In This Issue

Insect Pests Continue To Attack Hemp

(Marguerite Bolt, mbolt@purdue.edu)

CBD hemp harvest is underway for some growers, while others expect to harvest all the way into October. After a stressful growing season, growers are looking forward to a (hopefully) successful harvest. Because there are still plants in the field, pest attacks still loom, and some growers are seeing late-season damage first hand. As of Wednesday afternoon, growers in Jackson county have reported extensive damage to the flowering portion of their CBD plants caused by corn earworm (Fig. 1, 2). Unfortunately, there are no chemical control options at this point, but by documenting damage and the pests causing it, we can start developing recommendations for the coming years.

Fig. 1. Corn earworm larva feeding on CBD hemp plant.

Fig. 2. Damage caused by corn earworm.

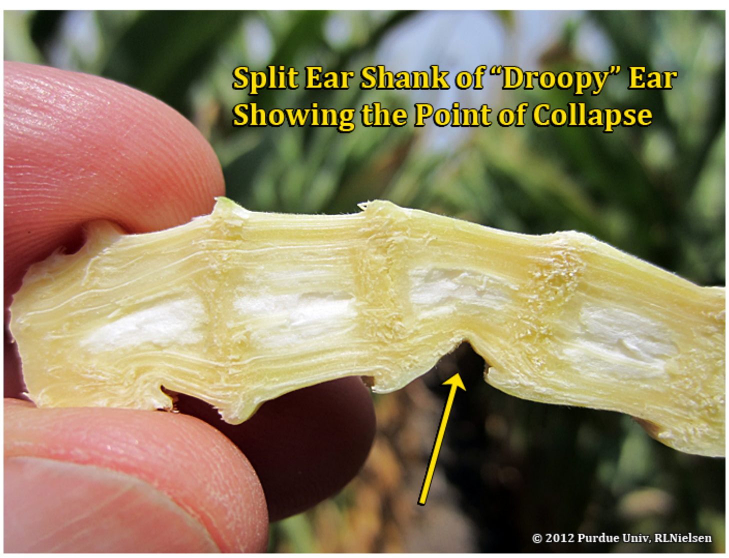
One management option for some pests may be cultivar selection. Hemp growers purchased seeds from different companies across the county and there are around 16 different cultivars currently grown across Indiana. However, some of the cultivars that growers selected seem to be more susceptible to pathogens and insects. One of the susceptible cultivars is the Midwest Strain from Jupiter Seed. This cultivar seems to be attractive to potato leafhopper (Fig. 3). Whole plants of this cultivar are exhibiting the characteristic hopper burn and have multiple nymphs crawling on leaves. Because we do not have the option to spray insecticides at this point, selecting resistant cultivars is going to be an important management strategy.

Fig. 3. CBD plant with hopper burn, notice the potato leafhopper nymph circled in the photo.

Do Your Ears Hang Low? (Premature Ear Declination in Corn)

(Bob Nielsen)

Droopy ears are cute on certain breeds of dogs, but droopy ears on corn plants prior to physiological maturity are a signal that grain fill has slowed or halted. Ears of corn normally remain erect until some time after physiological maturity (black layer development) has occurred, after which the ear shanks eventually collapse and the ears decline or "droop" down. The normal declination of the ears AFTER maturity is desirable from the perspective of shedding rainfall prior to harvest and avoiding the re-wetting of the kernels. PREMATURE ear declination, however, results in premature black layer formation, lightweight grain, and ultimately lower grain yield per acre.



What Causes Premature Droopy Ears? The most common contributing factor seems to be severe drought stress that extends late into the grain filling period. Indeed, I discovered droopy ears in a June-planted corn field (full dent stage, no visible milk line yet) the other day in westcentral Indiana, an area of the state that has been abnormally dry for at least a month. Last week's sunny days with warmer than normal temperatures caused higher than normal evapotranspiration demands on the late-developing crop.

The "droopy" symptom suggests a loss of turgidity in the ear shank due to stress, possibly combined with some cannibalization of the ear shank similar to what can occur with the stored reserves of the main stalk in response to severe photosynthetic stress. Eventually, the ear shank collapses and the ear droops down.

Flashback: In hybrids without the Bt-corn borer trait, collapsed ear shanks can also result from extensive tunneling by European corn borer larvae. Such tunneling weakens the ear shank, allowing it to collapse, and can ultimately also cause the ear to literally drop from the plant.

Impact on Yield? Remember that the ear shank is the final "pipeline" for the flow of photosynthates into the developing ear. An ear shank that collapses prior to physiological maturity will greatly restrict, if not totally prevent, the completion of grain fill for that ear and will likely cause premature black layer development in the grain. If the droopy ears have not yet black layered, they will black layer prematurely; sooner than neighboring erect ears.

The timing of the onset of the collapsed ear shanks determines the magnitude of the expected yield loss. If grain fill were totally shut down at the full dent stage of grain development (milk line barely visible at dent of kernels), the yield loss would be as much as 40 percent. If grain fill were totally shut down at the late dent stage of grain development (milk line halfway between dent and tip), yield losses for the affected ears would equal about 12 percent.

Multiplying the percentage of affected ears in a field by the estimated yield loss per ear will give you an estimate of whole field loss. For example, if ten percent of the field contained plants whose ears drooped prematurely at the late dent stage, whole field loss would be estimated at 1.2 percent (10 percent of the ears multiplied by 12 percent yield loss per ear).

Final thought: While it is never enjoyable assessing the yield potential of drought-stressed fields, it does serve a purpose in helping you develop your grain marketing strategy. Let this article serve as a reminder that the proverbial "windshield survey" often fails to provide an accurate assessment of crop condition.

Related reading

Nielsen, RL (Bob). 2012. Opportunities to Assess Yield Potential of Drought-Stressed Corn. Corny News Network, Purdue Univ. http://www.kingcorn.org/news/articles.12/YldAssessment-0727.html [URL accessed Sep 2019].

Nielsen, RL (Bob). 2018. Estimating Corn Grain Yield Prior to Harvest. Corny News Network, Purdue University. http://www.agry.purdue.edu/ext/corn/news/timeless/YldEstMethod.html. [URL accessed Sep 2019].

Nielsen, RL (Bob). 2019. Grain Fill Stages in Corn. Corny News Network, Purdue University. http://www.agry.purdue.edu/ext/corn/news/timeless/GrainFill.html. [URL accessed Sep 2019].


Erect Ears on Healthy Plants
(Late dent stage, milkline ~ 25%)
© 2011 Purdue Univ, RLNielsen


"Droopy" Ear on a
Drought-Stressed Plant
(Late dent stage, milkline ~ 50%)
© 2011 Purdue Univ, RLNielsen

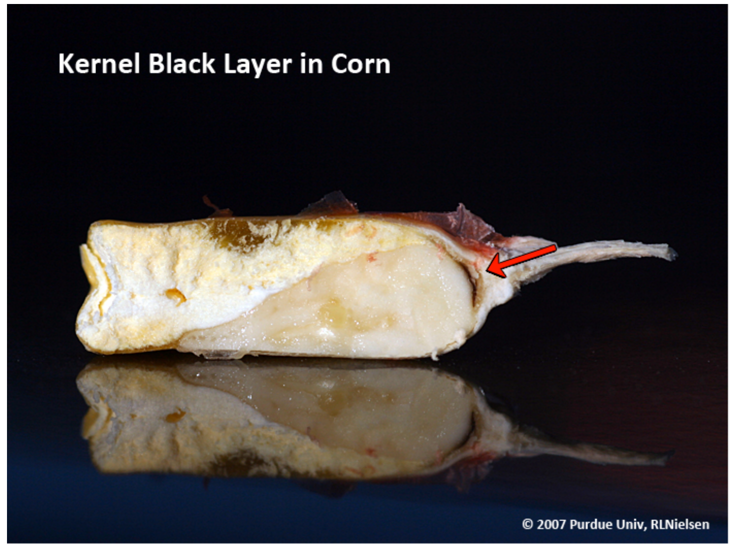

"Droopy" Ears on Drought-Stressed Plants
(Late dent stage, milkline ~ 50%)
This area of the field was less than 100 ft away
from the healthy plants with erect ears.
© 2011 Purdue Univ, RLNielsen


Collapsed Ear Shank of a "Droopy"
Ear on a Drought-Stressed Plant
(Late dent stage, milkline ~ 50%)
© 2011 Purdue Univ, RLNielsen

Predicting Corn Grain Maturity Dates for Delayed Plantings

(Bob Nielsen)

Delayed planting of corn in the upper Midwest often increases the risk that the grain will not mature prior to a killing fall freeze. Physiological maturity occurs near the time the so-called "black layer" develops at the tips of the kernels where they connect to the cob (Nielsen, 2019a). Kernel dry weight reaches its maximum at this point and the grain is generally considered to be safe from the effects of a subsequent killing fall freeze.



Under "normal" planting dates and growing conditions, the calendar time from individual grain fill stages to physiological maturity is similar across a wide geographical area of the U.S. Midwest. Physiological maturity (kernel black layer) for adapted corn hybrids occurs approximately 65 days after silking in the central Corn Belt (Abendroth et al., 2011; Brown, 1999; Neild & Newman, 1990) and 55 to 60 days after silking in the northern Corn Belt (Lauer, 2016). Earlier maturity hybrids not only reach silking in fewer days after planting, but will also reach black layer in fewer days after silking (Brown, 1999; Nielsen et al., 2002).

The nagging question that worries farmers during the "dog days" of late summer following a delayed planting season is whether there are enough days left in the growing season for the crop to mature safely. The answer to that question depends on the current growth stage of the late-planted crop, the relative maturity of the hybrid planted in the field (Nielsen, 2012), the number of heat units (GDDs) yet to be received, and of course the actual date of the pending killing fall freeze.

Based on field research conducted in Indiana and Ohio (Brown, 1999), we know that corn hybrids typically mature with fewer accumulated heat units when planted late compared to planting on "normal" dates. This knowledge provides the basis for our hybrid maturity recommendations to farmers faced with late plantings (Nielsen, 2019b; Nielsen & Thomison, 2003).

That same research provided insight into both the calendar and thermal times typically required for grain at various stages of development to reach physiological maturity (kernel black layer, R6). The research was conducted at two locations in Indiana (westcentral and southeast) and two locations in Ohio (northwest and southwest) with three hybrids representing 97, 105, and 111 "day" relative maturities planted in early May, late May, and early June. The calendar and thermal times from silking to black layer for the three hybrid maturities are provided in Tables 1 – 3 that follow.

While there were slightly different responses among the four locations of the trial, there did not seem to be a consistent north / south relationship. Consequently, I believe growers can use the results summarized in the following tables to "guesstimate" the number of calendar days or heat units necessary for a late-planted field at a given grain fill stage to mature safely prior to that killing fall freeze.

Table 1. Calendar days and GDDs to black layer from grain fill stages R1 - R5 for an adapted 111 "day" corn hybrid with a GDD rating of 2760 GDDs from planting to black layer. Data averaged over eight trial sites.

	Calendar days to kernel black layer (R6) from…				
Planting Date	**R1**	**R2**	**R3**	**R4**	**R5**
Early May	63	51	47	37	20
Late May	65	53	48	38	20
Mid-June	68	55	51	40	22

	GDDs to kernel black layer (R6) from…				
Planting Date	**R1**	**R2**	**R3**	**R4**	**R5**
Early May	1231	965	884	670	327
Late May	1165	919	811	604	289
Mid-June	1029	781	681	489	217

Adapted from Brown (1999).

R1 = Fresh silks; R2 = Blister; R3 = White kernels w/ milky fluid; R4 = Dough, no visible denting; R5 = Late dent, all kernels visibly dented

Table 2. Calendar days and GDDs to black layer from grain fill stages R1 - R5 for an adapted 105 "day" corn hybrid with a GDD rating of 2695 GDDs from planting to black layer. Data averaged over eight trial sites.

	Calendar days to kernel black layer (R6) from…				
Planting Date	**R1**	**R2**	**R3**	**R4**	**R5**
Early May	60	49	45	35	20
Late May	63	51	45	36	20
Mid-June	65	54	50	39	24

	GDDs to kernel black layer (R6) from…				
Planting Date	**R1**	**R2**	**R3**	**R4**	**R5**
Early May	1194	945	866	658	337
Late May	1134	902	784	576	297
Mid-June	1021	786	691	491	259

Adapted from Brown (1999).

R1 = Fresh silks; R2 = Blister; R3 = White kernels w/ milky fluid; R4 = Dough, no visible denting; R5 = Late dent, all kernels visibly dented

Table 3. Calendar days and GDDs to black layer from grain fill stages R1 - R5 for an early 97 "day" corn hybrid with a GDD rating of 2578 GDDs from planting to black layer. Data averaged over eight trial sites.

	Calendar days to kernel black layer (R6) from…				
Planting Date	**R1**	**R2**	**R3**	**R4**	**R5**
Early May	60	47	45	36	20
Late May	61	48	44	36	19
Mid-June	61	47	44	36	21

	GDDs to kernel black layer (R6) from…				
Planting Date	**R1**	**R2**	**R3**	**R4**	**R5**
Early May	1176	901	841	665	319
Late May	1137	878	804	627	279
Mid-June	1010	743	671	482	223

Adapted from Brown (1999).

R1 = Fresh silks; R2 = Blister; R3 = White kernels w/ milky fluid; R4 = Dough, no visible denting; R5 = Late dent, all kernels visibly dented

Related Reading

Abendroth, Lori J., Roger W. Elmore, Matthew J. Boyer, & Stephanie K. Marlay. 2011. Corn Growth and Development. Iowa State Univ. Extension publication PMR1009. Purchase online at https://store.extension.iastate.edu/product/6065. [URL accessed Sep 2019].

Brown, Greg A. 1999. Influence of Delayed Planting on Growing Degree Day Requirements of Corn (Zea mays L.) Hybrids During Grain Fill and Maturation. M.S. Thesis, Purdue University.

Lauer, Joe. 2016. Corn Development. Univ. of Wisconsin. http://corn.agronomy.wisc.edu/Management/L011.aspx [URL accessed Sep 2019].

Neild, Ralph & Jim Newman. 1990. Growing Season Characteristics and Requirements in the Corn Belt. Purdue Extension Pub. NCH-40. http://www.extension.purdue.edu/extmedia/NCH/NCH-40.html [URL accessed Sep 2019].

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Nielsen, RL (Bob). 2019b. Hybrid Maturity Decisions for Delayed Planting. Corny News Network, Purdue Extension. http://www.kingcorn.org/news/timeless/HybridMaturityDelayedPlant.html [URL accessed Sep 2019].

Nielsen, R.L. (Bob) and Peter Thomison. 2003. Delayed Planting & Hybrid Maturity Decisions. Purdue Univ. Cooperative Extension Publication AY-312-W. https://www.agry.purdue.edu/ext/corn/pubs/AY-312-W.pdf [URL accessed Sep 2019].

Nielsen, Robert L., Peter R. Thomison, Gregory A. Brown, Anthony L. Halter, Jason Wells, and Kirby L. Wuethrich. 2002. Delayed Planting Effects on Flowering and Grain Maturation of Dent Corn. Agron. J. 94:549-558.

Delayed Corn Grain Maturity & Frost/Freeze Worries

(Bob Nielsen)

Given the near record late planting of the 2019 Indiana corn crop and the continuing agony of delayed development of the crop, much of the coffeeshop talk down at Cecil's Corner Cafe in recent weeks has centered on the risk of the late crop not maturing before a light frost damages the crop or an outright lethal freeze (28F) kills the crop.

Where does Indiana's corn crop stand at the moment relative to maturity and risk of frost or freeze injury to immature corn? The current USDA-NASS estimates of the kernel development progress of the 2019 Indiana corn crop (Sept 16 report) indicates that 90% of the crop is at the dough stage of development or beyond (Fig. 1), 59% of the crop is at the dent stage of development or beyond (Fig. 2), and only 16% of the crop is physiologically mature (Fig. 3).

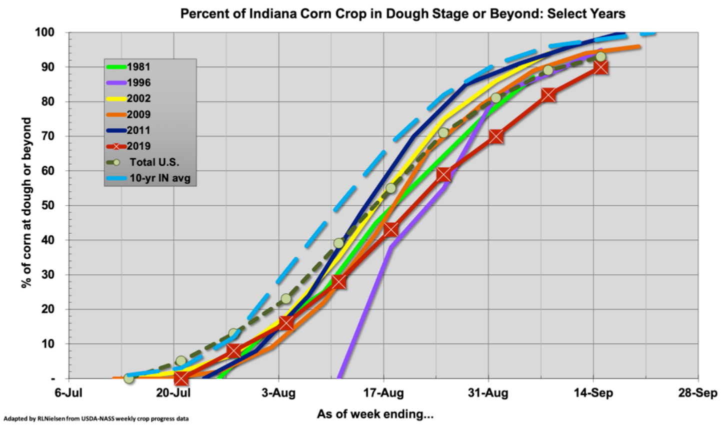


Fig. 1. Percentage of Indiana's corn crop at dough stage OR BEYOND; 15 Sep 2019.

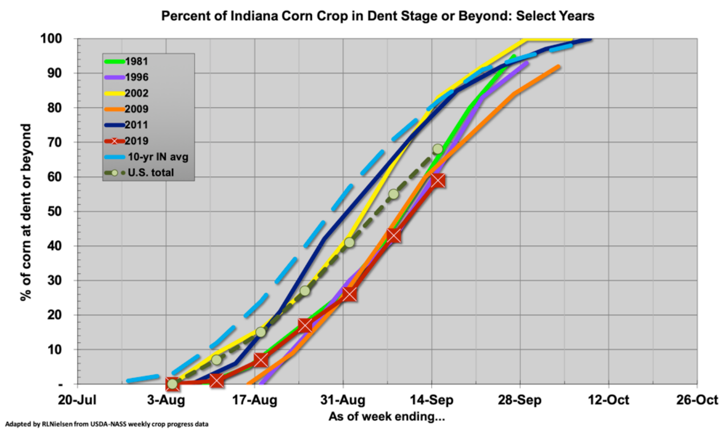


Fig. 2. Percentage of Indiana's corn crop at dent stage OR BEYOND; 15 Sep 2019.

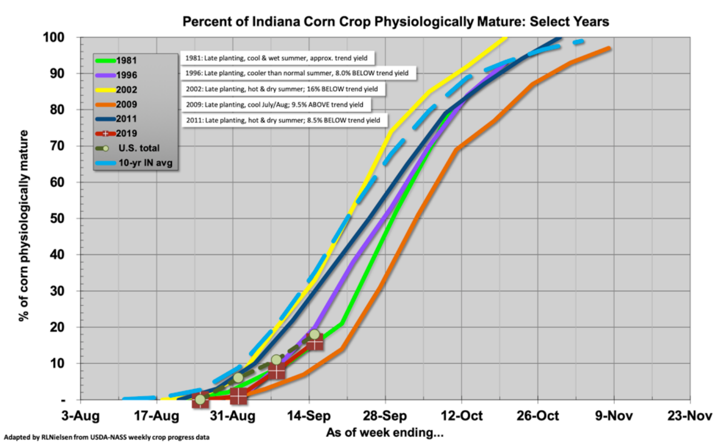


Fig. 3. Percentage of Indiana's corn crop safely mature; 15 Sep 2019.

Those numbers can be misleading because they represent the percentage of the crop at a given stage **OR BEYOND**. For example, when 59% of the crop is at the dent stage **OR BEYOND** and 16% of the crop is mature, then only 43% of the crop is actually in the dent stage of development.

One needs to do similar "reverse" calculations to estimate the actual percentages of the crop that are at specific kernel stages of development. Doing so results in estimates that suggest approximately 10% of the state's corn crop remains in the milk stage of development, approximately 31% of the crop is in the dough stage, and approximately 43% of the crop is in the dent stage of kernel development (Table 1).

An earlier article of mine offered some guidelines to help growers estimate the number of days to maturity for corn based on current stages of kernel development (Nielsen, 2019b). Those estimates are summarized in Table 1, along with the calendar dates that match up with the estimated days to maturity as of mid-September. Obviously, the corn fields most at risk for experiencing a frost or freeze event prior to maturity are those at the younger grain fill stages (milk and dough) that may not reach kernel black layer development until the third week of October or later.

Also included in Table 1 are estimates of possible yield losses if immature fields were damaged or killed by frost or freeze events (Carter & Hesterman, 1990). The difference between the estimates of yield losses in the last two columns of the table is based on whether the plant is completely killed or whether there is opportunity for surviving stalk tissue to remobilize stored carbohydrates to the immature grain before kernel black layer occurs.

Bottom Line

Given the estimated percentage of the state's corn crop yet in the dent stage of development or younger (84%), the significance of an early-occurring fall frost or freeze event in the next few weeks should not be underestimated. The good news is that I have not yet seen any forecast that suggests those events will occur in the near future.

Keep your fingers crossed!

Table 1. Kernel developmental stages, approx. maturity dates, and estimates of yield loss if damaged by frost or killing freeze prior to maturity.

Kernel stage	% of Indiana crop (15 Sep 2019)	Approx. days to maturity	Range of approx. calendar dates for mature grain (As of: 15-Sep)		Est. yield loss if… Only leaves killed	Death of whole plant
		(1)	earliest	latest	(2)	(2)
Milk (R3)	~ 10%	44 - 51	29-Oct	5-Nov	> 35%	> 60%
Dough (R4)	~31%	35 - 40	20-Oct	25-Oct	~ 35%	~ 55%
Dent (R5)	~43%	19 - 24	4-Oct	9-Oct	~ 27%	~ 41%
Half-milkline	??	10 - 14	25-Sep	29-Sep	~ 5%	~ 12%
Mature (R6)	~16%	0			0%	0%

R3 = White or yellow kernels with milky fluid
R4 = Dough, no visible kernel denting
R5 = Dent, all kernels visibly dented
Half-milkline = Kernel milkline halfway between crown and tip
R6 = Kernel black layer, physiological maturity
Approx. days to maturity = Calendar days remaining until kernel black layer
(1) Nielsen, 2019b; (2) Carter & Hesterman, 1990

Ear and Stalk Rots: How to Identify and Make Assessments for Harvest and Future Disease Management Decisions

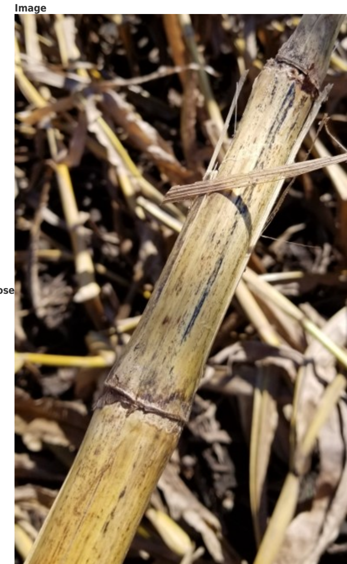
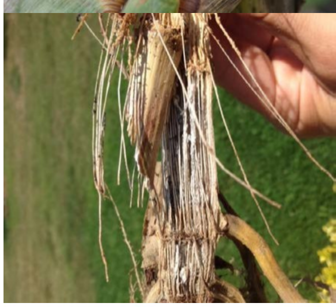
(Darcy Telenko)

The time has come to start scouting corn for ear and stalk rots. This will aid in making assessments about field harvest order and if there is a risk of mycotoxin contamination.

Stalk rots

There are a number of plant pathogens that can cause stalk rot including, Anthracnose, Bacteria, Charcoal, Diplodia, Fusarium, Gibberella, and Pythium. Some of these stalk rots have very characteristic symptoms that can help identify the specific problem, while others may require laboratory diagnosis (Table 1). The Purdue Extension publication Corn Diseases: Stalk Rot has good images to help identify the major stalk rot diseases we see in Indiana (https://www.extension.purdue.edu/extmedia/BP/BP-89-W.pdf).

Table 1. Stalk rot pathogens, identifying characteristics, and management options.

Stalk rot	Image	Characteristics	Management options[z] Resistance[y]	Rotation[x]	Tillage[x]	Other
Anthracnose		Distinctive blackening of the stalk rind, loss of pith leads to shredded interior	X	X	X	Strong stalks, reduced susceptibility to foliar diseases, and production practices that promote good plant health may reduce potential for lodging
Bacteria		Slimy, water soaked outer rind and pith	Fall	Good drainage and plant health		
Charcoal		Silver grey rind, peppered with microsclerotia – grainy, gray in color	X	Many hosts. Rotation not as effective since microsclerotia can survive for many years		
Diplodia		Many small, black pycnidia embedded in rind of lower internode- that cannot be scrapped off with thumbnail, white mold might appear in wet conditions, shredded pith	X	X	X	Strong stalks, reduced susceptibility to foliar diseases, and production practices that promote good plant health may reduce potential for lodging
Fusarium		Dark lesions, external brown streaks on lower internode, internal shredding, sometimes a pale-pink to salmon color on rotted tissue	X	X	X	Strong stalks, reduced susceptibility to foliar diseases, and production practices that promote good plant health may reduce potential for lodging
Gibberella		Small, black spots (perithecia) on internodes and nodes – these can be scrapped off with thumbnail, pink discoloration and shredding in pith	X	X	X	Strong stalks, reduced susceptibility to foliar diseases, and production practices that promote good plant health may reduce potential for lodging
Physoderma		Infected nodes will snap when pushed, node is black and rotten.	Maybe	Maybe	Strong stalks, reduced susceptibility to foliar diseases, and production practices that promote good plant health may reduce potential for lodging	
Pythium		Decay of first internode about soil – soft, brown, water-soaked pith. Stalk may twist. Typically no odor.	Strong stalks, reduced susceptibility to foliar diseases, and production practices that promote good plant health may reduce potential for lodging			

Reference: Freije and Wise. Stalk rots. Purdue Extension BP-89-W.
https://www.extension.purdue.edu/extmedia/BP/BP-89-W.pdf
Image sources: D. Telenko, Purdue PPDL, and K. Wise. [z]Management options that could be considered for future crops.
[y]Resistance may be available in some hybrids for the specific disease. [x]Rotation and tillage can reduce inoculum potential in the field.

It is time to check stalk integrity – check field by using the **Push** or **Pinch Test** by evaluating 20 plants in at least five random areas in a field.

Pinch Test – grab the stalk somewhere between the lowest two internodes and pinch between your fingers to see if the stalk is strong enough to handle the force – if the stalk collapses, it fails.

Push Test – push the stalk to a 30 degree angle – if it pops back up when released, it passes the test, if not it fails.

Threshold: 10% or more of the stalks fail then consider field for early harvesting to avoid risk for lodging.

What can you do in the future – management options will depend on the specific disease (see table 1). Production practices that promote good plant health including balanced fertilization, appropriate plant populations, and good water management can reduced stresses that might predispose corn to stalk rot. In addition, these key management tools can help mitigate future stalk rot issues.

1. **Properly diagnosis the stalk rot pathogen.** (Samples can be submitted to the Purdue Plant and Pest Diagnostic Lab)
2. **Select hybrids with resistance** if available.
3. **Crop Rotation** – rotating to non-host crop will help reduce stalk rot potential in a field. Note that Charcoal rot and Gibberella stalk rot can infect other rotational crops in Indiana
4. **Tillage –** burying infected crop residue will encourage more rapid desiccation and help reduces risk of overwintering in crop residue.
5. **Good soil drainage and reduced compaction**.
6. **Foliar Fungicides** – applying foliar fungicides can help protect crop from foliar diseases that could predispose plant to stalk rot when present, but devoid of foliar disease pressure fungicides applications have not consistently been found to help reduce stalk rot.

Ear rots and mycotoxin risks.

Scouting for ear rots is also very important. The Corn Mycotoxin webpage is great resource with videos on how to scout and sample your fields and grain lots. http://www.cornmycotoxins.com/home/

In Indiana, five ear rots can lead to mycotoxin production in corn. They include Aspergillus ear rot, Gibberella ear rot, Fusarium ear rot, and Penicillium ear rot (Figure 2). They can cause the production of five different mycotoxins in association with the different ear rot: **Aflatoxin** (Aspergillus), **Deoxynivalenol** or as also called DON/vomitoxin and **Zearalenone** (Gibberella); **Fumonisins** (Fusarium), and **Ochratoxin** (Penicillium and sometimes Aspergillus).

If a field has ear rot problems, it will be important to test the harvested grain lots for mycotoxins. The Grain and Silage Sampling and Mycotoxin Testing Resources publication provides a good reference on how to take a sample or sub-samples and a list of professional laboratories available to grain testing (https://crop-protection-network.s3.amazonaws.com/publications/grain-and-silage-sampling-and-mycotoxin-testing-filename-2019-04-10-184011.pdf).

2019 Corn Earworm Trap Report

(Laura Ingwell)

Camera Or Drone Video Aid Greatly In Identifying Needed Center Pivot Sprinkler Repairs

(Lyndon Kelley) & *(Eric Anderson)*

• Before you put the pivot away for the season, use a camera or drone video of pivot water patterns and pipe leaks to greatly help winter irrigation repairs.

Imagine being a repairman, sent to weld a patch on a leaky center pivot span in the middle of the winter. Think of how helpful the photo or a video of the water application and the leaks would be in helping you determine where the needed repair is. Even the off-season task of changing out faulty sprinklers can be greatly reduced if you have video of the sprinkler application patterns from last summer to guide you to the location.

Many crop consultants have drone services available to video fields and equipment. Drones are becoming more common among irrigation and crop supply businesses. “I think once irrigators have seen drone video of an irrigation system applying water, drone services will be more in demand” says Lyndon Kelley, MSU/Purdue Irrigation Educator. The drone flies a path 40-50 feet above and parallel to the pivot from the center point to the end gun. A 2-3 minute video documents each sprinkler’s water pattern problems and visible leaks for later repair.

Preparing for an August 16 field day near Sturgis, MI, MSU and Purdue Extension staff performed a system uniformity can test on a 1300-foot pivot. At the same time, a drone captured video images of the application. The concept is that taking a quick video of the pivot while applying water would allow a producer to identify needed repairs.

Our example video showed a 1300 foot pivot with one plugged sprinkler at the beginning that could be seen visually from the ground and corrected before the can test and the next drone flight. Three sprinklers where identified by the drone video that spun much faster than the others did, resulting in a smaller whipping application rather than the larger throwing pattern the sprinkler is designed to produce. Our drone flight was videoed by John Scott, Purdue Digital Ag Extension Coordinator and Eric Anderson, MSU Extension Field Crop Educator. The video can be viewed online with closed captions.

After viewing footage from the summer evaluation of a seven tower pivot several times, we wished we had numbered the top of the tower boxes with hog marker or tied marker ribbons to the spans to avoid having to restart the video over again to count the tower from the center point when documenting needed repairs. John found filming from above and to the side of the pivot, and aiming slightly ahead, the drone provided the best view of the water spray pattern. "Determining the best altitude and position to fly and the best angle to video is a matter of trial and error and will depend on factors such as quality of the camera, crop, stage of growth, time of day, and degree of cloud cover," said Anderson.

The identification of the needed repair areas of the application is the challenge. The repairs to our example pivot were simple and inexpensive: new caps for the damaged Nelsen 3000 sprinklers were purchased using the sprinkler chart to identify the correct parts. A trip to the local dealer and 10 minutes of student help climbing spans to replace the sprinkler tops corrected the problems. The sprinklers on our tested pivot contain a small resistance pump in the cap to regulate the spin of the deflector plate that creates the desired spray pattern. When these wear out, the plate rotates much faster creating a whipping effect and a much smaller throw. Three of the 131 sprinklers in the sprinkler package were replaced, replacement of all of the parts is recommended when the accumulated number of malfunctioning parts reaches 10%. Almost all sprinkler types will have a wear point that will need attention during their useable life span of 7 to 10 years.

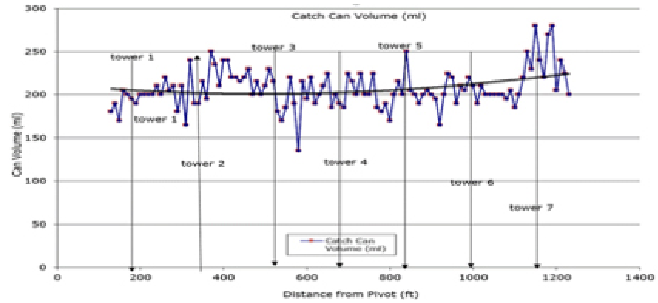
The irrigation system chosen for the study had its water supply flow tested to assure that the sprinkler design was matched to water supply. Photos and video provide easy identification of differences between a given sprinkler and those adjacent to it. Pivots that have inadequate water supply flow for the sprinkler pattern will have a slowly decreasing application as you move from the center of the pivot length to the end gun that will not be readily visible from photos or video.

There are common problems that greatly reduce water application uniformity from center pivots that our photos and drone video did not identify but our can test did. The drone footage did not capture the over application area between the interface of an end gun and the sprinkler package identified by the catch can test. It did a good job of identifying sprinklers out of sequence when we switched sprinklers causing a double and half application mistake area.

A local pivot technician looking at the flight video said the video would be the perfect method to document what leaks and flanges need repaired on a unit. It would eliminate their having to turn the water on to identify leaks when they first get to a site. A video from the ground would also work but would be much harder to get in the middle of the season with standing crops in the field. Whether taken from the ground or drone, a video sent to the repairman can be a huge benefit to identifying sprinkler problems.

Drone flying over irrigation system. (Photo Credit: Eric Anderson)

Finding the right angle is a matter of trial and error and will depend on factors such as crop, stage of growth, time of day, and degree of cloud cover. (Photos Credit: John Scott, Purdue Extension)



Conducting a catch can test can highlight sprinkler heads that are performing outside a range of tolerance which is generally ±5–8% of the average volume.

Indiana Climate and Weather Report –

9/12/2019

(Beth Hall)

Warmer and wetter than normal. That's the climate outlook through the end of this month. The warmer than normal is believable, but the wetter than normal is hard to imagine in the short term, since the forecasts have been dry this past week. However, the current weather system is expected to move out of the area so the outlooks are promising. It is still too soon to predict the first fall freeze. Let's hope those warmer temperatures stick around for a while!

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Editor: Tammy Luck | Department of Entomology, Purdue University, 901 W. State St., West Lafayette, IN 47907