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In This Issue

Stink Bug Damage in Corn

(John Obermeyer)

Reports from those checking fields indicate that brown stink bugs were busy this spring feeding on seedling corn. Perhaps now that plants are greening up, and getting some height, the damaged plants with yellow striping are becoming obvious. What seems to favor the development of the worst stink bug problems is where corn was planted into soils not suitable for good seed-slot closure. Not that we had any of that this spring!

Looking down on brown stink bug feeding injury expressed as yellow striping.

Stink bugs feed on corn by inserting their straw-like beak into the stalk or whorled-leaves while injecting an enzyme, which helps digest plant tissue. They prefer to feed on new growth. When seed slots are not properly closed during planting, stink bugs often feed on, or near, the growing point. It is important to remember that seedling corn plants are most vulnerable to attack and damage. By the time obvious feeding symptoms appear, the damage has been done. Symptoms vary, ranging from linear holes with a yellowish edge in the leaves, twisted or deformed stalks, plant suckering, and occasionally plant death. The damage can often be confused with other causes, e.g., herbicide injury, mechanical damage, etc. Brown stink bugs may still be seen in the field, but their feeding damage on leaves in the whorl is not a concern.

Sampling for stink bugs early in the season (at corn emergence) is difficult and time-consuming. In most cases, however, the best treatment is prevention: avoiding planting into wet soils if at all possible. Obviously, in a spring like this one, the small percentage of plants lost to stink bug feeding is probably worth the trade-off of having corn planted and growing.

Stink bug injury expressed as transverse holes with yellow halos.

Stink bug injury to the growing point, expressed as a suckered plant.

Japanese Beetles Emerging

(John Obermeyer)

A quick glance at some ornamentals on campus revealed that the Japanese beetle is beginning its emergence in west central Indiana. Hatch has undoubtedly been going for several days in southern counties, whereas, northern counties will soon be graced with their presence. What will be interesting to learn is how well the grubs survived this spring's saturated soils. In other words, will their numbers be down this summer?

Japanese beetles will feed on more than 350 different species of plants, but are especially fond of roses, grapes, smartweed, soybeans, corn silks, flowers of all kinds, and overripe fruit. Beetle damage to cultivated crops is often minimal and defoliation (leaf removal) on soybean usually looks much worse than it is. The beetles often congregate in several areas of a soybean field – often field borders – feeding on and mating in the upper canopy. The beetles' iridescent, metallic color and their proximity to the field edge catches the attention of those doing "windshield" field inspections. Closer inspections will often reveal that weeds such as smartweed have made fields even more attractive to the beetles. Let's hope this season they feed on the weeds…especially giant ragweed and marestail.

Wild grapes along a fence line will attract Japanese beetle to this soybean field.

Is That Abiotic Injury Or A Disease In Our Soybean Seedlings? What To Look For To Determine If That Spot Is Frogeye Or Herbicide Injury On Soybean.

(Darcy Telenko), (Bill Johnson) & *(Marcelo Zimmer)*

Recently there has been a number of calls and samples submitted to the Purdue Plant Pest Diagnostic Lab (PPDL) worried that they have frogeye on soybean. I know due to the issues we saw at the end of last season there is a bit of concern about managing frogeye. The current weather has led to a difficult start and if you have been successful in getting soybeans in the ground there is the worry about keeping them healthy.

Plant damage can be caused by either biotic (living) agents or abiotic (non-living) agents. It is important to determine the cause of the plant damage in making management decisions. Biotic agents will include all our plant pathogens (fungi, viruses, nematodes, bacteria) and insects. Abiotic agents can include soil nutrition, drought, lightening, improper cultural practices and chemical injury (herbicide, fertilizer solutions, or adjuvants).

There are four questions to consider when you are scouting your fields and you run across plant damage. (These will be the questions we will ask when receiving a sample or image of a plant with damage.)

1. Is there a pattern to the damage?
2. Where is this issue in the field?
3. Where is the issue on the plant? All or just a few individual plants?
4. Is there progression of damage? Do you see one type of damage or does the damage vary? Is it spreading or look to be a single event?
5. What plants are affected? Just the crop or surrounding weeds species? Or both?
6. Are there any insects or insect feeding injury?

Most of field crop diseases will tend to cause random, irregular patterns in a field when found early. The damage should show stages of progression and look to be spreading. Generally, only the host crop will be affected and not surrounding weed species. These are broad generalizations and each pathogen will have its own distinctive characteristics, but this is a starting point for determining if there is a biotic vs. abiotic issue. If the problem is uniform or showing a pattern in the field or on the plant, and multiple plant species in a field are affected then that will lead us towards an abiotic cause such as herbicide injury.

As a reminder, there are three things needed for disease to occur 1) susceptible host, 2) viable and virulent pathogen inoculum, and 3) **favorable environment.**

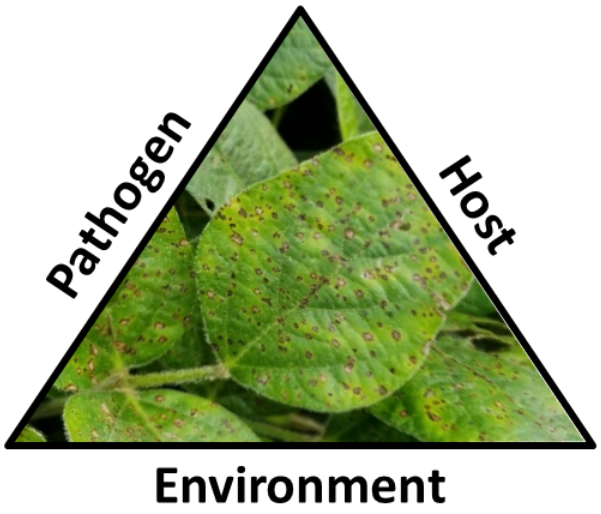

Figure 1. Disease triangle.

Frogeye leaf spot is caused by the fungus *Cercospora sojinia*. The fungus survives overwinter on infested crop debris. Fields most at risk are those planted to susceptible varieties, those that had soybeans last year with frogeye issues with continuous soybean or short rotation, and fields under conservation tillage. Both wind and splashing water can move spores in a field and infect new plants. In addition, wind may also disperse the spores to nearby fields. Initial disease symptoms of frogeye

will appear on the upper leaf surfaces as small, dark, water soaked lesions (spots) (figure 2A). These will enlarge and become round and angular with the characteristic gray to tan center with a red-purple border (figure 2B). The lesions may also have a light green or yellow halo.

Generally we do not worry about **frogeye until after flowering (R1 stage)**, to make a decision about fungicide application. All stages are susceptible and can be infected. Frogeye is most severe when there are high moisture, humid conditions and warm temperatures (77-86 F). We definitely have had the moisture, but I'm not sure we've had the heat. I would suggest continue to scout and keep a close eye. Frogeye can impact yield with early disease outbreaks or just after flowering and if this disease is active a fungicide application at R3 may be warranted.

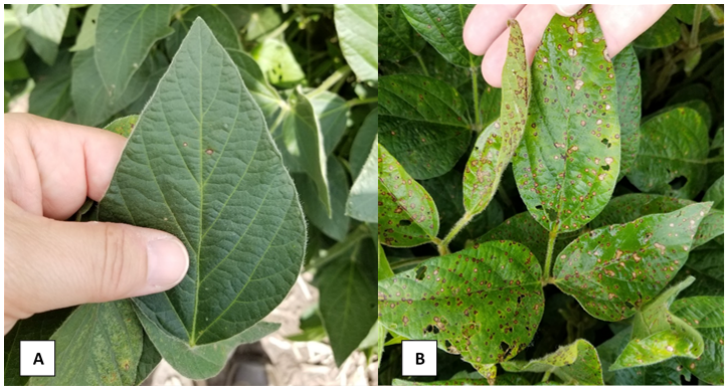

Figure 2: A – A few small lesions of frogeye. B – Multiple lesions of frogeye with variable lesion development from small to large lesions. All showing classic tan center and red-purple border.

There are a few herbicides that can mimic frogeye symptoms.

These herbicides include saflufenacil (Sharpen, and others), fomesafen (Flexstar and others), lactofen (Cobra and others), acifluorfen (Blazer and others), and paraquat (Gramoxone and others). See the Figures 3 to 9 for characteristic symptoms from each of these herbicides.

Saflufenacil is only labeled for pre-plant or pre-emergence use. Injury from saflufenacil typically occurs when the soybeans are just emerging or in the unifoliate stage, and a rainfall event causes herbicide residues to be splashed onto the young tender stems, cotyledons, and unifoliate leaves (Figures 3 and 4).

Figure 3. PPO injury on emerging soybeans (*Photo Credit: Joe Ikley*)

Figure 4. PPO injury on soybean seedlings (*Photo Credit: Travis Legleiter*)

Fomesafen can be used pre-emergence and postemergence in soybean. We rarely see injury from pre-emergence use. However, since it is a contact herbicide, injury from post emergence use is fairly common and symptomology is shown in Figures 5 and 6. This type of injury does not cause any impact on yield. Injury symptoms are typically more pronounced when this herbicide is applied in hot humid weather. (Figure 6).

Figure 5. Fomesafen injury applied POST on soybeans.

Figure 6. Soybean injury in response to fomesafen (Flexstar) applied under hot and humid conditions.

Lactofen and acifluorfen are labeled for postemergence use in soybeans and injury symptoms are shown in Figures 7 and 8. Much like fomesafen, this type of injury does not cause any impact on yield. Injury symptoms are typically more pronounced when this herbicide is free in the hot humid weather.

Figure 7. Lactofen injury applied POST on soybeans.

Figure 8. Acifluorfen injury applied POST on soybeans (*Photo Credit: Glenn Nice*).

Paraquat is labeled for preplant use as a burn down herbicide. Injury symptoms are shown in figure 9 and this might be the herbicide injury symptoms that are most easily confused with frog eye. Typically we will see a red edge around the necrotic spots on the leaves. (Figure 9).

Figure 9. Soybean injury in response to paraquat drift (*Photo Credit: Glenn Nice*).

The reality of the matter is at this point in the growing season, with our delayed planting dates statewide, most likely we are not seeing injury symptoms yet from fomesafen, lactofen, or acifluorfen. we have however received calls and samples that had saflufenacil and paraquat injury symptoms.

The unique conditions will probably cause us to see new and unexpected issues, we will try to keep you informed. Due to last season I expect there to be a high inoculum pressure and we need to be vigilant in our scouting. I commend those that are out there now, sending samples and contacting us – keep it up as we don't know what direction this season will take.

Other resources

https://crop-protection-network.s3.amazonaws.com/publications/cpn-1017-frogeye-leaf-spot.pdf

How Does The Hemp Crop Look So Far?

(Marguerite Bolt, mbolt@purdue.edu)

Both fiber, grain, and CBD hemp farmers are continuing to struggle with the wet weather and some fields remain unplanted. Sunstrand, a fiber processing company in Kentucky working with fiber farmers in the state, has realized that biomass goals will need to be adjusted because of the weather. Some growers have been able to get decent stand establishment and fiber hemp is up to three feet tall in some fields. Some of our fiber plots at Meigs farm are approaching three feet in height as well.

For farmers growing hemp for grain, we have encountered issues with early season flowering like previous years. Hemp is a short-day plant, meaning flowering occurs when daylength is less than 12-14 hours, however this is variable across cultivars (Sankari and Mela 1998). The period prior to flowering is the vegetative growth phase, a crucial part of the plant acquiring nutrients and producing resources that can be transferred to developing seeds after pollination occurs. The available grain cultivars have been bred for northern latitudes and we observe flowering approximately four weeks after planting. Legacy Hemp, a hemp seed distributor, has not commented on their recommendations for early flowering, but they have asked farmers to delay planting because of the rain.

There have been mixed reports of how the CBD hemp crop looks, and some growers have been unable to plant due to flooded fields. I have received reports of stressed plants likely due to transplant shock and the presence of aphids, leaf hoppers, and powdery mildew on clones. Because there are no registered pesticides (including organic pesticides) for use in hemp, controlling pathogens and insects is going to be challenging as we try to develop management recommendations. Starting with good stock that is healthy and free of pests will be crucial as this industry develops.

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Developing pollen sacs on male hemp plant four weeks after planting (photo taken 6/12/19).

Fiber hemp at Meigs farm approximately three feet tall (photo taken 6/18/19).

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 drownders”) 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.

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Indiana Climate and Weather Report – 6/20/2019

(Beth Hall)

Some weeks I wonder if I could just re-use the previous week's weather and climate article! The story seems to be the same: It's been wet and more rain is expected. It is impressive, however, astounded when to see the contrast in June precipitation (so far) for precipitation across the state (Figure 1). It seems plenty wet in northern Indiana, I can't even imagine how wet it must be to the south!

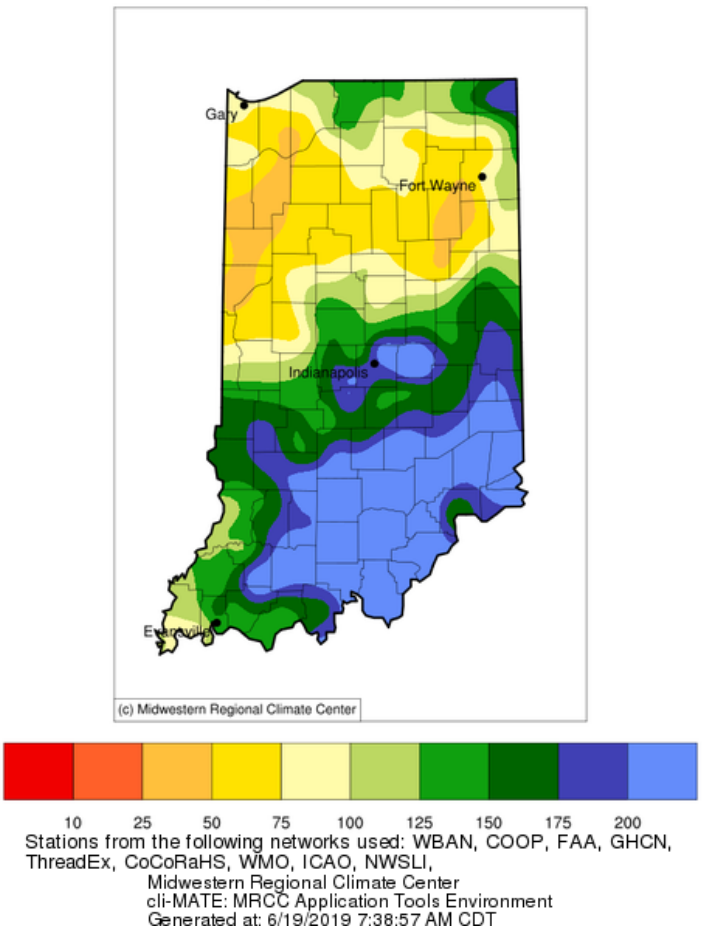
Unfortunately, the forecast predicts Indiana will continue to be wet. The 7-day Quantitative Precipitation Forecast (QPF) is predicting 3"-5" across most all of the state (Figure 2). Beyond that, the 6-14-day outlook (Jun 24 to Jul 2) is indicating a medium-to-high probability of above normal precipitation. Even the 3-4-week outlook (Jun 29 – Jul 12) shows a significant probability of above normal precipitation (at least for the northern two-thirds of the state). The hope will be that all of this above-normal precipitation will be intermittent enough to let some of that moisture evaporate and transpire with plant growth and warmer temperatures.

Temperatures have not helped the evapotranspiration hopes. For June (so far), temperatures across the state have been 1°F-3°F below normal. Fortunately, the 8-14-day outlook (June 26 to July 2) is showing significant confidence that temperatures will be above normal. Unfortunately, the 3-4-week outlook flips back to predicting below-normal temperatures. Translating to modified growing degree-days (accumulating since April 1), the northern half of Indiana is 50-150 units below normal, where the southern half is near normal.

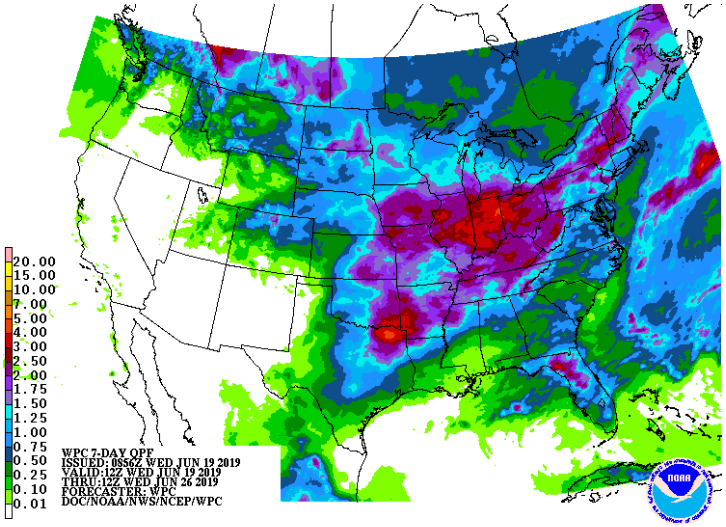
It's looking like another hot and muggy summer for Indiana!

Accumulated Precipitation (in): Percent of 1981-2010 Normals

June 01, 2019 to June 19, 2019



Precipitation percent of mean for Jun 1 – Jun 19 where a value of 100 would indicate the normal amount for 1981-2010.



7-day precipitation forecast representing June 19 – 26, 2019. Source: NOAA Weather Prediction Center.

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