In This Issue

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

Corn Tar Spot Update

Author: Darcy Telenko

Local epidemics of corn tar spot have growers worried in Indiana about how their corn will finish out the season.

The tar spot pathogen, *Phyllachora maydis*, was first identified in the United States in 2015 in Illinois and Indiana. Currently we **do not understand the biology or epidemiology** of this disease. There is very limited and incomplete information about this disease from its native region of Latin America. We are collaborating with the Kleczewski Lab (Univ. of Illinois), Smith Lab (Univ. Wisconsin) and others in the North Central region to determine the distribution of tar spot and gather any information we can about hybrid susceptibility or other environmental observations.

What we know or don't know to date:

1. Hybrids may differ in susceptibility
2. Use of fungicides as a management tool is UNKNOWN
3. Moisture/leaf wetness may play a role (see image below where in the valley of the field is senescing)
4. This disease has been seen in the Indiana every year since 2015
5. Likely overwinters – crop residue? Weeds or other plants?

What to look for: Small, black, raised spots (circular or oval) develop on infected plants, and may appear on one or both sides of the leaves, leaf sheaths, and husks. Spots may be found on both healthy (green) and dying (brown) tissue. Often, the black spots are surrounded by a tan or brown halo; this is especially obvious on healthy leaves (see images).

A multitude of tar spots on a corn leaf. (Photo Credit: Darcy Telenko)

Tar spot in a hybrid field. (Photo Credit: Darcy Telenko)

The map shows current distribution in India – 2018 counties are in red.

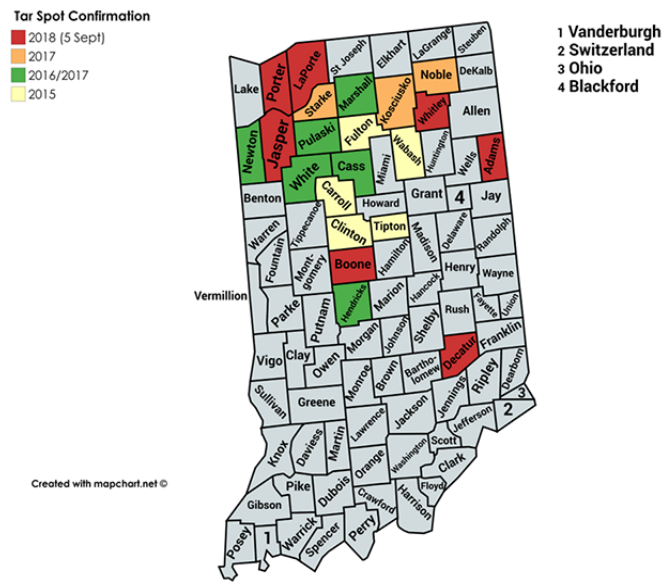

Figure 1: Distribution of Tar Spot of Corn in Indiana as of September 5, 2018. (Image Credit: Darcy Telenko)

Wanted: We need samples of corn infected with tar spot, especially in counties where is has not been reported. If you have (or think you have) corn tar spot, please collect several leaves showing the symptoms and send them with a PPDL form https://ag.purdue.edu/btny/ppdl/Documents/Forms/PPDL-Form_13MAY15FILLABLE.pdf. There will be no charge for corn tar spot samples since they are needed for research.

Please wrap the leaves in newspaper and ship in a large envelope. Please ship early in the week. If you are sending samples from multiple locations please label them and provide the date collected, variety of corn, field zip code or county, and previous crop.

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

We have many questions about why this disease has become such an issue. Why is it so bad this season? What changed? We will keep you updated as we learn more, so stay tuned.

Question please contact Darcy Telenko (dtelenko@purdue.edu/764-496-5168) or Gail Ruhl (765-494-7071)

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Soybean Nitrogen Deficiency: Soil Factors and Plant Response

Authors: Shaun N. Casteel

Highlighter green soybeans (N-deficient) are related to the root system, number of nodules, and nodule activity (i.e., evidence of N fixation). Figures 1, 2, and 3 show the whole plant, roots, and nodule loads that are related to the healthy vs. N-deficient soybeans. The vast majority of these N-deficient soybeans are related to soils that have been saturated periodically throughout the growing season (see last week's articles and this one).

Figure 1. Representative plants that had adequate supply of N (left) and those that were deficient in N (and S). August 31, 2018 in Shelby County.

Figure 2. The root system of the healthy soybean (left) are more extensive with more nodules and greater nodule activity (i.e., pink interior that indicates N fixation). N-deficient soybean on the right has smaller root system (diameter of roots, evidence of root hairs, depth of taproot), very few nodules, and nearly no evidence of active N fixation. August 31, 2018 in Shelby County.

Figure 3. Poor nodulation and limited N fixation on the N-deficient soybeans. Oldest nodules (the ones initiated during seedling development) are dead and young nodules are limited in number and activity due to saturation conditions periodically throughout the growing season. August 31, 2018 in Shelby County.

In last week's articles, we described seep hydrology to explain why these highlighter green soybeans were showing on the side slopes.

Other fields are demonstrating the highlighter green soybeans (Figures 4 and 5) that are not related to seep hydrology. Anything that has been affecting rooting and therefore, nodulation and N fixation can be the culprit. Many of these fields are still related to wet feet via compaction or other soil characteristics that influence water flow and water holding capacity. Figures 6 and 7 show and describe the soil profiles of the dark green, soybeans vs. highlighter green soybeans. My preliminary thoughts are related subsoil depth and water holding capacity to name a few.

Figure 4. Aerial image of highlighter green soybean to yellow (now, senescencing) soybeans in Shelby County. August 31, 2018.

Figure 5. Field level picture of the transition from dark green, healthy soybeans to the highlighter green and yellowing soybeans. August 31, 2018 in Shelby County.

Figure 6. Soil profile to a depth of 48” in the middle of dark green, healthy soybeans. The petioles are laid across the approximate soil layers. The depth of this soil was deeper than 48” as I did not hit a restricting layer. August 31, 2018 in Shelby county.

Figure 7. Soil profile to a depth of 42” in the middle of highlighter green to yellowing (senescence) soybeans. The petioles are laid across the approximate soil layers. Evidence of saturated conditions were seen higher in the profile: manganese concretions ~15” depth, gleying in the middle of the profile, and saturated/sticky soil at ~30”. Gravel and rocks were showing up at 24”, which then prevented any further boring beyond 42”. August 31, 2018 in Shelby county.

Limited N supply to soybean has a drastic effect on growth, development, and yield potential. Obviously, leaf nutrient concentrations (N and S in particular) will be different between the good and the bad areas. The leaf nodal development and branching will be limited thus, creating a short, compact plant. As the N deficiency continues, the plants will abscise the older leaves (lower portion of the soybean canopy) and progress upward (Figure 8). Pod retention and seed fill will be reduced as well. In Figure 8, you will notice fewer branches, shorter plants (i.e., fewer nodes), and fewer pods on the bottom of the plant. The N-deficient plants will also senescence faster/earlier than the healthy soybeans, especially at the two ends of the temperature spectrum: very hot (upper 80s and higher) or cool nights in the 50s.

Figure 8. Representative plants that had adequate supply of N (left) and those that were deficient in N (and S). Yield estimate of 65 bu/ac (left) vs. 40 bu/ac (right). August 31, 2018 in Shelby County.

Figure 9. Dark green, healthy soybean with good root system and nodulation (upper left) vs. N-deficient soybeans (off-green and yellowing leaves) with poor root system and nodulation (upper right). Photo courtesy of Denny Cobb, Becks Hybrids. August 28, 2018 near Warsaw, IN.

Stresses like N deficiency, limited water supply, and/or high temperatures also impact seed fill. The rate of seed fill and duration of seed fill are two of the major effects, but plants can also straight-out only produce 1- or 2-bean pods and/or arrest seed development (i.e., flat bean pods, 1- or 2- bean voids in a 3-bean pod) (Figures 9 and 10).

The yield effect of N deficiency can be quite severe. I collected the representative samples (1/10,000th acre) in the dark green, healthy soybeans and the highlighter green soybeans (not even the worse portions of the field) to estimate yield. My conservative estimate was 65 bu/ac for the healthy soybeans vs. 40 bu/ac for the highlighter green soybeans (Figure 8). The swing in yield production differences could be even greater depending on the final seed fill duration and rates. The N-deficient soybeans had more 2-bean pods and will likely have smaller seeds when is all said and done.

I want to raise the issue to your attention so you will be aware, so that you can still document these areas spatially before the combine comes into the field and averaging it across the header that is 25 to 40-ft wide. Yield maps can document some of these differences, but they will not have this level of resolution especially if the pattern is not matching side slopes or soil series.

Figure 10. Two-bean pods and arrested seed fill (1- or 2- bean voids in a 3-bean pod) from the N-deficient soybeans pictured in Figure 6. Photo courtesy of Denny Cobb, Becks Hybrids. August 28, 2018 near Warsaw, IN.

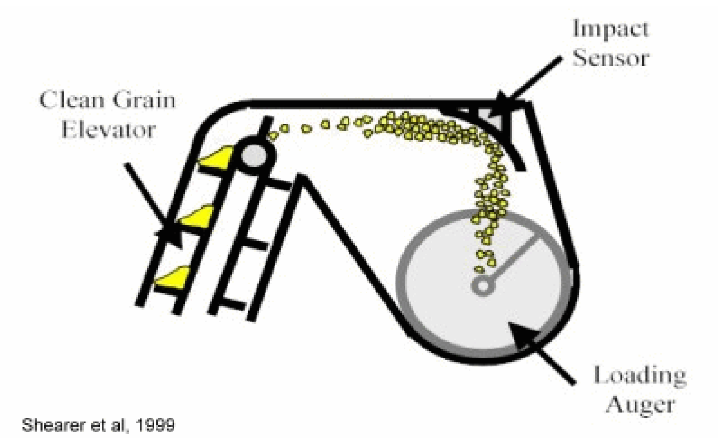
Yield Monitor Calibration: Garbage In, Garbage Out

Author: Bob Nielsen

Understand this one simple fact about grain yield monitors: They do not measure grain yield.

How's that for an opening statement?

What I want you to understand is that yield monitors ESTIMATE yield by converting electrical signals received from a mass impact or optical sensor, located somewhere in the clean grain elevator of the combine, into ESTIMATES of grain flow (lbs) per second or two of travel time. Along with ESTIMATES of distance traveled (usually based on differentially corrected GPS signals), header width, and ESTIMATES of grain moisture content… the yield monitor's firmware / software then ESTIMATES "dry" grain yield per acre, at a moisture content of your choice, and records those yield estimates, and their geographic location in the field, every second or two in the display's memory or uploaded by cellular connection to a Cloud-based Web server.



Flow sensor.

Yield monitor calibration involves a series of steps to ensure that the ESTIMATION of each of these factors is accurate. One of those steps involves the harvesting of calibration "loads" of grain that are used to "teach" the yield monitor's "black box" how to accurately convert the electrical signals from the sensors into ESTIMATES of grain flow rates.

The calibration "loads" should be harvested in such a way as to mimic the range of grain flow rates (i.e., the range of yield) you expect to encounter when harvesting a field. Ideally, each calibration load is calibrated at a different, but uniform grain flow rate. Some folks harvest strips at different speeds to accomplish this. Some folks harvest strips of varying widths (full header, 3/4 header, 1/2 header, etc.). In our field-scale nitrogen research trials where we have a wide range of N rate strips, our calibration loads typically come from 5 to 6 different N treatment rates because that often provides the greatest range of potential grain flow rates.

Yield estimates on a whole field or individual load basis made by a well-calibrated yield monitor are accurate in the sense that they often very closely match yield estimates calculated from weigh wagons or commercial weigh scales. However, to achieve a satisfactory level of accuracy, yield monitors must be "trained" to correctly interpret the electrical signals created by the impact sensor into estimates of grain flow rate . Some background information may help you better understand the nature of and importance of faithfully and regularly calibrating yield monitors.

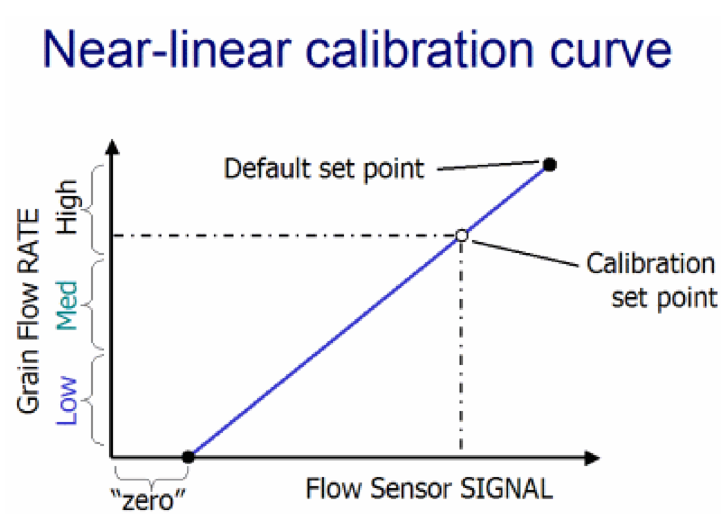
Calibrating a yield monitor simply requires the harvest of individual "loads" of grain that represent the range of grain flow rates (i.e., a range of yield levels) expected in the field(s) to be harvested.The amount of grain required for each calibration "load" ranges from 3,000 to 6,000 lbs (50 to 100 bu grain) depending on the manufacturer's recommendations for the specific model/make of yield monitor. The grain weight of each "load" is estimated "on the go" by the yield monitor as the grain is harvested. The grain for that specific "load" is then offloaded from the combine hopper and weighed on calibrated or "known to be accurate" weigh wagon or commercial scales. The actual weight is then entered into the yield monitor console and the yield monitor firmware makes mathematical adjustments to the calibration response curve.

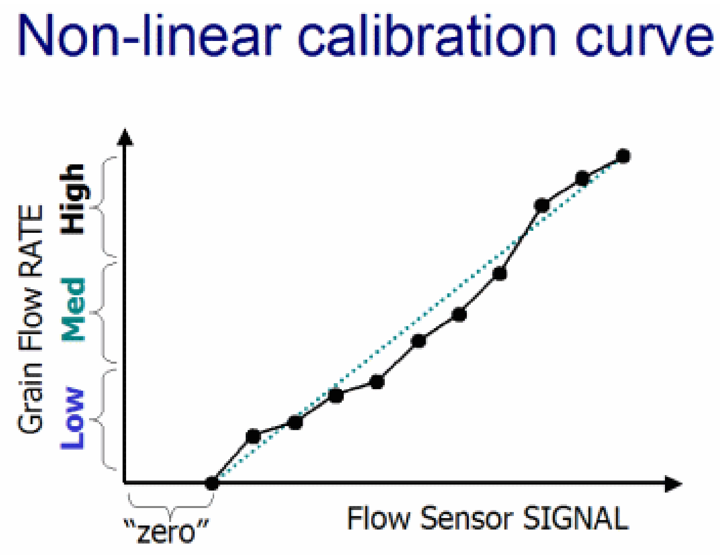
Conceptually, the calibration process involves fitting a response curve between grain flow rate and flow sensor signal strength in order to estimate low, medium, and high yields. Makes of monitors appear to differ in the nature of the calibration curve that is determined.

Some manufacturers suggest that only one grain load is necessary to perform an accurate calibration. That recommendation implies the calibration response curve is a straight-line or near-linear relationship between grain flow rates and flow sensor signals. While the standard recommendation is for only one grain load, the "fine print" in the owners' manual suggests that additional calibration loads may be added to fine-tune the accuracy when necessary.

Other manufacturers recommend between 3 and 6 grain loads are required to perform a satisfactory calibration of the yield monitor. This recommendation suggests that the calibration response curve for these yield monitors is not a straight-line, but is rather some sort of non-linear response curve that requires a number of calibration points to best "train" the yield monitor how to interpret the flow sensor signals.

The goal with multi-load calibration procedures is to "capture" the full range of grain flow rates (aka yield levels) you expect to encounter during the harvest of your fields. Capturing a range of grain flow rates during calibration can be a nuisance because it typically requires harvesting individual full header-width "loads" at different speeds or partial header-width "loads" at a constant speed. This headache plus the time it takes to off-load and weigh the individual grain loads are among the most common reasons why growers do not faithfully or routinely calibrate their yield monitors.





Yield monitor accuracy can be excellent if the yield monitor is well-calibrated. Yield estimates by calibrated yield monitors that I use in my field-scale research trials are typically within 1 % or less of the actual grain weight measured with a weigh wagon or farm scales. Conversely, yield estimates can be very poor if yield monitors are not well-calibrated. The error in accuracy can be as much as 100 % if the yield monitor is taken "off the shelf" and put into service without any calibration. Errors in accuracy can easily range as high as 7 to 10 % late in harvest season if the yield monitor was calibrated only at the beginning of the harvest season because of changes in grain moisture content. Errors in yield estimates are especially likely if the full anticipated range of harvested grain flow rates are not included in the calibration of the yield monitor.

Well, you may ask… who cares whether or not your yield monitor is providing you with accurate yield estimates? After all, growers are typically paid at the point of sale according to the net grain weights printed on the scale ticket and not according to a yield map. Quite honestly, accurate yield monitor estimates also may not matter for simple farm record-keeping purposes.

However, if you want to USE the information that an accurate yield dataset provides, then you should strive to ensure accuracy in the yield estimates made by your yield monitor. Common uses for yield monitor data include comparisons of one field to another, one specific spot in a field to another, one hybrid's performance to another, early versus late harvest season, and experimental treatments in on-farm field trials.

Yield monitor calibration accuracy can be influenced by yield levels outside the range of grain flow rates used for the yield monitor calibration, by seasonal changes in temperature, by seasonal changes in grain moisture content, by hybrids in terms of their differences for grain weight, grain shape, and grain moisture, and by field topography. Calibrating your yield monitor once a season will not assure that it remains accurate the entire season. Check the accuracy of the yield monitor calibration occasionally by harvesting and weighing additional calibration loads. Recalibrate the yield monitor when necessary to maintain an acceptable accuracy.

Don't forget to…

- Also calibrate the combine's grain moisture sensor.
- Also calibrate for the zero-flow combine vibration.
- Also calibrate the temperature sensor at the beginning of the season.
- Re-read the yield monitor operations manual prior to the harvest season.
- Create a pre-season and in-season yield monitor checklist of all adjustments and settings.
- Go through the yield monitor checklist every morning before beginning the day's harvest.

Bottom Line

Yield data can be very useful for identifying and diagnosing yield influencing factors in corn or soybean. Yield monitors can also be useful for harvesting on-farm research trials. Yield monitor calibration, yield data processing, and yield data "cleaning" are necessary to ensure accurate yield data.

The bottom line is that extra care and attention to details are important when calibrating yield monitors. Dig out that users guide for your yield monitor system NOW. Before the end of summer, devote some quality time to reading the sections on yield monitor calibration. Familiarize yourself with all aspects of yield monitor calibration. Attend a yield monitor workshop. Create your own checklist of calibration steps and follow them faithfully every time you calibrate the monitor. Do not forget the little things like vibration settings, header height stops, offset of the DGPS antenna, etc. Recognize that accurate weighing devices (grain carts, weigh wagons, farm scales) and moisture meters are crucial for the calibration of the monitor's wet weight estimates and adjusting the combine's moisture sensor readings.

And remember the old adage about computers: "Garbage in equals garbage out".

Related Reading

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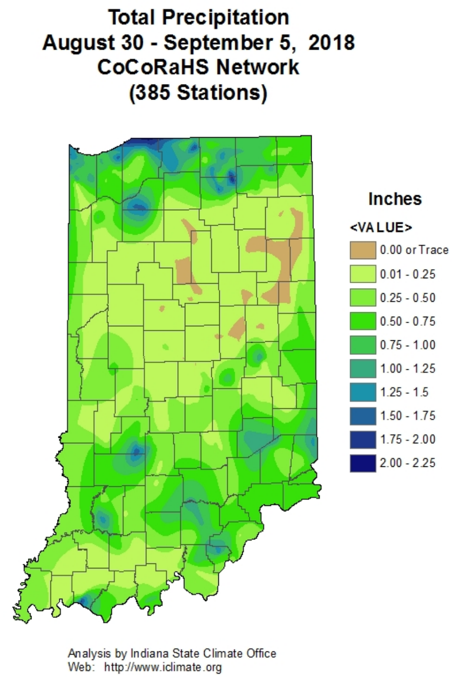
Total Precipitation August 30-September 5, 2018



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Average Temperature Departure from Mean August 29 to September 4, 2018