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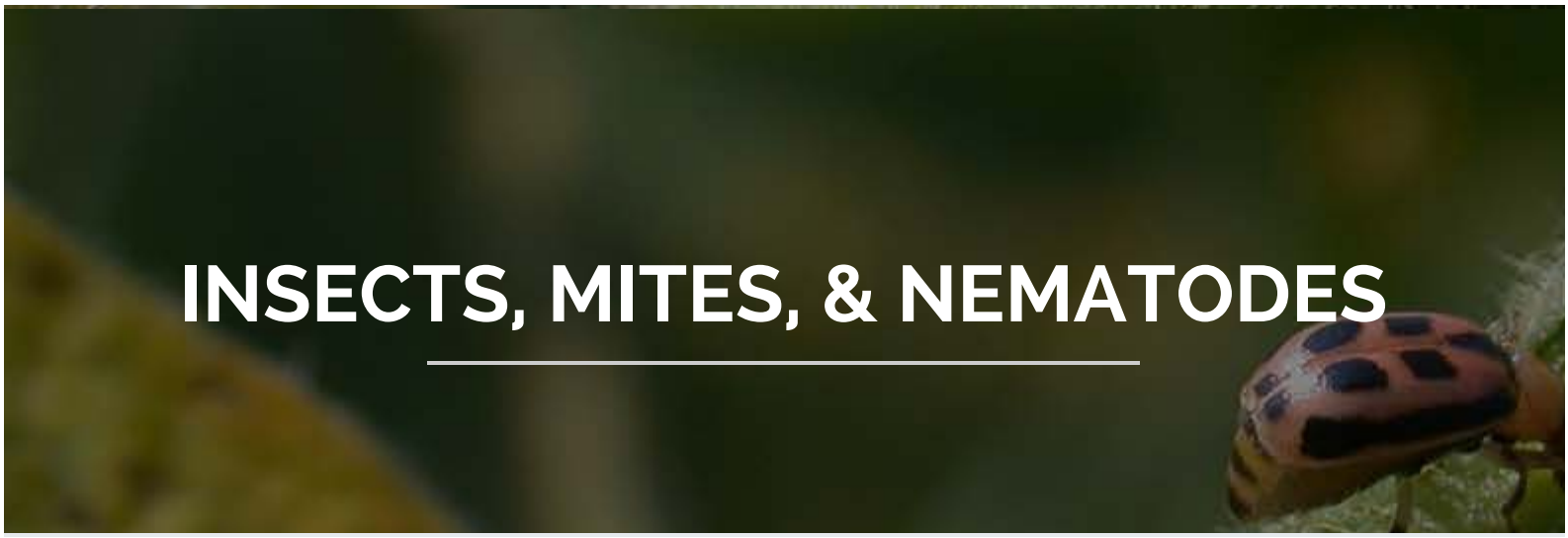


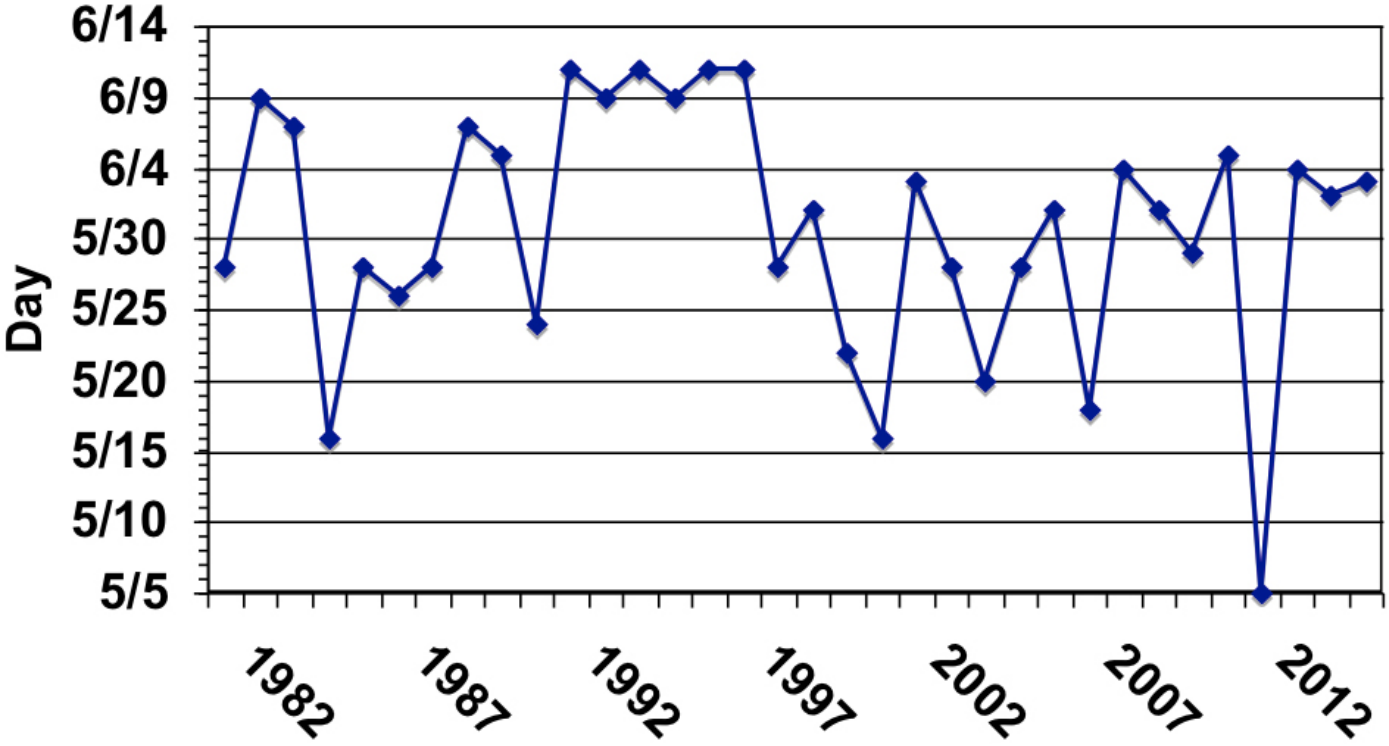
Rootworm Hatch Underway! – (Christian Krupke and Larry Bledsoe) -

- **Rootworm hatch is underway, will continue for many weeks.**
- **More reports of adults in summer 2014 than previous years may lead to more larvae in 2015 .**
- **Watch Bt corn fields closely this year with reports of resistance to Bt hybrids in many surrounding states.**

Rootworm hatch has begun, and is estimated to have begun locally (just a few miles south of Purdue campus) on June 3. This is in line with recent observations, which typically have occurred during the final days of May or early June. Overwintering mortality is not expected to be especially high, even though the winter was a cold one – rootworm eggs have exceptional cold tolerance and soil temps don't vary nearly as much as air temperatures, especially with abundant snow cover.

This is an important time to keep rootworm monitoring in mind later in the season, when larvae are large enough to cause visible damage to roots and plant lodging (usually apparent beginning in mid-July). Most of our corn hybrids are Bt-expressing hybrids, and as most of you have heard by now, there have been problems with resistance in rootworm populations in many states across the Midwest, including Illinois. The fields with problems are typically continuous corn that has been planted with the same Bt trait for several years in succession. There have been damage reports in first-year corn as well, so those fields are not necessarily "safe" either. But the continuous corn fields are most at risk and are the fields to keep an eye on this year – lots of beetles and lodged corn in July and August will be the early giveaways. More on this later, but for now just rest assured that rootworms have survived the winter. And they're coming for your corn.

First Observation of Rootworm Larvae in Corn Roots, Tippecanoe County, Indiana, 1982-2015



First Observation of Rootworm Larvae in Corn Roots.

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Corn Earworm Trap Report.

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Armyworm Pheromone Trap Report

County/Cooperator	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
Dubois/SIPAC Ag Center	0	0	1	0	2	1	0	4	0	3		
Jay/Davis Ag Center	0	0	2	0	4	1	0	0	0	0		
Jennings/SEPAC Ag Center	0	0	0	0	1	0	0	2	4	0		
Knox/SWPAC Ag Center		0	0	0	1	0	0	2	3	1		
LaPorte/Pinney Ag Center	0	0	3	0	17	35	29	5	0	11		
Lawrence/Feldun Ag Center	0	2	0	1	0	11	3	5	7	12		
Randolph/Davis Ag Center	0	0	0	0	0	0	0	0	0	0		
Tippecanoe/Meigs	0	0	1	0	0	0	0	0	0	0		
Tippecanoe/Meigs (Hartstack)				7	548	406	58	13	7	93		
Whitley/NEPAC Ag Center	0	1	5	2	17	25	4	0	5	3		
Whitley/NEPAC Ag Center (Hartstack)						792	404	137	103			

Wk 1 = 4/2/15 - 4/8/15; Wk 2 = 4/9/15 - 4/15/15; Wk 3 = 4/16/15 - 4/22/15; Wk 4 = 4/23/15-4/29/15;

Wk 5 = 4/30/15-5/6/15; Wk 6 = 5/7/15-5/13/15; Wk 7 = 5/14/15-5/20/15; Wk 8 = 5/21/15-5/27/15;

Wk 9 = 5/28/15-6/3/15; Wk 10 = 6/4/15-6/10/15

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Recovery From Hail Damage to Young Corn– (Bob Nielsen) -

Early summer thunderstorms often include not only torrential rainfall, but also damaging hail. Looking out the kitchen window the morning after such a storm at a field damaged by hail can be one of the most disheartening feelings in the world to a corn grower. The challenge is to separate emotion from reality when assessing actual damage to plants and estimating recovery of a hail-damaged field.

Yield loss in corn due to hail damage results primarily from 1) stand reduction caused by plant death and 2) leaf area reduction caused by hail damage to the leaves. Assessing the yield consequences of hail damage in corn therefore requires that the severity of each of these factors be estimated.

Two days after hail storm.

Assessing Plant Survival

As with most early-season problems, evaluation of hail-damaged fields should not be attempted the day after the storm occurs because it can be very difficult to predict survivability of damaged plants by simply looking at the damage itself. Young corn has an amazing capacity to recover from early season damage but patience is required to allow the damaged plants enough time to visibly demonstrate whether they will recover or not. Damaged but viable plants will usually show noticeable recovery from the whorl within 3 to 5 days with favorable weather and moisture conditions.

One thing you can do shortly after the storm, however, is to evaluate the relative condition of the main growing point area of the stalk. The growing point, or apical meristem, of a young corn plant is an area of active cell division located near the tip of the pyramid-shaped top of the stalk tissue inside the stem of the plant (Nielsen, 2008a). The growing point region is important because it is responsible for creating all the leaves and the tassel of a corn plant.

Initially, the growing point is located below ground but soon elevates above ground beginning at about the 5th leaf collar stage. Slicing a stalk down the middle and looking for the pyramid-shaped upper stalk tissue can identify the vertical position of the growing point. If hail has damaged the

growing point or cut off the stalks below the growing point, then those plants should be counted as victims and not survivors.

Remember that yield loss in corn is not directly proportional to the reduction in the number of plants per acre when the damage occurs early in the growing season. The surviving plants that surround a missing plant compensate by increasing their potential kernel numbers or by developing a second ear. Figure 1 illustrates corn grain yield response to final plant population, averaged over 54 field-scale trials involving a range of hybrids and soils around Indiana in recent years. The results of those trials suggest that maximum grain yield occurs at about 32,000 plants per acre (ppa) on soils with adequate soil moisture availability. Relative grain yield loss for final populations near 24,000 ppa (equal to a 25% reduction in population) is less than 4% of maximum grain yield. The crop insurance industry uses their own data to assess yield loss due to plant mortality, but the concept is the same... yield loss in corn is not directly proportional to the reduction in the number of plants per acre when the damage occurs early in the growing season.

Click for Hail Damage Photo Gallery

Assessing Defoliation Severity

Leaf damage by hail usually looks worse than it really is. Tattered leaves that remain green and connected to the plant will continue to photosynthesize. It takes a practiced eye to accurately estimate percent leaf death by hail. With that caution in mind, percent damage to those leaves exposed at the time of the hailstorm can be estimated and used to estimate yield loss due to defoliation alone.

The effects of leaf death on yield increases as the plants near silking, and then decreases throughout grain fill. Therefore, the grower needs to determine the leaf stage of the crop when the hail damage occurred. This can be challenging depending on the severity of the damage to the plants by the hail.

Remember that leaf staging for the purposes of hail damage assessment is slightly different than the usual leaf collar method. The yield loss estimates listed in Table 1 are based on leaf stages as defined by the "droopy leaf" method (Nielsen, 2014a). If you are walking damaged fields many days after the storm, you can stage the crop that day and backtrack to the day of the storm by assuming that leaf emergence in corn occurs at the rate of about 1 leaf every 82 GDDs from emergence to V10 (ten fully visible leaf collars) or every 50 GDDs from V10 to the final leaf (Nielsen, 2014b).

Once percent leaf damage and crop growth stage have been determined, yield loss can be estimated by using the defoliation chart provided below in Table 1. This table is a condensed version of the season-long table published in the Purdue Extension publication ID-179, Corn and Soybean Field Guide.

Click for Hail Damage Photo Gallery

Assessing Consequences of Whorl & Stem Bruising

The eventual yield effects of severe bruising of leaf tissue in the whorl or the stalk tissue itself in older plants are quite difficult to predict. Consequently, it can be difficult to determine whether to count severely bruised plants as survivors or whether they should be voted off the field. The good news is that observations reported from an Ohio on-farm study suggest that bruising from hail early in the season does NOT typically result in increased stalk lodging or stalk rot development later in the season (Mangen & Thomison, 2001).

Early season bruising of leaf tissue or stem tissue may, however, have other consequences on subsequent plant development; the occurrences of which are hard to predict. Areas of bruised whorl leaf tissue often die and can then restrict continued expansion of whorl leaves, resulting in the type of 'knotted' whorl reminiscent of frost damaged plants. These same bruised leaves would be more susceptible to secondary invasion by bacteria contained in splashed soil that might have been introduced into the damaged whorls if the hailstorm was accompanied by driving rains.

If the plant tissue bruising extends as deep as the plant's growing point, that important meristematic area may die; thus killing the main stalk and encouraging the development of tillers. If the plant tissue bruising extends into the area near, but not into, the growing point; subsequent plant development may be deformed in a fashion similar to any physical damage near the hormonally active growing point (stinkbug, stalk borer, drill bits used by malicious agronomists).

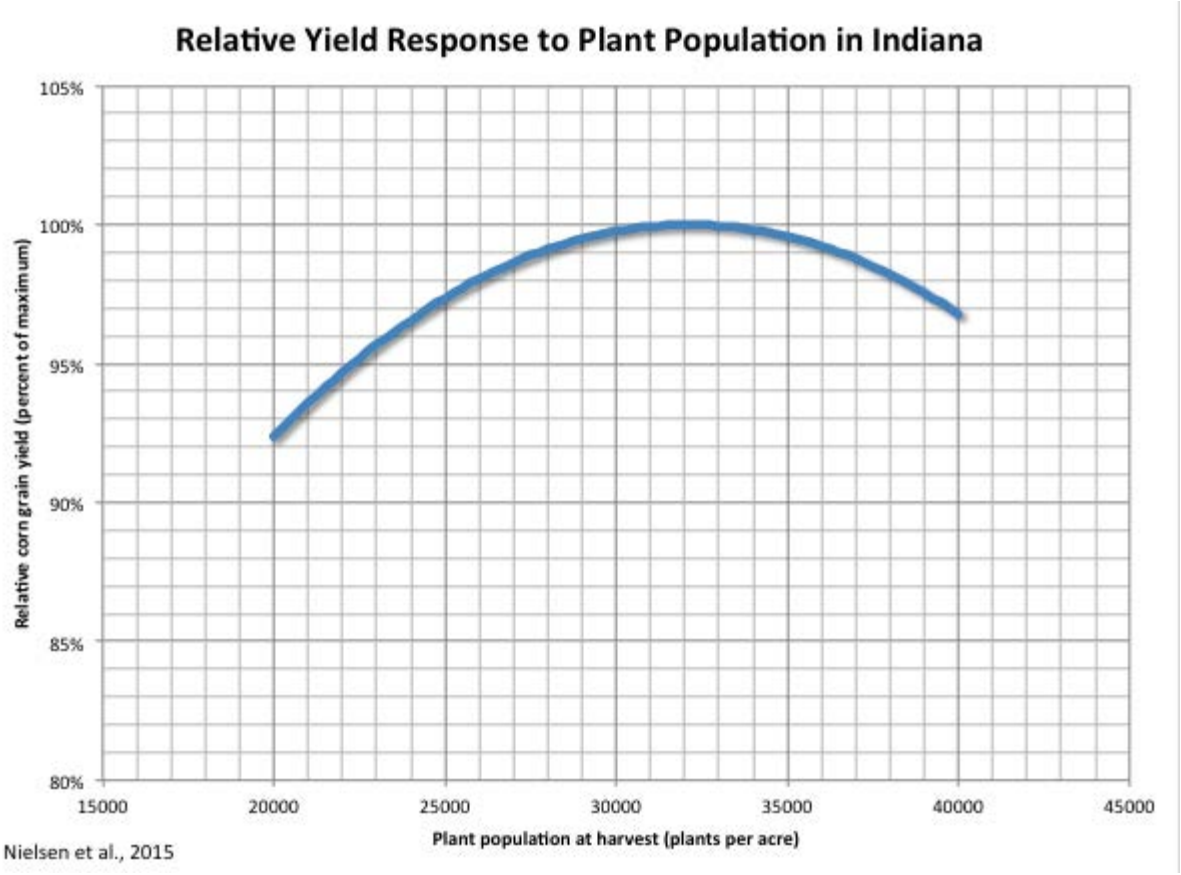
Click for Hail Damage Photo Gallery

Example of Assessing Damage

Let's say that your field of corn was at the 7-leaf stage (approximately V5 by the leaf collar method) when hail damage occurs. After walking the field several days later, you determine only 24,000 of

your original 32,000 plants per acre will survive the hail damage (which to most of us would look devastating). Your surviving stand of 24,000 now has an upper yield potential of 96.5% of "maximum" (Fig. 1). Therefore, the yield loss due to plant death itself would be about 3.5%.

Let's also assume that you estimate the average percent leaf death by defoliation to be 50% (which to most of us would look devastating). The combination of leaf stage and percent defoliation would translate into an additional 2% yield loss (Table 1), resulting in a total estimated yield loss due to both stand reduction and defoliation of approximately 5.5%.



Relative yield response to final plant population in Indiana.

Table 1. Estimates of Percent Yield Loss in Corn Due to Leaf Defoliation at Selected Leaf Stages

Stage of Growth	Percent Leaf Area Destroyed			
	25	50	75	100

	Approximate % Yield Loss			
7 leaf	0	2	5	9
8 leaf	0	3	6	11
9 leaf	1	4	7	13
10 leaf	1	6	69	16
11 leaf	1	7	12	22
12 leaf	2	9	16	28
13 leaf	2	10	19	34
14 leaf	3	13	25	44
15 leaf	3	15	30	51
16 leaf	4	18	36	61

Source: Adapted with permission from National Crop Insurance Services (NCIS) publication 6102, Crop-Hail Corn Loss Instructions (revised 2004©). Unauthorized reproduction of this material is prohibited.

NOTE: The term "leaf stage" in this table is that defined by the NCIS and corresponds to a leaf collar stage approximately 2 less than the values shown in the table. For example, a "7 leaf" plant would be equal to a V5 stage or five leaves with visible leaf collars (Nielsen, 2014a).

Related References

Klein, Robert and Charles Shapiro. 2011. Evaluating Hail Damage to Corn. Univ. of Nebraska Extension Pub. #EC126. http://www.ianrpubs.unl.edu/live/ec126/build/ec126.pdf. [June 2015].

Lauer, Joe. 2014. Hail Damage on Corn. Corn Agronomy, Univ of Wisconsin. http://corn.agronomy.wisc.edu/Management/L039.aspx. [URL accessed June 2015].

Lee, Chad. 2007. Estimating Hail Damage in Corn. Univ. of Kentucky Extension. Pub. #AGR-194. http://www2.ca.uky.edu/agc/pubs/agr/agr194/agr194.pdf. [URL accessed June 2015].

Mangen, Todd and Peter Thomison. 2001. Early Season Hail Damage in Corn: Effects of Stalk Bruising and Tied Whorls. Ohio State Univ. Cooperative Ext. Service Special Circular 179-01. [On-Line]. Available at http://ohioline.osu.edu/sc179/sc179_16.html [URL accessed June 2015].

Nielsen, RL (Bob). 2008a. Growing Points of Interest. Corny News Network, Purdue Univ. [On-Line]. Available at http://www.kingcorn.org/news/timeless/GrowingPoints.html [URL accessed June 2015].

Nielsen, RL (Bob). 2008b. 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 June 2015].

Nielsen, RL (Bob). 2014a. Determining Corn Leaf Stages. Corny News Network, Purdue Univ. [On-Line]. Available at http://www.kingcorn.org/news/timeless/VStageMethods.html [URL accessed June 2015].

Nielsen, RL (Bob). 2014b. 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 June 2015].

Nielsen, R.L. (Bob), Jason Lee, & Jim Camberato. 2015. Yield Response to Plant Population for Corn in Indiana. Research Update, Agronomy Dept, Purdue Univ. http://www.kingcorn.org/news/timeless/SeedingRateGuidelines.html. [URL accessed June 2015].

Thomison, Peter. 2013. Hail damage to corn varies depending on growth stage. C.O.R.N. Newsletter, Ohio State Extension. http://agcrops.osu.edu/corn/newsletters/2013/2013-19/hail-damage-to-corn-varies-depending-on-growth-stage. [URL accessed June 2015].

Vorst, J.J. 1993. Assessing Hail Damage to Corn. Purdue Univ Cooperative Ext. Service Publication NCH-1. [On-Line]. Available at http://www.ces.purdue.edu/extmedia/NCH/NCH-1.html [URL accessed June 2015].

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Effects of Flooding or Ponding on Corn Prior to Tassling– (Bob Nielsen) -

Recent intense rainfall events (technically referred to as “toad stranglers” or “goose drownders”) have caused flooding of low-lying corn fields or ponding (standing water) in poorly drained swales within fields. Other areas within fields, while not technically flooded or ponded, may remain saturated for lengthy periods of time.

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

Ponded corn.

Ponded corn.

Ponding on young corn plants.

Effects of ponding on young corn plants.

Effects of ponding on young corn plants.

What I mean to say 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.**
  - **Most agronomists believe that young corn can survive up to about 4 days of outright ponding if temperatures are relatively cool (mid-60's^{o}F or cooler); fewer days if temperatures are warm (mid-70's^{o}F or warmer).**
  - **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).

- Even if surface water subsides quickly, the likelihood of dense surface crusts forming 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.
- 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, 2008a). 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, 2012).
    - 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 due to denitrification and leaching of nitrate N.
    - 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).

    - 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.
- Certain diseases, such as common smut and crazy top, may also become greater risks due to flooding and cool temperatures (Pataky and Snetselaar, 2006; Jackson-Ziems, 2014, APS, 2015).
    - 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 occurs either as stalk breakage (aka "green snap") or root lodging (plants uprooted and laying nearly flat to the ground). 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 References

APS. 2015. Crazy top on corn. American Phytopathological Society. http://www.apsnet.org/publications/imageresources/Pages/Iw000015.aspx [URL accessed June 2015].

Butzen, Steve. Flooding Impact on Crops. Pioneer Hi-Bred Int'l. Online at http://www.pioneer.com/home/site/us/template.CONTENT/agronomy/crop-management/adverse-weather-disease/flood-damage/guid.DE1A9B1D-CAC0-4A04-B9CC-E0820B29080A [URL accessed June 2015].

Ciampiatti, Ignacio, Kraig Roozeboom, and Doug Jardine. 2014. Effect of water-logged soils on corn growth and yield. eUpdate, Kansas State Univ. [On-line] Available at https://webapp.agron.ksu.edu/agr_social/eu_article.throck?article_id=255 [URL accessed June 2015].

Coulter, Jeff, Seth Naeve, Dean Malvick, and Fabian Fernandez. 2014. Considerations for Flooded

Corn and Soybean. Minnesota Crop News, Univ of Minnesota Extension. http://blog-crop-news.extension.umn.edu/2014/06/considerations-for-flooded-corn-and.html [URL accessed June 2015].

Elmore, Roger and Lori Abendroth. 2008. Flooded Corn and Saturated Soils. Integrated Crop Management Newsletter, Iowa State Univ Extension. Online at http://www.extension.iastate.edu/CropNews/2008/0530RogerElmoreLori+Abendroth.htm [URL accessed June 2014].

Farnham, Dale. 1999. Corn survival in wet conditions. Iowa State Univ. Integrated Crop Management Newsletter. [On-line] Available at http://www.ent.iastate.edu/ipm/icm/1999/5-24-1999/wetcorn.html [URL accessed June 2014].

Jackson-Ziems, Tamra. 2014. Corn Diseases: Crazy Top . CropWatch, Univ. of Nebraska Extension. Video at https://youtu.be/1QSTWMEKreM [URL accessed June 2015].

Laboski, Carrie. 2013. Potential for Nitrogen Loss Following Heavy Rainfalls. NPK et cetera. Univ of Wisconsin Extension. http://www.npketc.info/?p=180 [URL accessed June 2014].

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 June 2015].

Nielsen, R.L. (Bob). 2003. Bacterial Ear Rot in Corn Due to Flooding. Corny News Network, Purdue Univ. [online] http://www.kingcorn.org/news/articles.03/EarRot-0720.html. [URL accessed June 2015].

Nielsen, RL (Bob). 2008a. Growing Points of Interest. Corny News Network, Purdue Univ. Online at http://www.kingcorn.org/news/timeless/GrowingPoints.html [URL accessed June 2015].

Nielsen, RL (Bob). 2008b. Tips for Staging Corn with Severe Leaf Damage. Corny News Network, Purdue Univ. Online at http://www.kingcorn.org/news/timeless/VStagingTips.html. [URL accessed June 2015].

Nielsen, RL (Bob). 2012. Prevalent Purple Plants Perennially Puzzle Producers. Corny News Network, Purdue Extension. Online at http://www.kingcorn.org/news/timeless/PurpleCorn.html [URL accessed June 2015].

Nielsen, RL (Bob). 2014a. Determining Corn Leaf Stages. Corny News Network, Purdue Univ. Online at http://www.kingcorn.org/news/timeless/VStageMethods.html [URL accessed June 2015].

Nielsen, RL (Bob). 2014b. Use Thermal Time to Predict Leaf Stage Development in Corn. Corny News Network, Purdue Univ. Online at http://www.kingcorn.org/news/timeless/VStagePrediction.html [URL accessed June 2015].

Pataky, J. K., and K. M. Snetselaar. 2006. Common smut of corn. The Plant Health Instructor. DOI:10.1094/PHI-I-2006-0927-01 [On-line] Available at http://www.apsnet.org/edcenter/intropp/lessons/fungi/Basidiomycetes/Pages/CornSmut.aspx [URL accessed June 2015].

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

Thomison, Peter. 2010. Ponding Effects on Corn. C.O.R.N. Newsletter, Ohio State Extension. Online at http://corn.osu.edu/newsletters/2015/2015-15/ponding-effects-on-corn [URL accessed June 2015].

Wiebold, Bill. 2013. Heavy Rains Exclude Oxygen Needed for Seedling Health from Soils. Integrated Pest & Crop Mgmt, Univ of Missouri. Online at http://ipm.missouri.edu/IPCM/2013/5/Heavy-Rains-Exclude-Oxygen-Needed-for-Seedling-Health-from-Soils [URL accessed June 2014].

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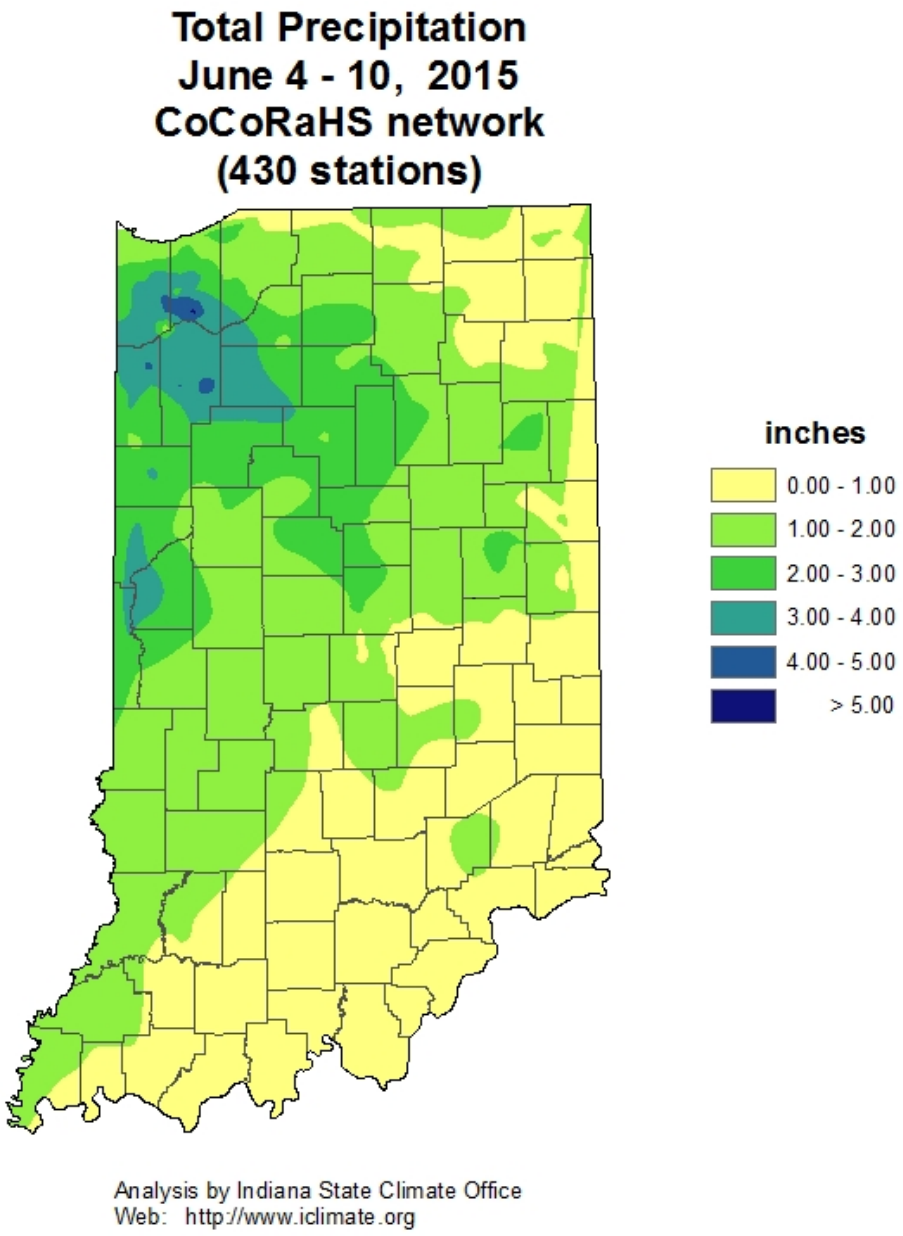
WEATHER UPDATE

Precipitation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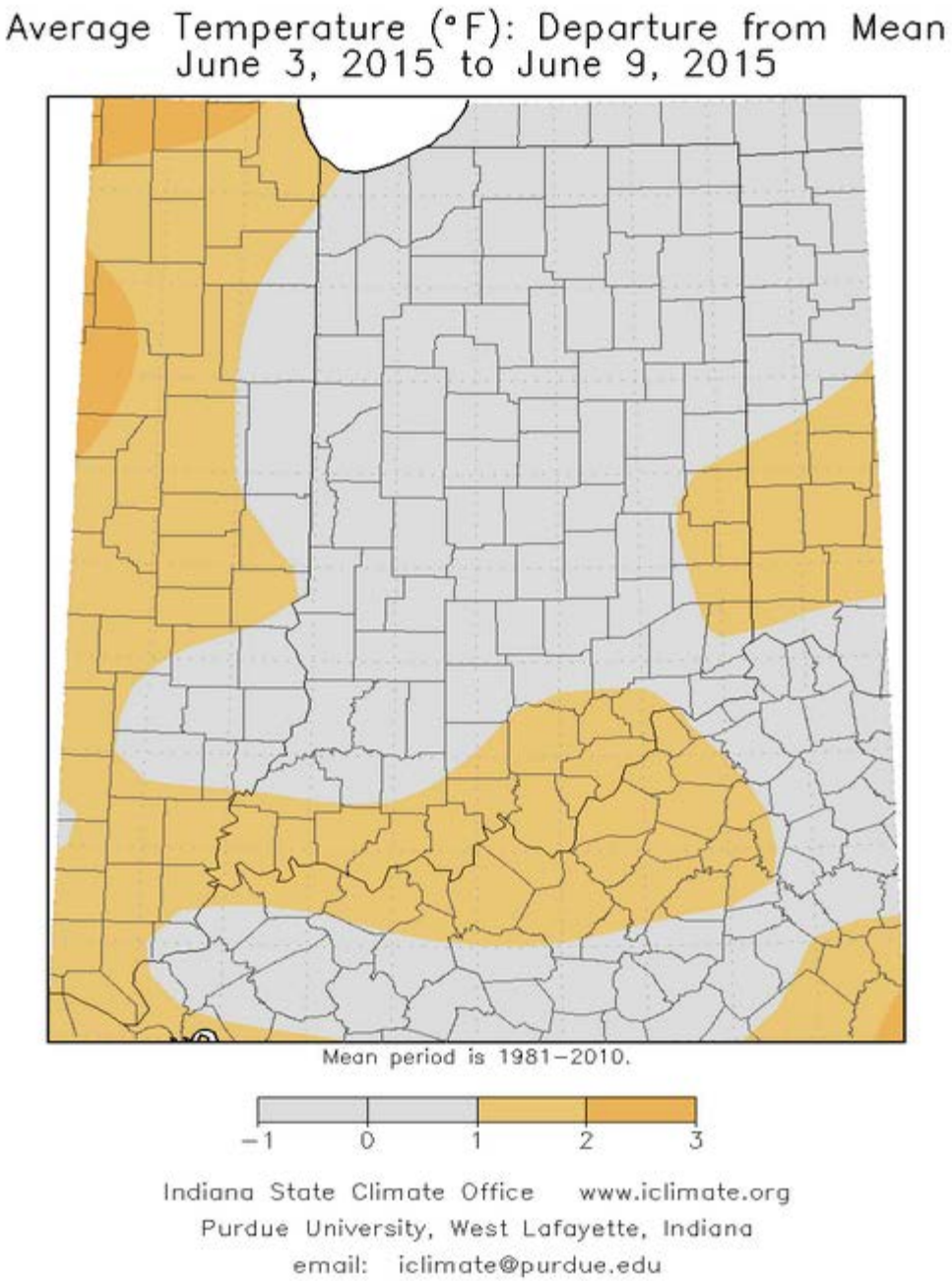
Temperature



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