by silks quickly germinate and develop pollen tubes that penetrate the silk tissue and elongate to the ovule within about 24 hours. The pollen tubes contain the male gametes that eventually fertilize the ovules. Within about 24 hours or so after successfully fertilizing an ovule, the attached silk deteriorates at the base, collapses, and drops away. This fact can be used to determine fertilization success before visible kernel development occurs (Nielsen, 2016a).

Kernel Blister Stage (Growth Stage R2)

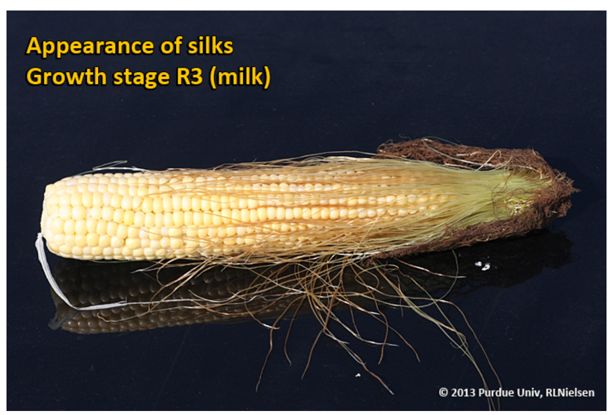
About 10 to 12 days after silking, the developing kernels are whitish “blisters” on the cob and contain abundant clear fluid. The ear silks are mostly brown and drying rapidly. Some starch is beginning to accumulate in the endosperm. The radicle root, coleoptile, and first embryonic leaf have formed in the embryo by the blister stage. Severe stress can easily abort kernels at pre-blister and blister stages. Kernel moisture content at the beginning of R2 is approximately 85 percent. For late April to early May plantings in Indiana, the thermal time from blister stage to physiological maturity is approximately 960 GDDs (Brown, 1999).

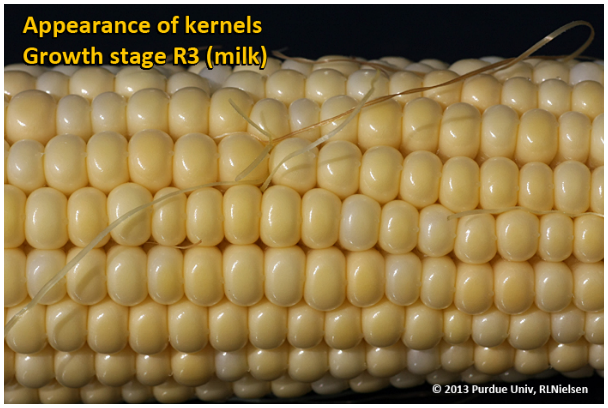


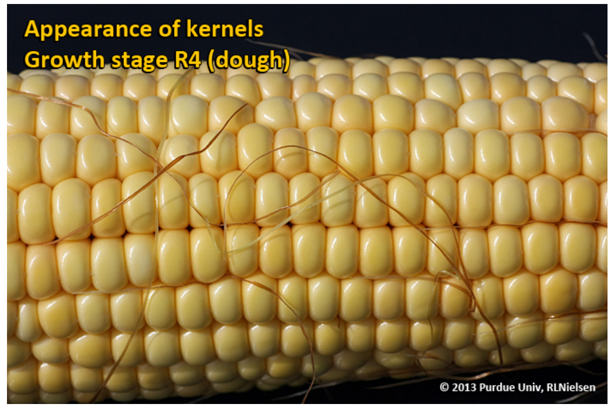


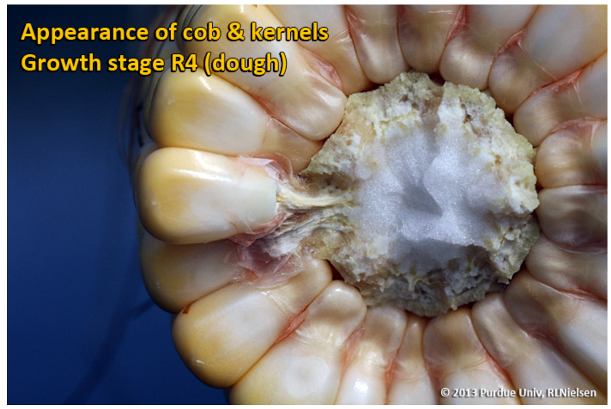
Kernel Milk Stage (R3)

About 18 to 20 days after silking, the kernels are mostly yellow and contain “milky” white fluid. The milk stage of development is the infamous “roasting ear” stage, when you will find die-hard corn aficionados standing out in their field nibbling on these delectable morsels. Starch continues to accumulate in the endosperm. Endosperm cell division is nearly complete and continued growth is mostly due to cell expansion and starch accumulation. Severe stress can still abort kernels, although not as easily as at the blister stage. **Kernel moisture content at the beginning of R3 is approximately 80 percent**. For late April to early May plantings in Indiana, the thermal time from milk stage to physiological maturity is approximately 880 GDDs (Brown, 1999).



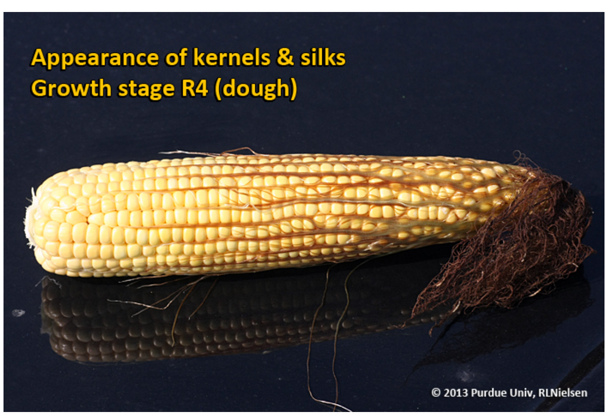






Kernel Dough Stage (R4)

About 24 to 26 days after silking, the kernel's milky inner fluid begins changing to a "doughy" consistency as starch accumulation continues in the endosperm. The shelled cob is now light red or pink. By dough stage, four embryonic leaves have formed and the kernels have reached about **33 percent of their mature dry weight**. **Kernel moisture content is approximately 70 percent at the beginning of R4**. Near the end of R4, some kernels will typically be starting to dent. Kernel abortion is much less likely to occur once kernels have reached early dough stage, but severe stress can continue to affect eventual yield by reducing kernel weight. For late April to early May plantings in Indiana, the thermal time from dough stage to physiological maturity is approximately 670 GDDs (Brown, 1999).



Kernel Dent Stage (R5)

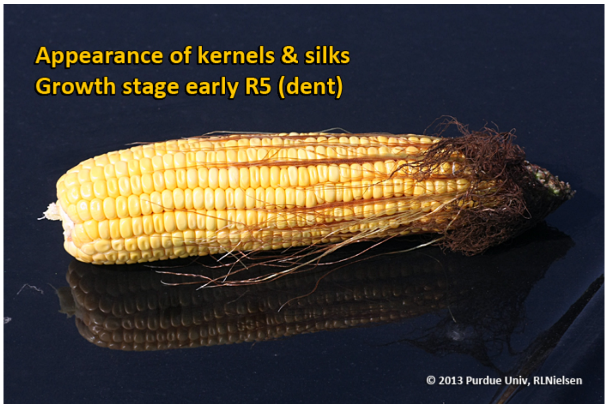
About 31 to 33 days after silking, all or nearly all of the kernels are denting near their crowns. The fifth (and last) embryonic leaf and lateral seminal roots form just prior to the dent stage. **Kernel moisture content at the beginning of R5 is approximately 60 percent**. More importantly, **kernel dry matter content at the beginning of R5 is only about 45% of the eventual final** accumulation and there **remains approximately more 30 days before physiological maturity** occurs. This is sobering considering that farmers and agronomists alike often breathe a sigh of relief when the crop reaches R5 because of a mistaken and, frankly, emotional belief that the "crop is made" by this grain fill stage.

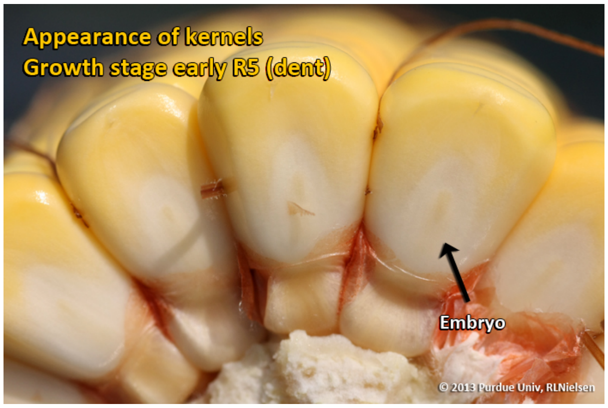
> **Interesting Exercise:**
> You can get a sense of the importance of the final 30 days of grain filling by calculating a number of "what-if" grain filling scenarios using the traditional pre-harvest yield estimation formula for corn with a range of kernel weight "fudge factors" from about 65 to 105, which represent kernel weights equivalent to 65,000 (excellent grain fill, heavy kernels) to 105,000 (poor grain fill, light weight) kernels per 56-lb bushel.

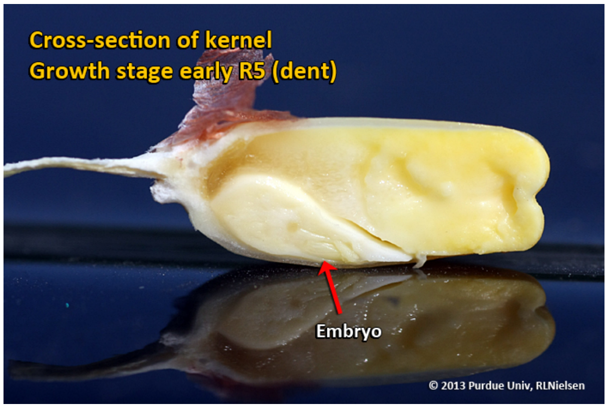
Within about a week after the beginning of R5, a distinct horizontal line appears near the dent end of a split kernel and slowly progresses to the tip end of the kernel over the next 3 weeks or so. This line is called the "**milk line**" and marks the boundary between the liquid (milky) and solid (starchy) areas of the 0maturing kernels.

In field trials conducted over 8 site-years in Indiana and Ohio (Brown, 1999), the thermal time from full dent (kernel milk line barely visible) to physiological maturity (kernel black layer) for three adapted hybrids ranging from 105 to 115 "day" relative maturities, ranged from 337 to 360 GDDs. Thermal time from the half-milkline stage to physiological maturity in those same trials averaged about 200 GDDs (Brown, 1999).

Severe stress can continue to limit kernel dry weight accumulation between the dent stage and physiological maturity. Estimated yield loss due to total plant death at full dent is about 40%, while total plant death at half-milkline would decrease yield by about 12% (Carter & Hesterman, 1990)

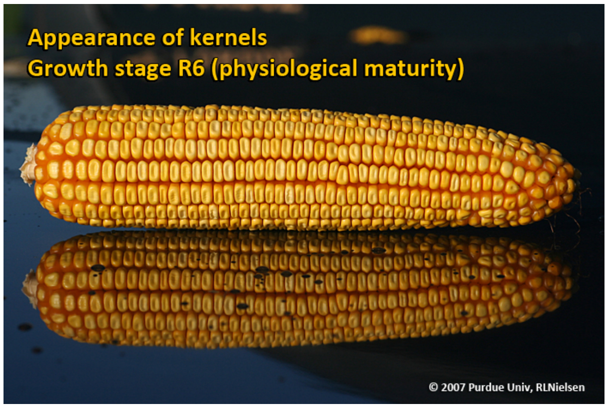


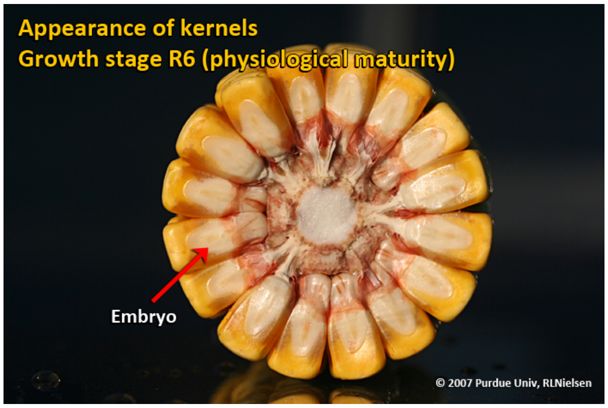


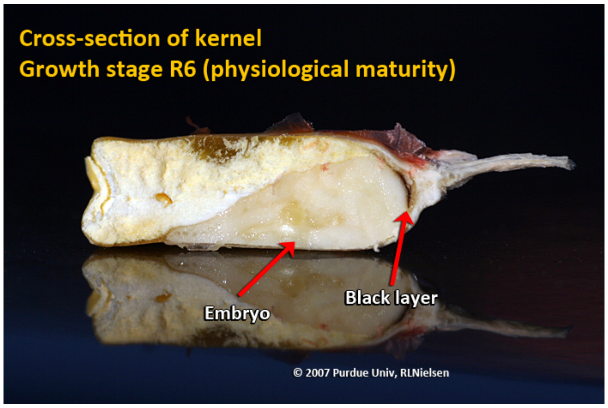


Physiological Maturity (R6)

About 55 to 65 days after silking, kernel dry weight usually reaches its maximum and kernels are said to be physiologically mature and safe from frost. Physiological maturity occurs shortly after the kernel milk line disappears and just before the kernel black layer forms at the tip of the kernels. Severe stress after physiological maturity has little effect on grain yield, unless the integrity of the stalk or ear is compromised (e.g., damage from European corn borer or stalk rots). **Kernel moisture content at physiological maturity averages 30 percent**, but can vary from 25 to 40 percent grain moisture depending on hybrid and growing conditions.







Harvest Maturity

While not strictly a stage of grain development, harvest maturity is often defined as that grain moisture content where harvest can occur with minimal kernel damage and mechanical harvest loss. Harvest maturity is usually considered to be near 25 percent grain moisture.

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So Lush, So Green, and Oh So Poisonous

(Keith Johnson)

In memory of livestock that met "Their Maker" because they ate yew.

It's that time of year when the yew (pronounced like the letter "U") is likely in need of a trim to look best as a landscaping plant. Yews have been used as a common landscaping shrub or small tree for decades. They have closely spaced, glossy, rather tough, dark green, linear pointed-end leaves that are 1.5 – 2 inches long. Hard-to-see male and female flowers are found on separate plants and form fleshy red to yellow fruits that contain a single seed.

Many plants have poisonous compounds that can cause all kinds of concerns, and even death, if consumed. The interactions that I have had with veterinarians, suggest that the yew is right at or near the top of plants that cause livestock death. A disheartening scenario is when yew trimmings are thrown over the fence by the livestock owner or neighbor thinking that the trimmings would make a great snack for the livestock. Fresh or dry trimmings, it doesn't matter. The result will be the same – death.

Yews are hardy perennial landscaping plants, but don't toss the trimmings to your equine, herd, or flock or they won't see the light of the next day.

A yew bush used as landscaping is in need of a trim. Don't feed the trimmings to livestock or death will occur. Photo provided by Keith Johnson.

Reference Evapotranspiration Forecasts across Indiana

(Beth Hall)

The past 30 days have been met with warmer than normal temperatures in the northern counties and drier than normal conditions throughout most of the state (Figures 1 and 2). This warm and dry environment is conducive to developing drought – particularly with the increased evapotranspiration rates. While climate outlooks are calling for increased confidence of above-normal precipitation throughout the rest of July, these events are likely to remain spotty with inconsistent coverage across the state.

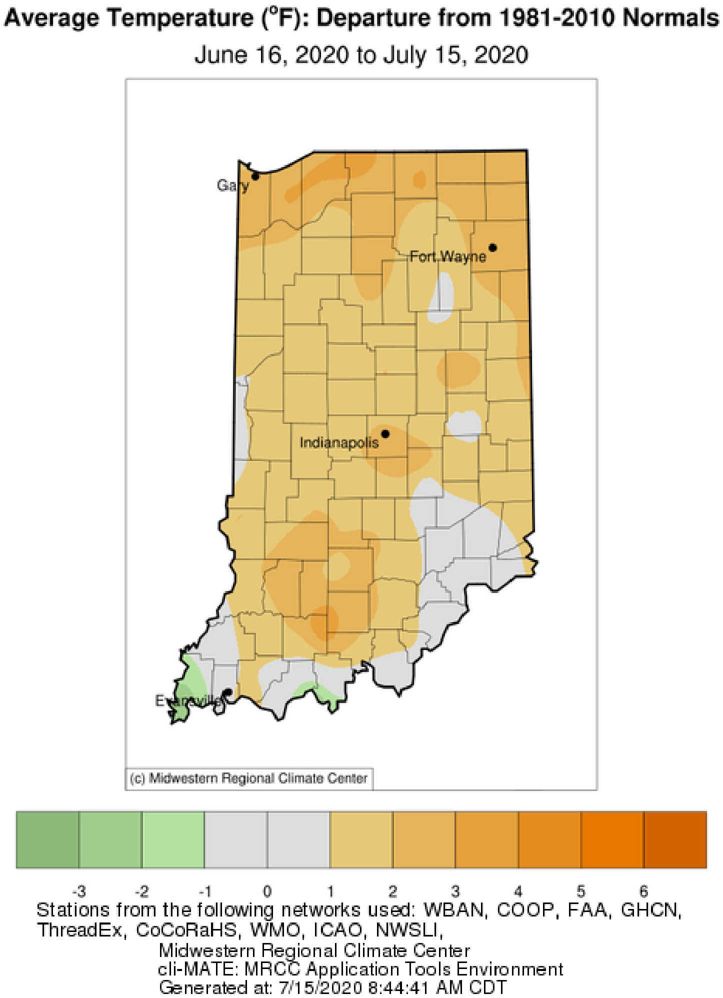

Figure 1. Temperature departures from normal in degrees Fahrenheit for June 16 through July 15, 2020.

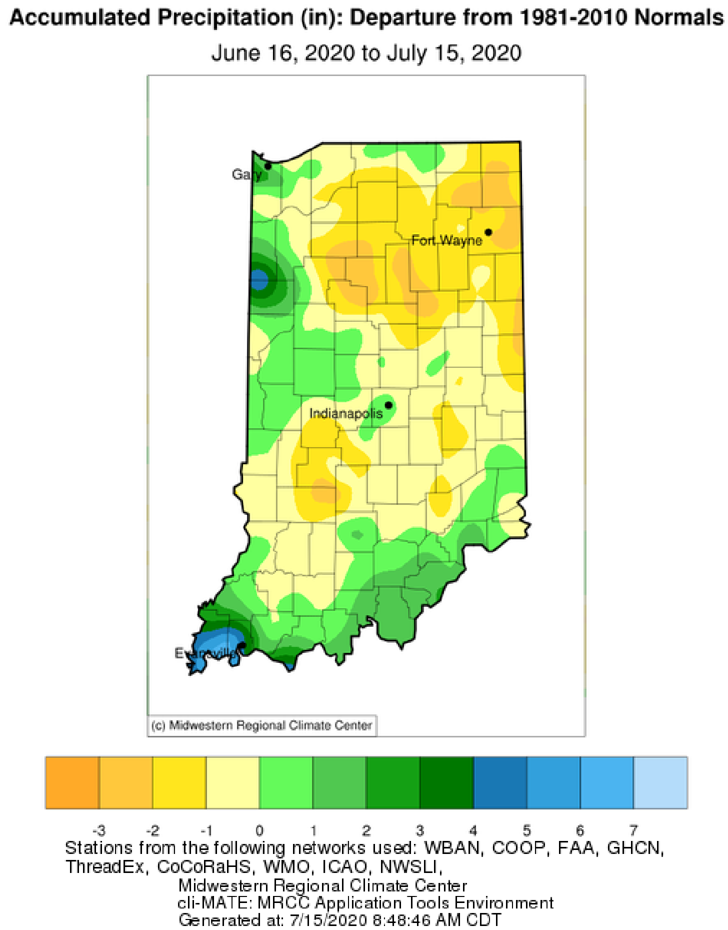

Figure 2. Precipitation departure from normal in inches for June 16 through July 15, 2020.

For planning purposes, it may be helpful to know what the forecast is for reference evapotranspiration (ET). The National Weather Service provides a nice graphical tool (https://digital.weather.gov/) where users can zoom into their area of interest and then view a variety of variables for future time periods out to six days (e.g., Figure 3). Several derivations of the forecasts of reference evapotranspiration (FRET) can be found at the very bottom of the variable pull-down list, including weekly total FRET, daily FRET, and daily departure from normal FRET.

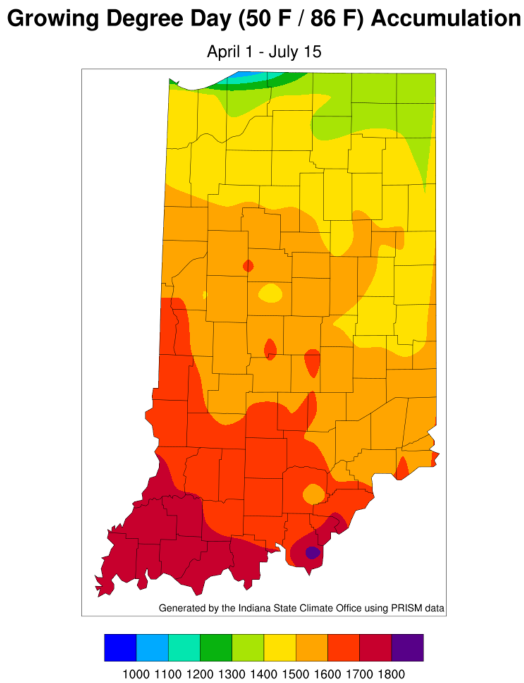

Figure 4. Accumulated modified growing degree days since April 1, 2020.

Accumulated modified growing degree days (MGDDs) continue to increase, however extremely warm days may be slowing down progress (Figure 4). Since MGDDs cap temperatures at 86 degrees Fahrenheit within its computation– to account for the assumption that plant development is limited at higher temperatures – the warm nights and hot days tend to stunt accumulation compared to more traditional growing degree day methods. Regardless, MGDD accumulations across the state for this year seem to be lagging behind recent years, with the exception of the Lafayette, Tippecanoe County region (Figure 5).

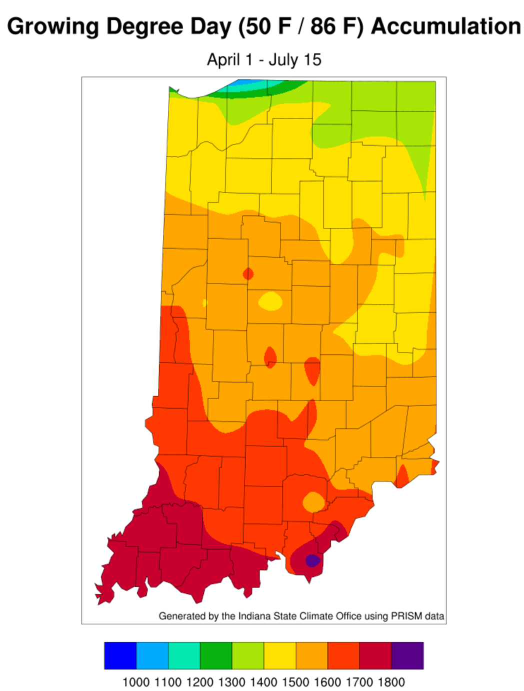

Figure 4. Accumulated modified growing degree days since April 1, 2020.

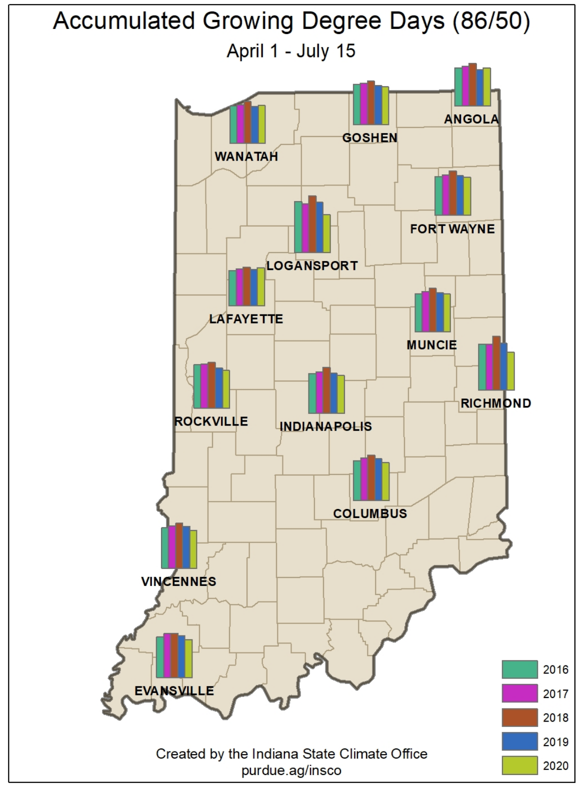

Figure 5. Comparison of accumulated modified growing degree days from April 1 through July 15 for 2016 through2020.