PURDUE UNIVERSITY | Extension ENTOMOLOGY

Pest&Crop newsletter

Issue: 2019.11
May 30, 2019

Purdue Cooperative Extension Service and USDA-NIFA Extension IPM Grant

This work is supported in part by Extension Implementation Grant 2017-70006-27140/ IND011460G4-1013877 from the USDA National Institute of Food and Agriculture.

In This Issue

Yet another storm moving through west central Indiana. (*Photo credit: John Obermeyer)*

Armyworm Pheromone Trap Report – 2019

(John Obermeyer)

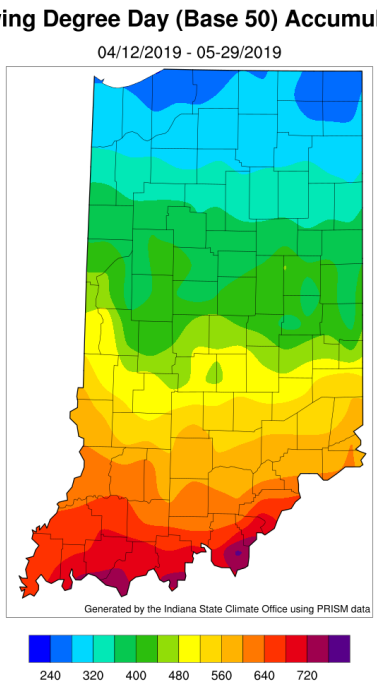
County/Cooperator	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10
Dubois/SIPAC Ag Center	5	24	91	74	8	3	77	82		
Jennings/SEPAC Ag Center	0	2	9	11	6	1	0	0		
Knox/SWPAC Ag Center	105	34	78	200	185	43	42	87		
LaPorte/Pinney Ag Center	0	127	312	52	51	39	186	13		
Lawrence/Feldun Ag Center	148	60	124	327	376	29	134	637		
Randolph/Davis Ag Center	0	193	183	420	446	236	162	50		
Tippecanoe/Meigs	8	5	127	120	361	82	291	251		
Whitley/NEPAC Ag Center	4	191	384	392	1222	739	1349	605		

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

Scout Seedling Corn for Black Cutworm

(John Obermeyer)

The early intensive black cutworm flights into Indiana, 2nd week of April, have now received enough heat accumulation for larva to have developed to the cutting stage throughout the state. It is important to understand that black cutworm moths continue to arrive, and by one cooperator's report who kept out his trap, they are still plentiful. This means that corn just planted, or yet to be planted, should be scouted in the seedling stage for damage from this pest. Happy Scouting!



Sulfur Deficiency in Alfalfa

(Jim Camberato) & *(Keith Johnson)*

Light green alfalfa in the background of the photo was adequate in all nutrients except S which was 0.14% – well below the critical level of 0.25%. Sulfur was 0.26% S in the darker green alfalfa. Although appearance and tissue analysis suggest the alfalfa is ailing from S deficiency, the ultimate criteria is seeing a response to applied S. Leaving a few strips without S or only applying S to several test strips is the best way to determine if this is truly a S deficiency. For more information on S nutrition of alfalfa click here.

Southeast Purdue Agricultural Center. (Photo Credit: Alex Helms)

Cover Crops for Prevented Planting Acres

(Eileen Kladivko)

Planting cover crops on prevented planting acres can be a good way to improve soil health after the excessive water this spring and can help with weed control on otherwise fallow land. The Extension Publication "Cover Crops for Prevented Planting Acres" (AY-355-W) discusses reasons for using cover crops and some general recommendations for their selection and use (attached) https://www.edustore.purdue.edu/item.asp?Item_Number=AY-355-W. This publication does not specifically deal with fields that have major problems with marestail, waterhemp, palmer, or giant ragweed; in those cases, a simple grass cover crop may be best, to allow use of broadleaf herbicides later in the summer. See articles in the Illinois and Ohio newsletters for more discussion of this option.

http://bulletin.ipm.illinois.edu/?p=4619

https://agcrops.osu.edu/newsletter/corn-newsletter/2019-15/current-weed-issues-i-controlling-weeds-prevented-planting-areas

Effects of Flooding or Ponding on Corn Prior to Tasseling

(Bob Nielson)

The consequences of flooding, ponding, and saturated soils on young corn depend heavily on the duration of the stress and temperatures.

Intense rainfall events (technically referred to as "toad stranglers" or "goose drowners") flood low-lying corn fields and create ponding (standing water) in poorly drained areas (depressions, compacted soil) within other fields. Other areas within fields, while technically not flooded or ponded, often remain saturated for lengthy periods of time. Recurrent heavy rainfall events simply "add insult to injury" by re-wetting, re-ponding, and re-flooding the same areas of the fields.

What are the prospects for recently submerged corn fields or plants simply enduring days and days of saturated soils? The flippant answer is that suffering crops will survive until they die.

What I really mean is that no one can tell you with certainty the day after the storm whether a ponded area of a corn field will survive or whether there will be long-term yield consequences until enough time has gone by such that you can assess the actual recovery of the damaged plants. We can, however, talk about the factors that increase or decrease the risks of severe damage or death to flooded soils.

- Plants that are completely submerged are at higher risk than those that are partially submerged.
    - Plants that are only partially submerged may continue to photosynthesize, albeit at limited rates.

- The longer an area remains ponded, the higher the risk of plant death.
    - Soil oxygen is depleted within about 48 hours of soil saturation. Without oxygen, the plants cannot perform critical life sustaining functions; e.g. nutrient and water uptake is impaired and root growth is inhibited (Wiebold, 2013).
    - Many agronomists will tell you that young corn can survive up to about 4 days of outright ponding if temperatures are relatively cool (mid-70's F or cooler); fewer days if temperatures are warm (mid-70's F or warmer).
- Even when surface water subsides quickly, the likelihood of dense surface crusts that form as the soil dries increases the risk of emergence failure for recently planted crops.
    - Be prepared with a rotary hoe to break up the crust and aid emergence. For those "youngsters" among you who do not know how to use a rotary hoe, see Hanna et al. (2001).
- The greater the deposition of mud or old crop residues on plants as the water subsides, the greater the stress on the plants due to reduced photosynthesis.
    - Ironically, such situations would benefit from another rainfall event to wash the mud deposits from the leaves.
- Mud and crud that cakes the leaves and stalks encourage subsequent development of fungal and bacterial diseases in damaged plant tissue. In particular, bacterial ear rot can develop when flood waters rise up to or above the developing ears of corn plants (Nielsen, 2003).
- Corn younger than about V6 (six fully exposed leaf collars) is more susceptible to ponding damage than is corn older than V6.
    - This is partly because young plants are more easily submerged than older taller plants and partly because the corn plant's growing point remains below ground until about V6. The health of the growing point can be assessed initially by splitting stalks and visually examining the lower portion of the stem (Nielsen, 2019a). Within 3 to 5 days after water drains from the ponded area, look for the appearance of fresh leaves from the whorls of the plants.

- Extended periods of saturated soils AFTER the surface water subsides will take their toll on the overall vigor of the crop.
    - Some root death will occur and new root growth will be stunted until the soil dries to acceptable moisture contents. As a result, plants may be subject to greater injury during a subsequently dry summer due to their restricted root systems.
    - Nutrients like nitrogen are rapidly remobilized from lower leaves to upper, newer leaves; resulting in a rapid development of orange or yellow lower leaves.
    - Because root function in saturated soils deteriorates, less photosynthate is utilized by the root system and more accumulates in the upper plant parts. The higher concentration of photosynthate in the stems and leaves often results in dramatic purpling of those above-ground plant parts (Nielsen, 2017).
    - As more of the root system dies, the ability of the affected plants to take up water decreases and, ironically, the plants begin to show signs of drought stress (leaf rolling, plant wilting, leaf death).
    - Damage to the root system today will predispose the crop to the development of root and stalk rots later by virtue of the photosynthetic stress imposed by the limited root system during the important grain filling period following pollination. Monitor affected fields later in August and early September for the possible development of stalk rots and modify harvest-timing strategies accordingly.

- Concomitant (I found a new word in the dictionary!) with the direct stress of saturated soils on a corn crop, flooding and ponding can cause significant losses of soil nitrogen (N) from either denitrification of nitrate-N in heavier soils or leaching of nitrate-N in coarser soils.
    - Significant loss of soil N will cause nitrogen deficiencies and possible additional yield loss.
    - On the other hand, if the corn dies in the ponded areas it probably does not matter how much nitrogen you've lost.
- Lengthy periods of wet soil conditions favor the development of seedling blight diseases in young corn seedlings, especially those caused by Pythium fungi (Sweets, 2014).
    - Fungicidal seed treatments effectively protect the seed and seedling for only about 3 weeks after planting. After that, especially if seedling development has been delayed by cold or excessive soil moisture, the risk of infection increases quickly. Fields that looked acceptable one week can be devastated by seedling blight by the next week if conditions are favorable for the disease and seedling development has not yet reached about V3 to V4.
    - Poorly drained areas of fields are most at risk for the development of these diseases and so will also be risky for potential replant operations.
- The risk of diseases like common smut and crazy top also increases when soils are saturated or plants are submerged and temperatures are cool (Pataky and Snetselaar, 2006; Jackson-Ziems, 2014).
    - The fungus that causes crazy top depends on saturated soil conditions to infect corn seedlings.
    - The common smut fungal organism is ubiquitous in soils and can infect young corn plants through tissue damaged by floodwaters. There is limited hybrid resistance to either of these two diseases and predicting damage is difficult until later in the growing season.
- Wind damage to corn during severe storms results in either stalk breakage (aka "green snap") or root lodging (plants uprooted and laying nearly flat to the ground). The risk of permanent damage is greater during late vegetative development and less with younger plants.
    - The yield effect of "green snap" damage depends on the percentage of field affected and whether the stalk breakage occurs above or below the ear, but is usually serious regardless. Obviously, stalk breakage below the ear results in zero yield for that plant. Stalk breakage above the ear results in significant yield loss due to the loss of upper canopy photosynthesis capacity for that plant.
    - Root lodged corn will recover or straighten up to varying degrees depending on the growth stage of the crop. Generally, younger corn has a greater ability to straighten up with minimal "goose-necking" than older corn. Yield effects of root lodging depend on whether soil moisture remains adequate for root regeneration, the severity of root damage due to the uprooting nature of root lodging, and the degree of "goose-necking" that develops and its effect on the harvestability of the crop.

Related Reading

Anonymous. 2019. Seed Decay and Seedling Blight of Corn. Crop Protection Network. EXCELLENT PHOTOS. https://cropprotectionnetwork.org/resources/articles/diseases/seed-decay-and-seedling-blight-of-corn [URL accessed May 2019].

Butzen, Steve. Flooding Impact on Crops. Pioneer Hi-Bred Int'l. https://www.pioneer.com/home/site/us/agronomy/crop-management/adverse-weather-disease/flood-impact/ [URL accessed May 2019].

Ciampiatti, Ignacio, Doug Shoup, Doug Jardine, Dorivar Ruiz, & Stu Duncan. 2017. Effect of Standing Water and Saturated Soils on Corn Growth. eUpdate, Kansas State Univ. Extension. https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=1362 [URL accessed May 2019].

Diaz, Dorivar Ruiz and Mary Knapp. 2019. Wet soils and N loss: How much of the applied nitrogen has undergone nitrification?. eUpdate, Kansas State Univ. Extension. https://webapp.agron.ksu.edu/agr_social/article/wet-soils-and-n-loss-how-much-of-the-applied-nitrogen-has-undergone-nitrification-337-1 [URL accessed May 2019].

Hanna, Mark, Mahdi Al-Kaisi, and Michael Tidman. 2001. Use the rotary hoe for soil crusting. Integrated Crop Management, Iowa State Univ. Extension. https://crops.extension.iastate.edu/use-rotary-hoe-soil-crusting [URL accessed May 2019].

Jackson-Ziems, Tamra. 2014. Corn Diseases: Crazy Top . CropWatch, Univ. of Nebraska Extension. Video at https://youtu.be/1QSTWMEKreM [URL accessed May 2019].

Laboski, Carrie. 2013. Potential for Nitrogen Loss Following Heavy Rainfalls. NPK et cetera. Univ of Wisconsin Extension. https://npketc.soils.wisc.edu/2013/06/26/potential-for-nitrogen-loss-following-heavy-rainfalls/ [URL accessed May 2019].

Malvick, Dean. 2014. Soybean and Corn Seedling Diseases Increase With Flooded and Wet Soil Conditions. Minnesota Crop News, Univ of Minnesota Extension. http://blog-crop-news.extension.umn.edu/2014/06/soybean-and-corn-seedling-diseases.html [URL accessed May 2019].

Miller, Ryan, Liz Stahl, Jeff Coulter, Seth Naeve, Dean Malvick, and Fabian Fernandez. 2018. Continued Rainfall and Excessively Wet Field Conditions. Minnesota Crop News, Univ of Minnesota Extension. http://blog-crop-news.extension.umn.edu/2018/06/continued-rainfall-an

d-excessively-wet.html [URL accessed May 2019].

Nielsen, R.L. (Bob). 2003. Bacterial Ear Rot in Corn Due to Flooding. Corny News Network, Purdue Univ. http://www.kingcorn.org/news/articles.03/EarRot-0720.html. [URL accessed May 2019].

Nielsen, RL (Bob). 2017. Prevalent Purple Plants Perennially Puzzle Producers. Corny News Network, Purdue Extension. http://www.kingcorn.org/news/timeless/PurpleCorn.html [URL accessed May 2019].

Nielsen, RL (Bob). 2019a. Corny Growing Points of Interest. Corny News Network, Purdue Univ. http://www.kingcorn.org/news/timeless/GrowingPoints.html [URL accessed May 2019].

Nielsen, RL (Bob). 2019b. Determining Corn Leaf Stages. Corny News Network, Purdue Univ. http://www.kingcorn.org/news/timeless/VStageMethods.html [URL accessed May 2019].

Nielsen, RL (Bob). 2019c. Tips for Staging Corn with Severe Leaf Damage. Corny News Network, Purdue Univ. http://www.kingcorn.org/news/timeless/VStagingTips.html. [URL accessed May 2019].

Nielsen, RL (Bob). 2019d. Use Thermal Time to Predict Leaf Stage Development in Corn. Corny News Network, Purdue Univ. http://www.kingcorn.org/news/timeless/VStagePrediction.html [URL accessed May 2019].

Pataky, J. K., and K. M. Snetselaar. 2006. Common smut of corn. The Plant Health Instructor. DOI:10.1094/PHI-I-2006-0927-01. https://www.apsnet.org/edcenter/disandpath/fungalbasidio/pdlessons/Pages/CornSmut.aspx [URL accessed May 2019].

Sweets, Laura. 2014. Seed Decay and Seedling Blights of Corn. Integrated Pest & Crop Management Newsletter, Univ of Missouri Extension. http://ipm.missouri.edu/IPCM/2014/4/Seed-Decay-and-Seedling-Blights-of-Corn/ [URL accessed May 2019].

Thomison, Peter and Alexander Lindsey. 2018. Impact of ponding and saturated soils on corn. C.O.R.N. Newsletter, Ohio State Extension. https://agcrops.osu.edu/newsletter/corn-newsletter/2018-19/impact-ponding-and-saturated-soils-corn [URL accessed May 2019].

Timmerman, Amy, Tamra Jackson-Ziems, Roger Elmore, Tyler Williams, and Brian Krienke. 2018. Flooding and Ponding in Corn. CropWatch, Univ Nebr Extension. https://cropwatch.unl.edu/2018/flooding-and-ponding-corn [URL accessed May 2019].

Wiebold, Bill. 2013. Heavy Rains Exclude Oxygen Needed for Seedling Health from Soils. Integrated Pest & Crop Mgmt, Univ of Missouri. http://ipm.missouri.edu/IPCM/2013/5/Heavy-Rains-Exclude-Oxygen-Needed-for-Seedling-Health-from-Soils [URL accessed May 2019].

Tips for Staging Corn with Severe Leaf Damage

(Bob Nielson)

It is not uncommon for young corn plants to suffer severe leaf damage from frost, freezing temperatures, or hail. Such weather-related events usually lead to vigorous debate over coffee and rolls down at the local cafe as to how one goes about staging corn that survives the defoliation caused by such events.

Some may wonder why this topic is worthy of discussion. The reason lies with the fact that a number of post-emergence corn herbicides can only be applied to corn up to a label-specified leaf stage (Ikely and Johnson, 2018). Growers and applicators obviously need to be able to accurately stage corn plants, even if damaged, to determine whether application of a such herbicides will still be within label restrictions.

Unfortunately, dead leaf tissue does not resurrect itself and will eventually slough off as the plants continue to grow. A common question I hear from farmers is whether the leaf stage of a recovered plant begins anew with the healthy leaves expanding from the whorl or whether the dead leaves (which may no longer be identifiable) should be counted. In other words, should a 5-leaf plant that has lost four leaves to frost injury now be considered a 1-leaf plant?

The simple answer is: A V5 plant is a V5 plant no matter how many lower leaves are damaged, dead, or otherwise missing. As long as the dead lower leaves remain attached to the plants, leaf staging is reasonably simple. Count the dead leaves and any additional ones with visible leaf collars (Nielsen, 2019a).

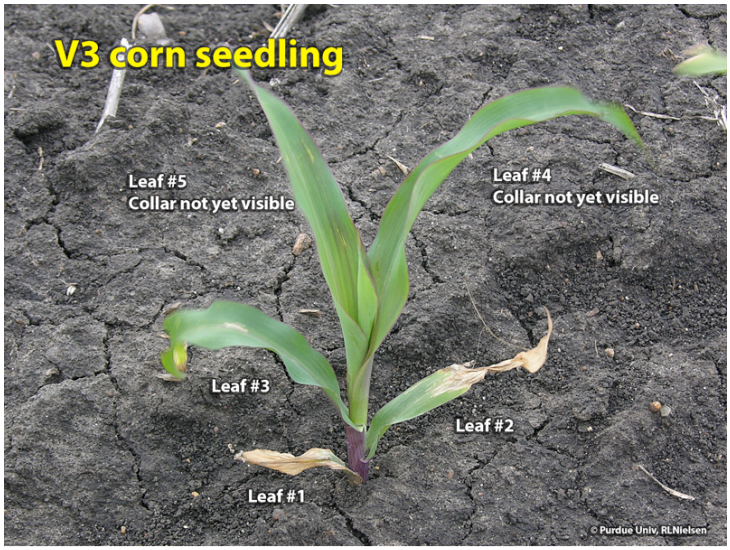
The challenge occurs when the dead lower leaves slough off and decompose or blow away. Now how do you count leaves if you are not sure whether the lowermost remaining leaf is #2 or #3? This is not a problem when staging V7 or older corn because one can then split stalks to identify the 5th node and its respective attached leaf, then count the remaining leaves with collars above that leaf (Nielsen, 2019a).

However, this technique does not work well for corn plants younger than about V6 or V7 because stalk elongation up to about that stage is not far enough along for you to use the “split stalk” technique. Unfortunately, a number of post-emergence herbicides have label restrictions for applications to corn older than V5 or V6 (Ikely and Johnson, 2018) and so there is a need to be able to accurately estimate the leaf stage of corn plants that were damaged at earlier leaf stages.

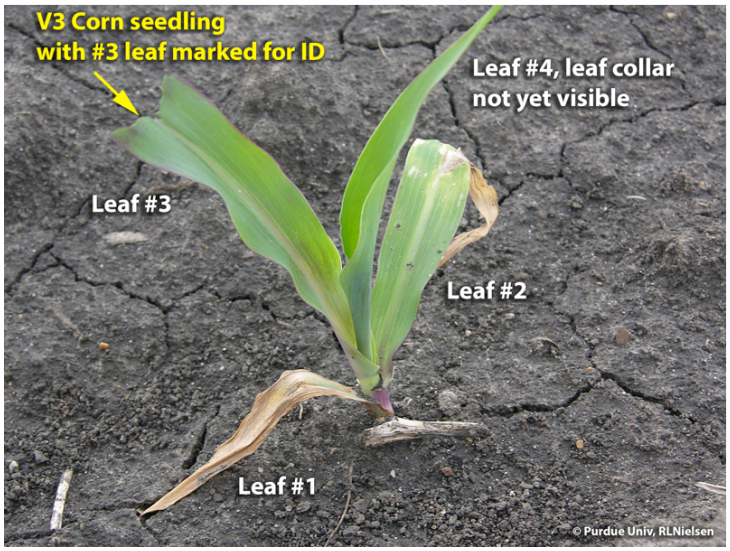
Here are **two alternatives** for staging damaged young corn:

1) Walk damaged and recovering fields as soon as you can while the dead lower leaves of damaged plants are still attached. Mark ten consecutive plants with plot flags or garden stakes. Identify and record the leaf number of the lowermost healthy leaf (one likely to remain attached for some time) of each plant. Mark each such leaf by simply ripping off a third or half of the leaf blade. To simplify future leaf staging, similarly mark the same leaf number on each of the 10 consecutive plants. When you come back in a week or later to stage the plants again, find the marked leaf on each plant and continue counting the number of leaves with visible leaf collars.

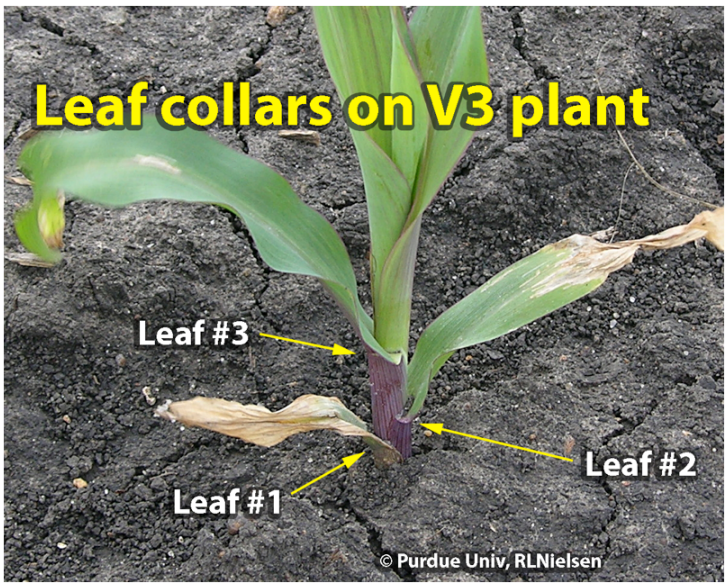
2) Predict leaf stage development based on thermal time (growing degree days or GDDs) from planting or emergence (Nielsen, 2019b). The relationship between corn development and temperature is reasonably strong. Emergence occurs about 115 to 120 GDDs from planting and leaf collar emergence (up to about leaf #10) requires about 82 GDDs per leaf. The online Corn GDD Tool (https://hprcc.unl.edu/gdd.php) is a good source of actual and estimated GDD accumulations for specific locations you choose.



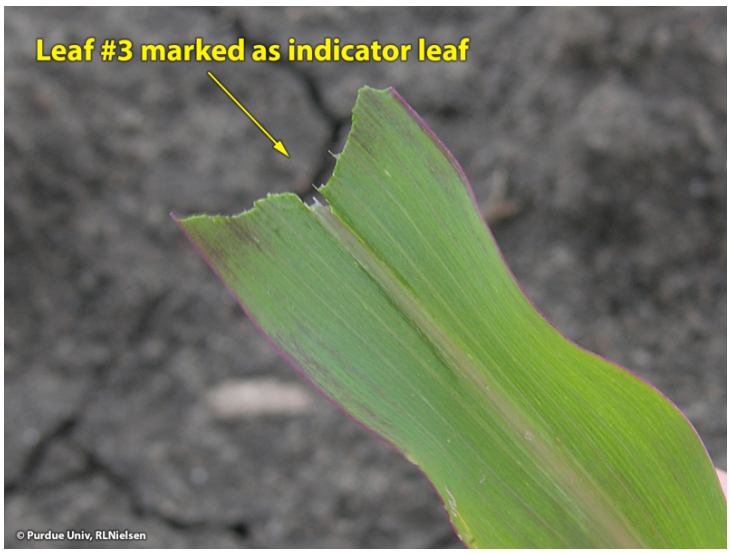
V3 corn seedling with lower leaves damaged earlier at V1 by frost.



V3 corn seedling with #3 leaf marked as an indicator leaf for subsequent leaf staging.



Closer view of leaf collars of damaged V3 seedling.



Leaf #3 marked by simply ripping off upper third of leaf.

Related References

Andresen, Jeff, Jim Angel, Larry Biehl, Roger Elmore, Beth Hall, Chad Hart, Tom Hultquist, Ray Massey, Chris Panza, Brian Raub, Martha Shulski, Dennis Todey, Melissa Widhalm, and Ray Wolf. 2019. U2U Decision Support Tools – Corn GDD. High Plains Regional Climate Center. https://hprcc.unl.edu/gdd.php [URL accessed May 2019]

Ikley, Joe and Bill Johnson. 2018. Growth Stage Cutoffs for Herbicide Applications in Corn and Soybean. Pest & Crop Newsletter, Purdue Univ. Extension. https://extension.entm.purdue.edu/newsletters/pestandcrop/article/growth-stage-cutoffs-for-herbicide-applications-in-corn-and-soybean [URL accessed May 2019].

Nielsen, R.L. (Bob). 2017. Heat Unit Concepts Related to Corn Development. Corny News Network, Purdue Univ. Extension http://www.kingcorn.org/news/timeless/HeatUnits.html. [URL accessed May 2019].

Nielsen, R.L. (Bob). 2019a. Determining Corn Leaf Stages. Corny News Network, Purdue Univ. Extension http://www.kingcorn.org/news/timeless/VStageMethods.html [URL accessedMay 2019].

Nielsen, R.L. (Bob). 2019b. Use Thermal Time to Predict Leaf Stage Development in Corn. Corny News Network, Purdue Univ. Extension http://www.kingcorn.org/news/timeless/VStagePrediction.html. [URL accessed 5/8/08].

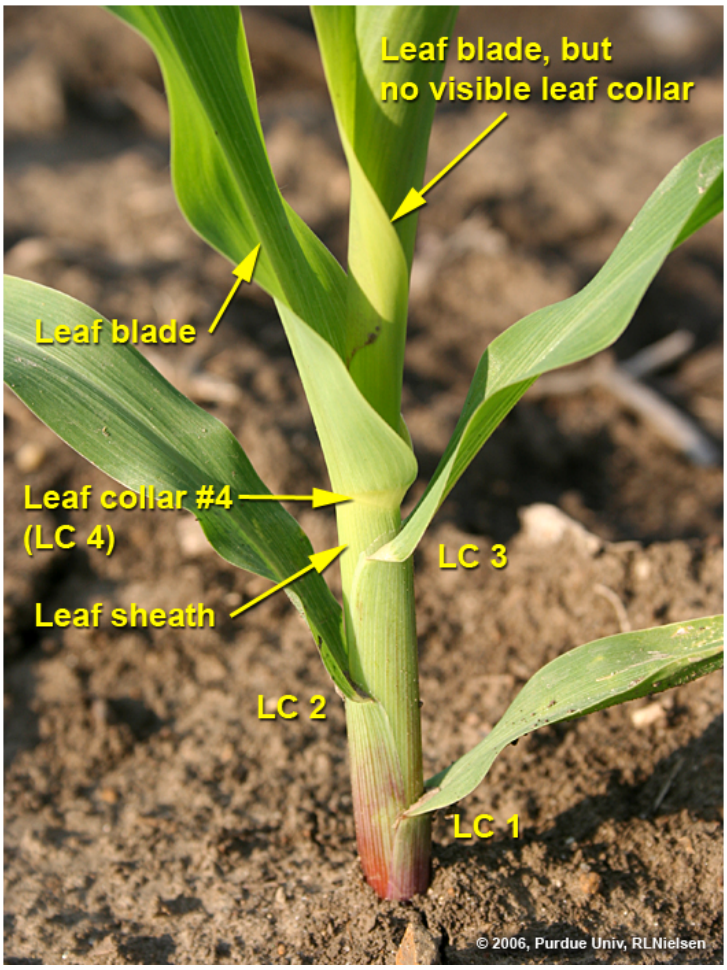
Determining Corn Leaf Stages

(Bob Nielson)

Many of us remember standing against the doorframe in our early years while our parents marked our height with a pencil to measure how much we had grown. Some of you may have spent more time in your youth standing in the corner, but that is between you and your parents.

The lowermost, thumb-shaped leaf of a corn plant.

Because it is difficult to transport corn plants from the field to that doorframe to measure their growth, agronomists developed other means to measure the phenology or development of corn. Counting the number of leaves would seem to be a simple way to document corn development, but folks still tend to become confused over this simple strategy. There are two basic methods for leaf staging corn that are used by agronomists and hail loss adjusters in the field today.



Parts of a corn leaf.

Leaf Collar Method. This method determines leaf stage in corn by counting the number of leaves on a plant with visible leaf collars, beginning with the lowermost, short, rounded-tip true leaf and ending with the uppermost leaf with a visible leaf collar (Abendroth et al., 2011). The leaf collar is the light-colored collar-like "band" located at the base of an exposed leaf blade, near the spot where the leaf blade comes in contact with the stem of the plant.

Leaves within the whorl, not yet fully expanded and with no visible leaf collar are not included in this leaf staging method. The exception to this statement may be that leaves with barely visible leaf collars can be counted when you are staging plants early in the day, recognizing that the leaf collar may become completely visible by the end of the day.

Leaf stages are usually described as "V" stages, e.g., V2 = two leaves with visible leaf collars. The leaf collar method is generally the most widely used method by university and industry agronomists in the U.S.

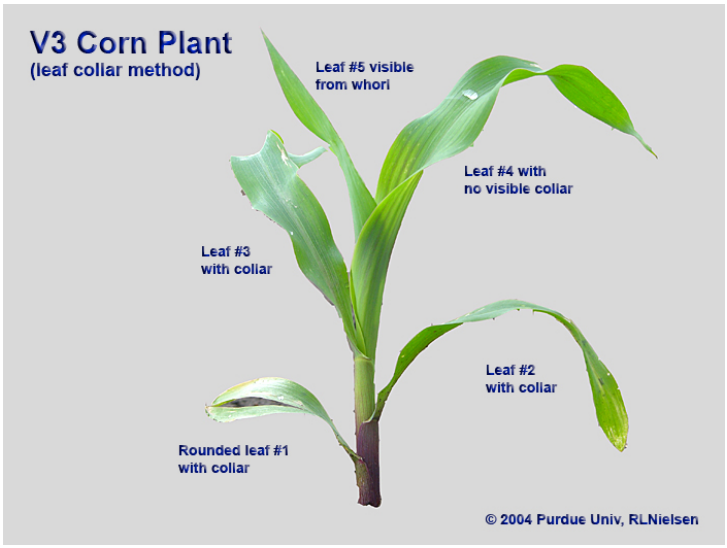
TIP: Recognize that not all plants in a given field will be at the same leaf stage at the same time due to normal variability among plants for emergence or subsequent exposure to stress. By definition, the specific leaf stage for an entire field is defined by that value that represents the majority of the plants in the field (Abendroth et al., 2011). For example, if half or more of the plants you rate are at the V5 stage of development, then the entire field is assigned a V5 rating.

"Droopy" Leaf Method. Crop insurance adjusters, when assessing damage to a corn crop from weather events such as hailstorms, use this leaf staging method. Like the leaf collar method, this method of leaf staging begins with the short first leaf. Leaf counting then differs, though, by ending not with the uppermost leaf with a visible collar, but at that leaf that is at least 40 to 50 percent exposed from the whorl. In knee-high corn or older, the tip of this "indicator" leaf typically also "droops" or hangs down, thus I refer to this as the "droopy" leaf method.

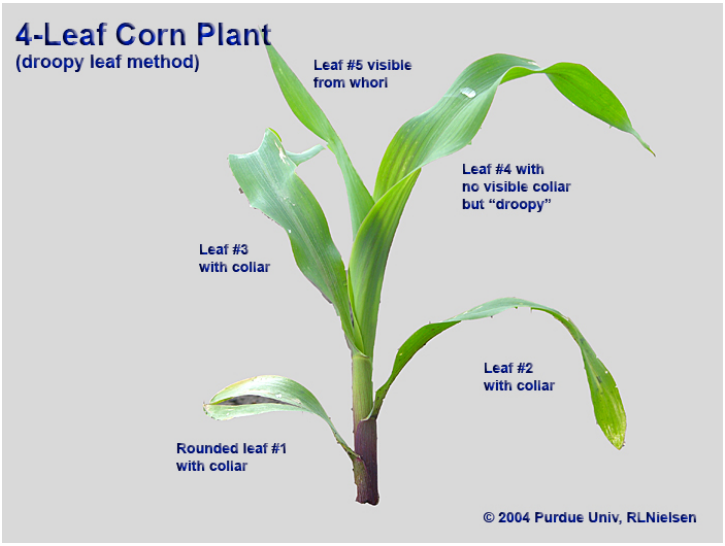
The Two Methods Compared. Both methods assign a leaf stage to a field on the basis of the leaf stage common to the majority of the plants in the field. Up to the 5- or 6-leaf collar stage, the leaf collar method will typically result in a leaf stage value that is numerically one less than the "droopy" leaf method. For example, the images to the left show the same corn plant that could be staged either as V3 by the leaf collar method or as a 4-leaf plant by the "droopy" leaf method. After corn reaches 18 to 24 inches in height, the leaf collar method will typically result in a leaf stage value that is numerically two less than the "droopy" leaf method.

The usefulness in understanding the differences between these two leaf staging methods lies in the fact that the yield loss chart used by hail insurance adjusters to estimate yield loss due to defoliation is based on the "droopy" leaf method. That chart is reproduced in the Purdue Extension publication ID-179, *Corn & Soybean Field Guide*.

Identifying true "droopy" leaves on shredded, hail-damaged corn plants can be quite difficult, whereas leaf collars are often still identifiable. Thus, you can usually stage a damaged crop by the leaf collar method and then add one or two more leaves to the count in order to use the defoliation chart. See my Corny News article for more details.



Young corn plant staged as V3 according to the collar method.



Same plant, but staged as 4-leaf according to the "droopy" method.

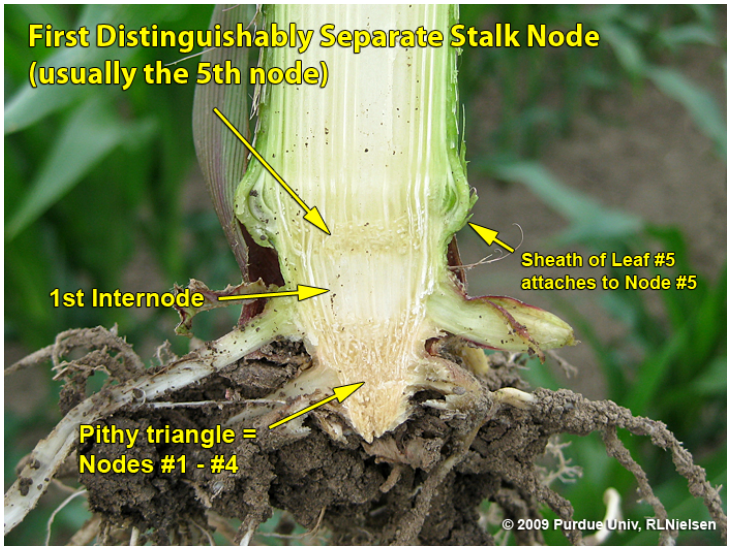
What About Herbicide Labels? Growers' confusion with leaf staging often originates with less than clearly described growth stage restrictions listed on herbicide labels (Ikely and Johnson, 2018). Label restrictions of older post-emergence herbicides typically ignored the short first leaf with the rounded tip and ended with the uppermost leaf that was at least 50% exposed from whorl. In essence, this was a bastardized "droopy leaf" method that resulted in roughly the same numerical leaf stage as the leaf collar method. Newer labels purport to define leaf stages according to the leaf collar method, but there is still some question about whether the short first leaf with the rounded tip is included. If in doubt with these newer herbicides, check with your agricultural chemical technical representative to verify which leaf staging method is appropriate for the herbicide you intend to use.

Staging Older Plants. As corn plants develop, the lower few leaves typically die or are torn away from the stem by the expansion of the stalk or by developing roots. Consequently, growth stage identification can be difficult on older plants when you aren't sure which leaves to begin counting first. But, not to worry, such plants can still be staged!

First, dig or pull a plant without breaking the stalk. With a knife, carefully split the stalk down the middle, completely through the root ball. Look for the lowermost obvious internode (the whitish area between the "woody" horizontal stalk nodes) above the triangular "woody" base of the stalk. The length of this first internode is typically only 1/2 to 3/4 inch (1.3 to 1.9 cm for you fans of the metric system).

Determine which leaf corresponds with the node immediately above the first noticeable internode by carefully identifying which leaf sheath attaches to the node. This leaf is usually Leaf #5. Once Leaf #5 is identified, then stage the plant by continuing to count the remainder of the leaves with visible leaf collars above Leaf #5. For example, assume you've identified Leaf #5 and there are six more leaves above that one with visible leaf collars, then the plant is at leaf stage V11 (11 leaves with visible leaf collars).

Typical deterioriation of lower leaves in older corn plants.



Split stalk illustrating the first distinguishable node above the pithy triangle.

Useful Tip: Even though one or more lower leaves may have "disappeared" due to injury or natural senescence, their absence does not mean they should be forgotten or ignored. In other words, a plant that is assessed at being at the V12 stage as a result of the previously described stalk splitting steps may only have 8 leaves with visible leaf collars if 4 lower ones have already withered away. Do not be misled into thinking the plant is only at the V8 stage.

Related References

Abendroth, L.J., R.W Elmore, M.J. Boyer, and S.K. Marlay. 2011. Corn Growth and Development. Iowa State Univ. Extension Publication #PMR-1009.

https://store.extension.iastate.edu/Product/Corn-Growth-and-Development [URL accessed May 2019].

Ikley, Joe and Bill Johnson. 2018. Growth Stage Cutoffs for Herbicide Applications in Corn and Soybean. Pest & Crop Newsletter, Purdue Univ. Extension. https://extension.entm.purdue.edu/newsletters/pestandcrop/article/growth-stage-cutoffs-for-herbicide-applications-in-corn-and-soybean [URL accessed May 2019].

Nielsen, R.L. (Bob). 2017. Heat Unit Concepts Related to Corn Development. Corny News Network, Purdue Univ. [On-Line]. Available at http://www.kingcorn.org/news/timeless/HeatUnits.html. [URL accessed May 2019].

Nielsen, R.L. (Bob). 2019. Tips for Staging Corn with Severe Leaf Damage. Corny News Network, Purdue Univ. [On-Line]. Available at http://www.kingcorn.org/news/timeless/VStagingTips.html. [URL accessed May 2019].

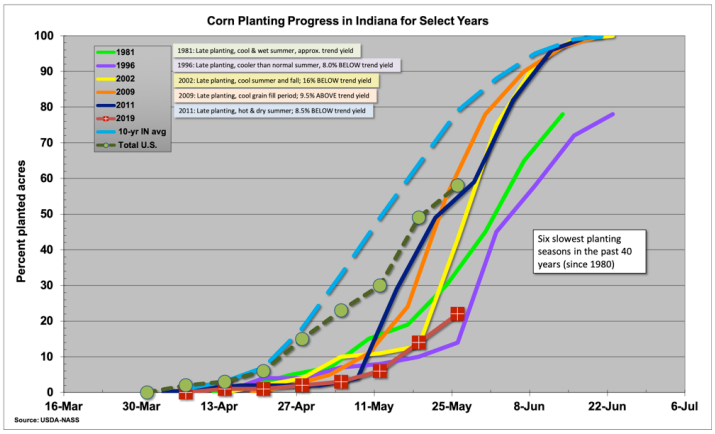
Nielsen, R.L. (Bob). 2019. Use Thermal Time to Predict Leaf Stage Development in Corn. Corny News Network, Purdue Univ. [On-Line]. Available at http://www.kingcorn.org/news/timeless/VStagePrediction.html. [URL accessed May 2019].

Purdue University. 2019. Corn & Soybean Field Guide (ID-179). Purdue Univ. Extension. https://ag.purdue.edu/agry/dtc/Pages/CSFG.aspx [URL accessed May 2019]

Some Points to Ponder as You Struggle With Decisions About Late-Planted Corn

(Bob Nielson)

As May transitions to June, many Indiana corn growers are faced with substantial acreage yet to plant. Statewide, as of May 26 (USDA-NASS, 2019), only 22% of the state's corn crop was estimated to have been planted. That disappointing planting progress positions the 2019 planting season AT THE MOMENT just slightly ahead of the similarly slow 1996, which currently holds the unenviable record for the most delayed planting season in the past 40 years. AND, there is still a chance we will surpass (or should I say "fall behind"?) that record by the time this planting season is finished. In the remaining days of May, thunderstorms continued to rumble across the state… sometimes across the north… sometimes across the south… sometimes through the central counties. Unless a rapid shift from rainy to sunny, warm, and windy occurs soon, the prospects of serious planting progress through the first week of June are dismal.



Slowest planting seasons since 1980.

The question of how late is "too late" to continue trying to plant corn is not an easy one to ponder. PHYSIOLOGICALLY, we could plant corn anywhere in Indiana through at least the end of June and still safely mature the crop before an average date of a killing fall freeze. Success in doing so relies heavily on the choice of **RELATIVE HYBRID MATURITY** AND that choice relies heavily on the availability of hybrids with Growing Degree Day (GDD) requirements suitable for the estimated number of GDDs between the end of June and the average date of a killing fall freeze (Nielsen, 2019a).

At some late planting date, however, the "safe" relative hybrid maturities would be so unadapted to Indiana growing conditions that it would be foolish to plant them. Practically speaking, hybrids rated no less than about 2400 GDDs to kernel blacklayer, roughly equivalent to "100-102 day" relative maturity (reasonably adapted to Indiana growing conditions), could be safely planted in the northern tier of Indiana counties through June 15. However, I would strongly encourage you to make sure such hybrids have disease ratings for important foliar diseases like gray leaf spot and fast grain drydown characteristics.

Understand, though, selecting a hybrid maturity that just barely reaches physiological maturity before a killing fall freeze in mid- to late October will not have much opportunity for significant field drydown and so grain moisture at harvest will be high. If you search for a hybrid maturity that will reach blacklayer by, say, the end of September, that would provide more time for meaningful grain drydown in the field before harvest. Let's use an example from northeast Indiana (Dekalb, Noble, LaGrange, Steuben counties) with an expected planting date of June 10 and a desired blacklayer date of Sept 30. The average number of GDDs available to a corn crop for that time period is about 2100. Using the method for estimating the reduction in hybrid GDD ratings for late plantings described in my related article (Nielsen, 2019a), you arrive at a hybrid GDD rating originally defined as 2400 GDDs, roughly equivalent to "100-102 day" relative maturity, that should mature by the end of September.

DISCLAIMER: The example of a 2400 GDD hybrid is not a broad rule of thumb. The process outlined my related article (Nielsen, 2019a) will help you fine-tune these hybrid maturity estimates for your specific combination of location, expected planting date, and desired maturity date.

Other Late Planting Considerations:

There is little need to change **SEEDING RATES** for unusually late planting (Nielsen, 2019b). Certainly, I would never increase my seeding rate. I might, however, decrease it by a couple thousand seed if I believed that germination, emergence, and initial stand establishment would be more successful due to warmer soils in June than what we typically experience in late April.

The **ECONOMIC OPTIMUM NITROGEN RATE** for unusually late planted corn is essentially the same as for earlier planting, especially if your typical nitrogen (N) program involves application near planting or in a sidedress operation (Camberato and Nielsen, 2019). HOWEVER, if you normally apply fall anhydrous ammonia or apply nitrogen early in the spring (late March – early April), then you might be able to decrease your "usual" N rate by 20 to 30 lbs N to account for the fact that N applied closer to the crop's need has a lower risk for N loss than much earlier applied N.

Corn yield response to **STARTER FERTILIZER** is admittedly inconsistent and not necessarily correlated with early or late plantings, or with tillage system. Based on 30 field scale trials conducted in the

past several years, my colleague Jim Camberato and I have observed increased yields due to row starter about 33% of the time. If you normally use starter fertilizer at planting AND if eliminating that from your planting process will significantly increase the number of acres you can plant per hour AND if you believe that you need all the acres per hour you can squeeze out of the planting operation… Then you can eliminate the starter fertilizer with minimal risk of lower yields. Recognize, however, that grain moisture response to row starter (2×2) is more consistent and grain moisture is often 1 to 2 points drier at harvest. If this is economically important to you AND the time savings from not using starter fertilizer is not significant, then don't eliminate it from your late planting… How's that for wishy-washy advice?

The typical **REDUCTION IN YIELD** potential due to **LATE PLANTING** ranges from 1 to 2 bushels/acre/day delay after about May 10 to 15. That is certainly a consideration when you are debating whether to switch from planting corn to planting soybean in early June or opt for the Prevented Plant option of your crop insurance policy. However, recognize that this estimate of reduced yield with delayed planting does not tell you what the actual yield will be for that late planted corn field (Nielsen, 2019c). If the remainder of this season turns out to be picture perfect, then yields may end up surprisingly high… It's just that they could have been even higher if the corn could have been planted earlier in good conditions. If the remainder of this season continues its path down the proverbial toilet, then yields will be dismal… And, yes, the yield might have been higher if the corn could have been planted earlier in good conditions. IF, IF, IF…… To me, this conundrum is the "devil in the details" when it comes to penciling out the comparisons of switching to soybean or opting for the Prevented Plant provision of crop insurance.

Last fall's wet weather prevented a lot of post-harvest **TILLAGE** around the state. Certainly, the wet weather this spring has prevented a lot of pre-plant tillage. The seemingly incessant rainfall events continue to delay significant drying of the soils. In a perfect world, one would tell you to eliminate tillage at this point on the calendar and focus on planting once the fields dry out. The reality is that if your planting equipment and/or herbicide programs are not geared toward no-till practices, this is not a good time to experiment. Nevertheless, consider no-tillage for corn following soybeans, especially if existing weed pressure in the fields is not out of control and there are no ruts from last fall's harvest operations. Consult with your ag. chemical retailer about changes to your herbicide program relevant to no-tillage.

For fields with **SEVERE RUTS**, fill and level them with shallow tillage, but avoid deeper tillage because soil moisture below the depth of the ruts will likely be too wet for tillage without creating compaction (Staton, 2018). If you simply have to till fields before planting, try to minimize the number of trips across the field. Try to avoid tilling fields that are "on the wet side" in order to avoid creating compacted soil layers that will restrict crop roots later (Nielsen, 2019d).

Obviously, **CROP INSURANCE** options are a key consideration to your decisions about planting corn well into June. Two excellent resources published within the past couple weeks include a recorded Webinar from Purdue's Center for Commercial Ag and and summary of financial options from Univ. of Illinois' "farmdocDAILY" Web site (Schnitkey et al., 2019). Take time to view or read these two pieces of information and visit with your crop insurance agent.

Related references

Camberato, Jim and RL (Bob) Nielsen. 2019. Nitrogen Management Guidelines for Corn in Indiana. Agronomy Department, Purdue Univ. http://www.kingcorn.org/news/timeless/NitrogenMgmt.pdf [URL accessed May 2019].

Center for Commercial Ag. 2019. Delayed Corn & Soybean Planting Decisions Webinar. Purdue Univ. Extension. https://youtu.be/OYLbjfCtk8g [URL accessed May 2019].

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

Nielsen, RL (Bob). 2019b. Optimum Plant Populations for Delayed Planting of Corn. Corny News Network, Purdue Univ. Extension. http://www.kingcorn.org/news/timeless/CornPltPopPltDate.html [URL accessed May 2019].

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

Nielsen, RL (Bob). 2019d. Soil Compaction: The "Gift" That Keeps on Giving. Corny News Network, Purdue Univ. Extension. http://www.kingcorn.org/news/articles_19/SoilCompaction.html [URL accessed May 2019].

Schnitkey, Gary, Krista Swanson, Ryan Batts, Jonathan Coppess, and Carl Zulauf. 2019. Prevented Planting, 2019 Market Facilitation Program Payments, Disaster Assistance, and Price Dynamics. farmdocDAILY, Univ. of Illinois. https://farmdocdaily.illinois.edu/2019/05/prevented-planting-2019-market-facilitation-program-payments-disaster-assistance-and-price-dynamics.html [URL accessed May 2019].

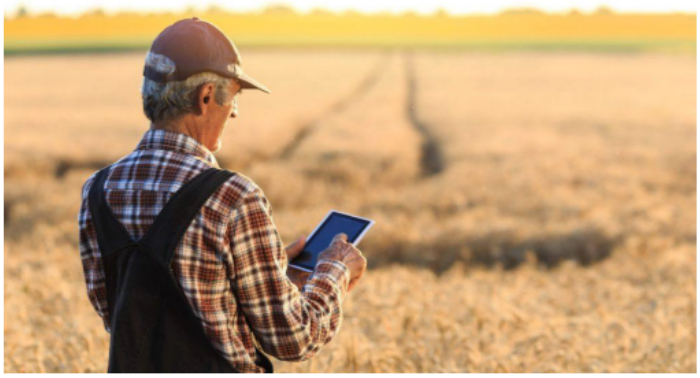
Staton, Mike. 2018. Repairing Harvest Ruts This Spring. Michigan State Univ. Extension. https://www.canr.msu.edu/news/repairing_harvest_ruts_this_spring [URL accessed May 2019].

USDA-NASS. 2019. Crop Progress. USDA National Ag. Statistics Service. https://usda.library.cornell.edu/concern/publications/8336h188j [URL accessed May 2019].

Organic Agronomy Training Series Pilot Sessions Offer Education for Agronomists, Crop Advisors

(Michael O'Donnell), *(Nick Rogers)* & *(Mallory Krieger)*

As demand for organic grain products soars, newly certified organic grain farmers — or those in the process of transitioning to organic grain — struggle to find reliable technical service and support as they navigate this new production system.



Upcoming two-day pilot sessions of the Organic Agronomy Training Series (OATS) can help agronomists, crop advisors, extension agents and technical service providers receive education on organic production systems and USDA-National Organic Program regulatory compliance — and more strongly support these farmers.

Co-hosted by Purdue Extension, the OATS East pilot session will be held July 24-25 at Fusion 54, 119 N. Green St., in Crawfordsville, Ind. Early-bird registration for the training is available through Sunday, June 16. The registration deadline is midnight on Sunday, July 14.

Agronomists, certified crop advisors / consultants, extension agents and technical service providers in Indiana, Ohio, Michigan and Illinois are encouraged to attend. (An additional session for the same audiences in Wisconsin, Minnesota and Iowa will be held in August.) OATS East participants will visit a nearby organic farm that features a grain and livestock operation with parallel conventional and certified-organic row crop production.

According to the Organic Trade Association, sales of U.S. organic products have grown from $3.6 billion in 1997 to nearly $50 billion in 2017. While organic food sales make up 5.5% of total U.S. food sales, less than 1% of U.S. farmland is dedicated to organic production (with much of the shortfall made up by imports).

Organic grain production is as much an opportunity for advisors and consultants eager to grow their customer bases and support diverse production with potential for increased margins as it is for farmers interested in diversifying cropping systems and income streams. However, a recent report from the U.S. Organic Grain Collaboration identified a shortage of technical service providers that understand organic production and offer sufficient support. Founded in 2018, OATS unites industry, nonprofit, agency and agronomy partners to fill the gap.

“If OATS is a success, it will increase the number and geographic spread of technical service providers able to meet the needs of organic grain producers,” says Michael O’Donnell, organic and diversified agriculture educator for Purdue Extension. “In turn, that will help grow available organic acreage, optimize organic production systems and maximize the potential for success among existing and transitioning growers.”

After completing the OATS training, participants will be able to:

- Provide basic agronomic services to certified / transitioning organic producers
- Discuss successful organic crop production strategies
- Understand thoroughly the organic certification and inspection process
- Advise producers on compliance with all applicable USDA rules and regulations
- Recommend profitable, diverse crop rotations that meet rotational requirements
- Understand organic weed-control strategies, including cultural and mechanical
- Advise on the integration of cover crops and reduced tillage into organic systems
- Recommend organically approved pest-control strategies
- Advise on basic organic fertility programs
- Refer to current research relevant to organic production systems

“Those who complete the OATS pilot program can become more confident, knowledgeable resources for producers in this growing segment of U.S. agriculture,” O’Donnell says.

Continuing Education Units for Certified Crop Advisors have been requested for this training.

For more details on the pilot training, or to register, visit thelandconnection.org/OATS or organicagronomy.com.

Sponsorship opportunities are also available at thelandconnection.org/sponsorOATS.

Writer: Nick Rogers, 765-494-0948, rogersn@purdue.edu

Sources: Michael O’Donnell, 765-284-8414, modonnel@purdue.edu and Mallory Krieger, 217-840-2128, mallory@thelandconnection.org

Indiana Climate and Weather Report – 5/30/2019

(Beth Hall)

The story of excessive rain and soil moisture continues and the 7-day precipitation forecast suggests this wet pattern will continue (Fig. 1). When looking at the precipitation percent of mean for May 1-30, 2019, the southern half of the state received near normal amounts. However, the northern half has experiences well over normal amounts with some areas receiving double the average amount (Fig. 2). Regardless, the April rains and lack of significant warm temperatures have kept the ground close to saturation so even normal precipitation is causing flooding (Fig. 3). The climate outlook for June is too uncertain for the National Center for Environmental Prediction to provide significant probability of either above- or below-normal precipitation. However, the 3-month climate outlook (valid for June – August) is predicting a significant chance of above-normal precipitation.

Modified growing degree-days (MGDDs) since April 1 have accumulated to 400-800 units (from north to south) across the state, which is approximately 90 units less than average in the northern parts of the state and 90 units greater than average in the southern parts. Similar to the precipitation outlook, the temperature outlook for June showed no statistical confidence that Indiana will be either warmer or cooler than normal.

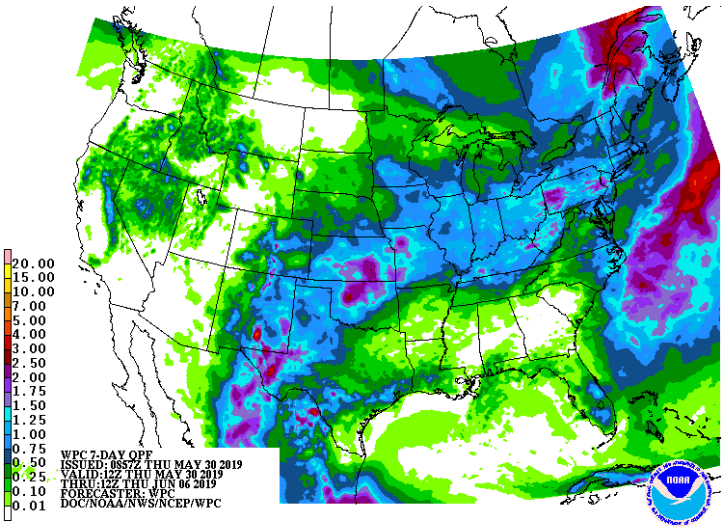


Fig. 1. 7-day precipitation forecast representing May 30 – June 6, 2019. Source: NOAA Weather Prediction Center

Fig. 2. Accumulated precipitation percent of mean for May 1-29, 2019 compared to 1981-2010 normals.

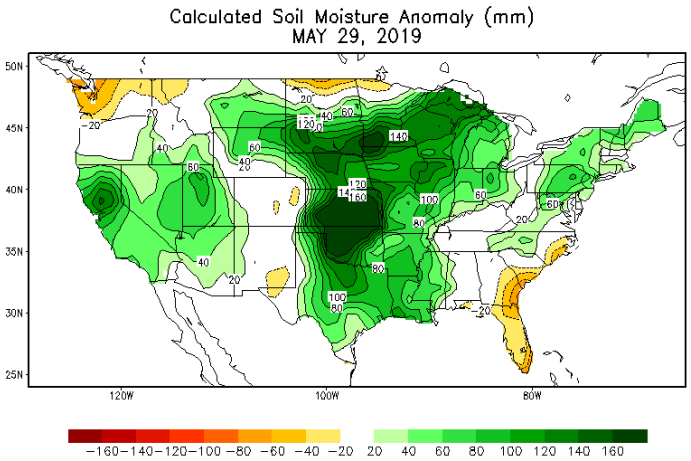
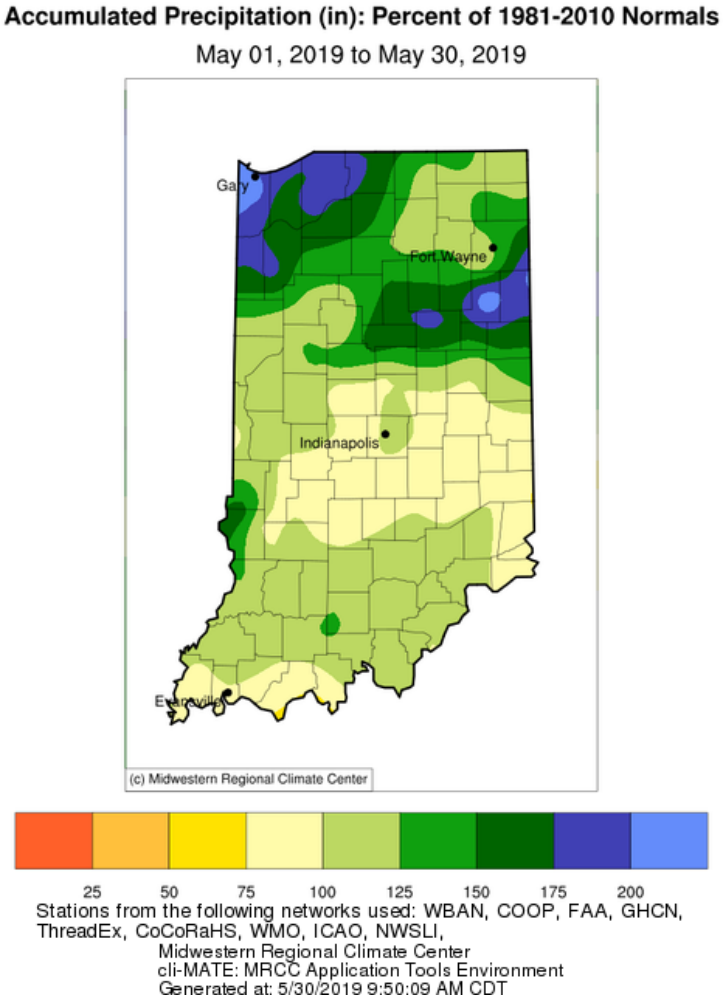


Fig. 3. Soil moisture anomaly (in millimeters) for 28 May 2019. Source: NOAA Climate Prediction Center.



Pest&Crop newsletter © Purdue University - extension.entm.purdue.edu/newsletters/pestandcrop
Editor: Tammy Luck | Department of Entomology, Purdue University, 901 W. State St., West Lafayette, IN 47907