Wisconsin Crop Manager

Volume 23 Number 18- - - University of Wisconsin Crop Manager - - -June 30, 2016

Contents

Soybean Flowers, Glyphosate Label, and Wheel Track Damage…Oh My!

Shawn P. Conley; Soybean and Wheat Extension Specialist

Given the quick start to our soybean growing season we will begin to see many soybean fields begin to flower (R1) over the next week. As we enter the soybean reproductive growth phase there are a few things to keep in mind. The first is that soybean will produce flowers for ~3 to five weeks, depending upon planting date and environment. During that time soybean will abort anywhere from 20 to 80% of the flowers that they produce. Generally it is the first and last flush of flowers produced that are most likely to be aborted.

Next, the timing window for glyphosate applications in our early planted soybean is quickly closing. Glyphosate labels indicate that applications can be made through R2 or full flower. The R3 growth stage begins when one of the four top nodes with a fully developed leaf has a 3/16 inch long pod. Applications made after the R3 stage begins are off-label applications. On average it takes ~

R1. Soybean Growth Stage

Spraying Soybean at the R1 Growth Stage

4 days to move from R1 (beginning flower) to R2 (full flower) and ~10 days from R2 to the start of R3 (beginning pod).

Last but not least, wheel track damage made from ground applications may start to reduce yield. Sprayer wheel traffic from first flower (R1) through harvest can damage soybean plants and reduce yield (Hanna et al. 2008). Our research suggests that an adequate soybean stand (more than 100,000 plants per acre) planted in late April though mid-May can compensate for wheel tracks made when a field is sprayed at R1. Yield loss can occur, however, when wheel tracks are made at R1 or later in thin soybean stands (less than 100,000 plants per acre) or late planted soybeans. Regardless of stand, plants could not compensate for wheel tracks made at R3 (early pod development) or R5 (early seed development). The average yield loss per acre is based on sprayer boom width (distance between wheel track passes). In our trials yield losses averaged 2.5, 1.9, and 1.3% when sprayer boom widths measured 60, 90, and 120 foot, respectively. Multiple trips along the same wheel tracks did not increase yield loss over the first trip.

Hanna, S., Conley, S. P., Shaner, G., and Santini, J. 2008. Fungicide application timing and row spacing effect on soybean canopy penetration and grain yield. Agronomy Journal: 100:1488-1492.

Wheel Track Damage to Drilled Soybean at R1

Time to Start Watching for White Mold in Soybeans

Damon L. Smith, Extension Field Crops Pathologist, University of Wisconsin-Madison

Jaime Willbur, Graduate Research Assistant, University of Wisconsin-Madison

The warm weather over the last several weeks has pushed the Wisconsin soybean crop quickly toward the reproductive growth stages. By the end of the week, most early-planted soybean fields in the southern portion of Wisconsin will begin flowering (R1 growth stage). This growth stage is a critical time to make a fungicide application decision for white mold (Fig. 1; also called Sclerotinia stem rot). Fungicide decisions should be made for this disease between the R1 and the R3 (pods beginning to form on upper nodes) growth stages. After the R4 growth stage control of white mold using fungicides quickly declines. The decision to apply fungicide during this time should be made based on the weather. As discussed in this FACT SHEET and VIDEO, cool (less than 80F) and wet and/or humid conditions during the R1-R3 growth stages can lead to increased risk of white mold later in the season.

Figure 2 illustrates the white mold cycle. Small hardened black structures called sclerotia survive many years in the soil (Fig. 2A). When conditions are cool and wet during the bloom period small mushroom-like structures called apothecia germinate from the sclerotia (Fig. 2B). The apothecia release spores that land on flower petals and germinate (Fig. 2C) allowing the fungus to infect and colonize the soybean plant. As the fungus continues to colonize the inside of the plant, symptoms will begin to develop around the R5 or R6 soybean growth stages. These include wilting plants and paper bag-brown lesions on stems. Eventually new sclerotia of the fungus begin to develop on the plant (Fig. 2D). These sclerotia become the source for future white mold epidemics. Because the white mold fungus needs the open flowers

Figure 1. Severe white mold in a soybean field.

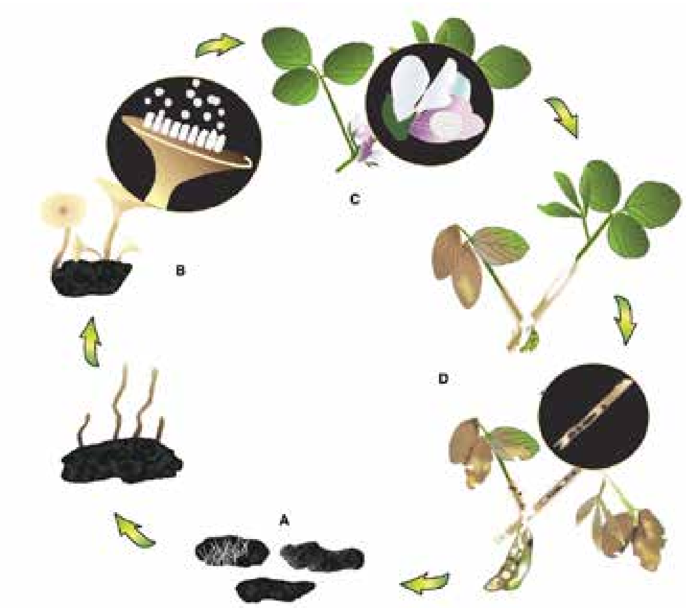


Figure 2. White mold cycle on soybean. Drawing created by Renée Tesdall.

to infect and colonize soybean, it is important to apply a fungicide during this time to protect the plants from infection IF the weather is conducive for the white mold fungus. It can be difficult to determine what "conducive weather" is and if you need to spray.

In an effort to help define these "conducive" conditions, a model was developed at the University of Wisconsin-Madison in conjunction with Michigan State University to identify at-risk regions which have been experiencing weather favorable for the development of white mold apothecia. This model predicts when apothecia will be present in the field using 30-day averages of maximum temperature, relative humidity, and wind speed. Using virtually available weather data, predictions can be made in most soybean growing regions. Based on these predictions, a map is generated (Fig. 3) to indicate areas at no (white), low (blue), medium (yellow), and high (red) risk levels. Fields in yellow or red areas have >40% chance of having apothecia present and may be at risk of white mold developing later in the season. Model predictions must be combined with soybean growth stage and canopy characteristics to aid in timing of fungicide sprays. If the model is predicting medium to high risk in your area, the soybeans are flowering, and the canopy is somewhat closed, then the white mold risk is elevated. If your fields are at-risk, we recommend to consult your local extension personnel or resources for the best in-season management options for your area. To view and download a handy user guide for the model, CLICK HERE.

For Wisconsin soybean growers, regular updates and commentary regarding risk of white mold can be found on this blog. Color coded, state-wide maps will be posted and our recommendations will accompany these posts. So be sure to check back regularly or subscribe to the blog to receive an automatic e-mail update when a new post has been added. You can subscribe via the window immediately to the right of this window. The inaugural post for 2016 can be viewed by clicking here.

If you have decided to spray soybeans for white mold, what are the best products to use. Over the last several years we have run numerous fungicide efficacy trials in Wisconsin and in conjunction with researchers in other states. Fungicides that have performed well in multi-state studies can be found in the 2016 version of the Soybean Fungicide Efficacy Table. In Wisconsin, we have observed that Endura applied at 8 oz at the R1 growth stage performs well. We have also observed that the fungicide Aproach applied at 9 fl oz at R1 and again at R3 also performs comparably to the Endura treatment. Other fungicide options also include Omega and Proline. You can view results of past fungicide evaluations by CLICKING HERE.

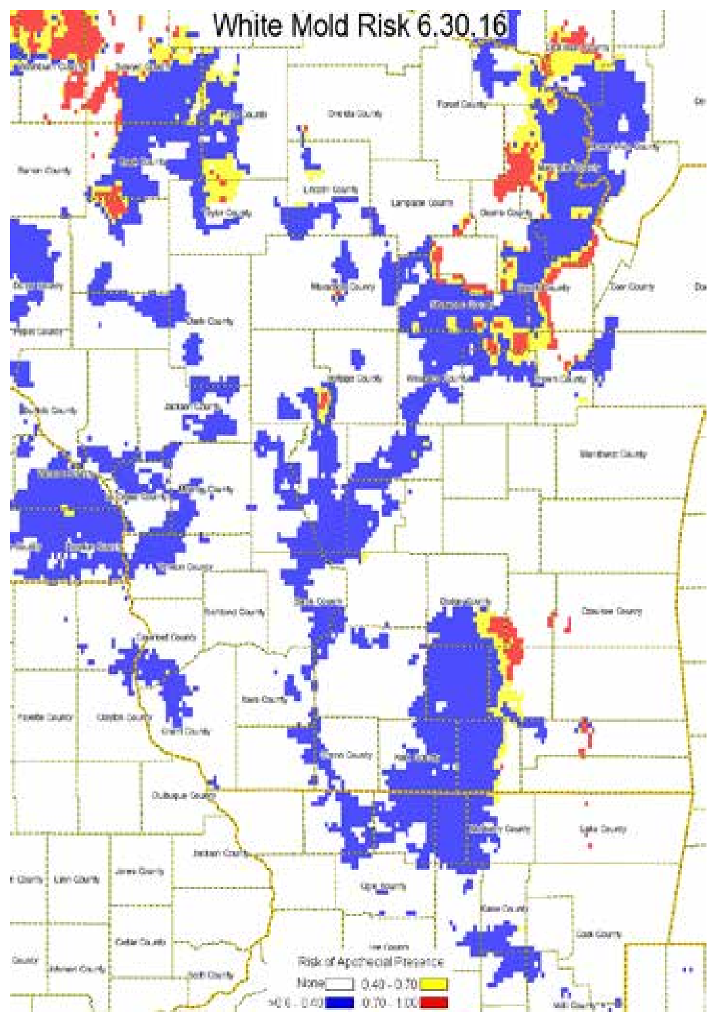


Figure 3. White Mold Risk Map for Wisconsin on June 30, 2016. White and blue colors indicate low risk. Yellow and red colors indicate moderate to high risk, respectively.

For even more detailed information about white mold you can visit the Crop Protection Network page on white mold and also download this handy white mold scouting card. You can also find more information about white mold by clicking here and scrolling down to the white mold section.

To vist other posts on this blog about white mold, click below:

2015 Blog Post

2014 Blog Post

Fusarium Head Blight and Wisconsin Wheat Harvest in 2016

Damon L. Smith, Extension Field Crops Pathologist, University of Wisconsin-Madison

Shawn P. Conley, Extension Soybean and Small Grains Agronomist, University of Wisconsin-Madison

Fusarium head blight (FHB) or scab has been relatively low in most Wisconsin winter wheat fields this season. Occasionally we have run across a field with somewhat higher levels of FHB; however, compared to the 2015 crop, we suspect that the 2016 winter wheat crop should have much less FHB. With that said, it is still important to scout your maturing wheat crop and consider how much damage from FHB might be in a field as you prepare for harvest. While FHB can cause direct yield loss, the fungus that causes this disease can also produce deoxynivalenol (also known as DON or vomitoxin). Assessing wheat fields now can assist you in determining how much vomitoxin might be expected at harvest.

Figure 1. Fusarium head blight on a wheat head

What does scab look like? Diseased spikelets on an infected grain head die and bleach prematurely (Fig. 1). Healthy spikelets on the same head retain their normal green color. Over time, premature bleaching of spikelets may progress throughout the entire grain head. If infections occur on the stem immediately below the head, the entire head may die. As symptoms progress, developing grains are colonized causing them to shrink and wrinkle. Often, infected kernels have a rough, sunken appearance, and range in color from pink or soft gray, to light brown. As wheat dries down, visual inspection of heads for scab will become more difficult.

Why is identifying scab important? Scab identification is important, not only because it reduces yield, but also because it reduces the quality and feeding value of grain. In addition, the FHB fungus may produce mycotoxins, including DON or vomitoxin, that when ingested, can adversely affect livestock and human health. The U.S. Food and Drug Administration has set maximum allowable levels of DON in feed for various animal systems, these are as follows: beef and feedlot cattle and poultry < 10ppm; Swine and all other animals < 5ppm.

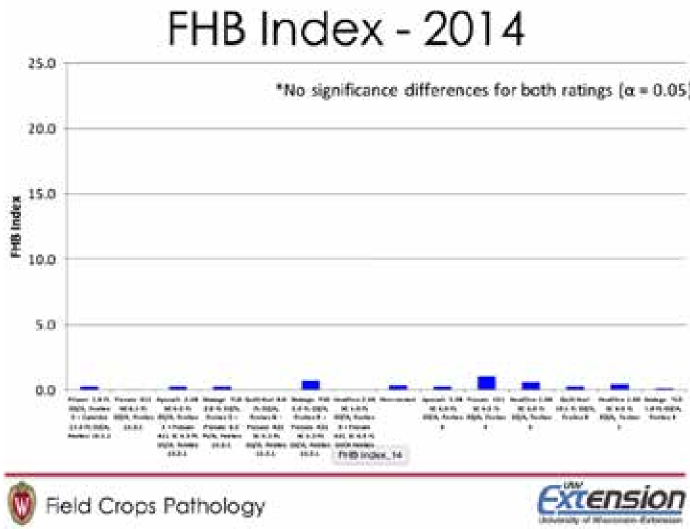
What should I do to prepare for wheat harvest?

1. Scout your fields now to assess risk. Wheat is beginning to mature. As maturity progresses over the next couple of weeks, it will be increasingly difficult to assess the incidence and severity of the infection. Understanding a field's risk will help growers either field blend or avoid highly infected areas so entire loads are not rejected.

2. DO NOT spray fungicide now. Research has demonstrated that the window of opportunity to manage FHB with fungicides is at the beginning of anthesis and only lasts about 7 days. Applications later than 7 days after the start of anthesis are not effective in controlling FHB. In addition, most fungicide labels do not allow a pre-harvest interval (PHI) suitable for a late application on wheat. Any application now would be off-label.

3. Adjust combine settings to blow out lighter seeds and chaff. Salgado et al. 2011 indicated that adjusting a combine's fan speed between 1,375 and 1,475 rpms and shutter opening to 90 mm (3.5 inches) resulted in the lowest discounts that would have been received at the elevator due to low test weight, % damaged kernels, and level of the mycotoxin deoxynivalenol (DON; vomitoxin) present in the harvested grain.

4. Know your elevators inspection and dockage procedure (each elevator can have a different procedure).

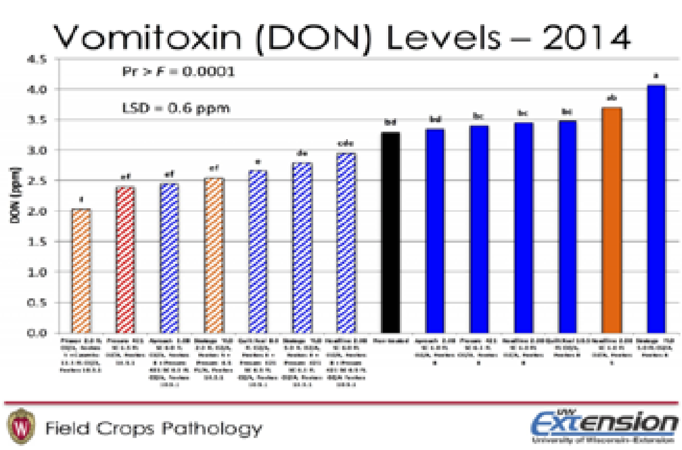


[Figure 2. Levels of Fusarium head blight (FHB) visually observed in a fungicide efficacy trial in Wisconsin.]

5. Scabby kernels does not necessarily mean high DON levels and vice versa. For example, in a 2014 fungicide evaluation very low visible levels of FHB were observed for all treatments (Fig. 2). However, when the finished grain was tested for DON, significant levels were identified for all treatments (Fig. 3). Be sure to test and know what levels of DON are in your grain even if you didn't see a high level of visible disease. Also, don't assume that because a fungicide was used, there will be no DON.

6. DON can be present in the straw so there is concern regarding feeding or using scab infected wheat straw. DO NOT use straw for bedding or feed from fields with high levels of scab (Cowger and Arellano, 2013). If in doubt, have the straw tested for DON levels.

7. Do not save seed from a scab-infected field. Fusarium graminearum can be transmitted via seed. Infected seeds will have decreased growth and tillering capacity as well as increased risk for winterkill.



8. Do not store grain from fields with high levels of scab. DON and other mycotoxins can continue to increase in stored grain.

[For more information on Fusarium head blight click here.]

References

Cowger, C., and Arellano, C. 2013. Fusarium graminearum infection and deoxynivalenol concentrations during development of wheat spikes. Phytopathology 103:460-471.

Salgado, J. D., Wallhead, M., Madden, L. V., and Paul, P. A. 2011. Grain harvesting strategies to minimize grain quality losses due to Fusarium head blight in wheat. Plant Dis. 95:1448-1457.

The Nebulous of Non-Nodulating Soybean in 2015 and Again in 2016

Shawn P. Conley; Soybean and Wheat Extension Specialist

Every year I get an occasional phone call, email or text regarding issues surrounding soybean nodulation concerns. This year it has been non-stop for several weeks! Here are the top four questions and my responses for your consideration.

- Why is nodulation such a problem this year? Abiotic stress such as low pH (≤ 6.0), saturated or droughty soils and cool soil temperatures can negatively impact nodulation (Valentine et al. 2011). Duzan et al. (2004) reported that root hair deformations (a physiological precursor to rhizobia infection and nodulation) was 64 and 82% of the control when rhizosphere (root zone) temperatures were 59 and 63 degree F when compared to 77 degrees F. This suggests that the cool soil temperatures we have been experiencing have likely limited the infection sites available for nodulation to occur. This effect has likely been exacerbated in no-till or compacted conditions in 2015 and 2016. In short less nodulation sites on the roots means increased likelihood for less nodules.

- I double inoculated my soybeans on virgin ground and my nodule count is really low? First, please refer to #1 above regarding abiotic stress on soybean nodulation. Secondly remember to read and follow the application, compatibility, and planting timing of inoculants. In reading through various inoculant labels today, I saw everything from 'not tested' to 'not compatible to plant within hours to weeks to months of application'. Lastly remember there is a poor correlation between nodule number and N2 fixation, so don't get overly concerned about nodule count; it is nodule efficiency that matters and you can't measure that by counting. In short, read the labels and make sure everything is compatible and your application and planting window is adequate prior to purchasing the product.

- How long will soybeans continue to put on new nodules? Dr. Purcell indicated that they can measure very active N2 fixation almost until the end of seedfill (personal communication). Given the normal life span of an active nodule is 4-5 weeks, this would suggest that soybean will continue to put on new nodules (if the environment is conducive and rhizobia are present) until R6 soybean (late pod fill).
- Should I apply nitrogen to these poorly nodulating soybeans, and if so, how much? My general answer is no and none. First of all, the application of nitrogen to soybean beyond a "starter" rate (≤~30 pounds) will lead to a rapid and dramatic inhibition of N fixation (Sinclair, 2004). Though it does not appear that the applied nitrogen is directly damaging to the N fixation machinery (nodules), it will reduce or stop fixation. If the soil NO3 levels drop, then N fixation can resume in about a week (Sinclair, 2004). Over-application of N will shut down whatever rhizobia is actively working. Furthermore, our 2014 and 2015 data shows that a soybean plant takes up 3.75 pounds of N in above-ground tissue per bushel of grain. So a 80 bu/a crop removed 302 pounds of N/a. This does not account for below-ground uptake or nitrogen loss and efficiency from the applied nitrogen. In short, that is tough math to get a positive ROI on.

Literature cited:
Dr. Larry Purcell (personal communication 7/16/15)

H. M. Duzan, X. Zhou, A. Souleimanov and D. L. Smith*. 2004.Perception of Bradyrhizobium japonicum Nod factor by soybean [Glycine max (L.) Merr.] root hairs under abiotic stress conditions. Journal of Experimental Botany, Vol. 55, No. 408, pp. 2641–2646, December 2004 doi:10.1093/jxb/erh26

Sinclair, 2004. Improved Carbon and Nitrogen Assimilation. "In: Soybeans: Improvement, Production, and Uses." Third Edition. Agronomy No.16. Edited by H.R. Boerma and J.E. Specht.

Valentine, A., V. Benidito, and Y Kang. 2011. Legume Nitrogen Fixation and Soil Abiotic Stress: From Physiological to Genomics and Beyond. Annual Plant Reviews. 42:207-248.

Research lacking to back claims for foliar-applied fertilizers

Nathan Slaton, Rick Norman, Trent Roberts, Jason Kelley, Jarrod Hardke, Bill Robertson, Jeremy Ross and Leo Espinoza; University of Arkansas System Division of Agriculture

Farmers must ask at least two fundamental questions about every product they are asked to purchase and apply to their crop: What is the frequency of crop response and what is the average yield increase? The answers to these two questions should be based on an adequate amount of unbiased, reputable research. With such a large number of crop yield enhancing products and nutrient solutions formulated for foliar application available there is no way that each product can be thoroughly researched by university scientists. For the record, let's establish that there is not a university scientist alive that does not want to discover or recommend farming practices and products that enhance grower yields and profits. If there is a foliar applied fertilizer or biostimulant that increases crop yield 10-20 percent for minimal cost, we want to be the ones doing the research and promoting it at professional educational meetings.

A lot of phone calls have been fielded in recent weeks regarding recommendations for and the agronomic value of foliar-applied nutrient solutions and tissue testing programs. These same questions have been around for the past 50 years, but the aggressiveness at which foliar feeding and the associated products are now promoted is unparalleled. The issue becomes even more complicated when you include "crop performance enhancing" chemicals, sometimes called biostimulants, which are often included in nutrient solutions. Both tissue testing and foliar feeding have a place in row crop agriculture in the mid-South but they must be adequately understood to ensure that they are properly implemented.

Research lacking

Recommendations are being made to farmers based on crop tissue analysis programs offered by several farm-service providers. Farmers and consultants have shared the results and recommendations of some tissue analysis programs and the tissue nutrient concentrations used to define what is deficient or sufficient typically approximates textbook values. We must all recognize that the textbook values that define sufficient and deficient nutrient concentrations are not always based on research. For many of the essential micronutrients and some macronutrients, the critical concentrations are simply based on a survey of tissue collected from a large number of fields at a specific crop growth stage that generated a bell-shaped – normal — distribution curve. The information from survey-based critical concentrations is agronomically interesting and useful, especially for troubleshooting field problems. However, for many nutrients, there is little or no published information showing a valid relationship between crop yield increase and tissue nutrient concentration that provides good reason for making widespread recommendations to apply a foliar- or soil-applied fertilizer that includes that nutrient. Research-based information is a challenge to find even for the few macro- and micro-nutrients for which nutrient deficiency occurs annually and is visually evident in commercial fields. The concentration of essential nutrients in crop tissues is likely related to crop performance, however, for many of these essential nutrients, we lack proven research that defines the exact minimum nutrient concentration below which yield is harmed and verifies that a beneficial yield response to foliar feeding occurs.

As a general rule, if land grant university recommendations do not include tissue monitoring thresholds and subsequent research-based relationships showing a yield benefit from soil or foliar fertilization then we would advise you to avoid the practice or approach it with a plan to test whether a crop response occurs (e.g., perform replicated strip trials on your own farm). Over the last few years, university research programs have examined various products marketed for foliar application to several crops and we have yet to find products that produce significant yield increases beyond what a solid fertilization and crop management program provide.

Misinformation and high-pressure sales

Most of the textbook critical nutrient concentrations are specific to a particular plant part and growth stage. Any deviation from that specific plant part and growth stage may cause the critical nutrient concentration to change. There is usually no single nutrient concentration that can be used for the duration of a growing season to define nutrient deficiency, especially during reproductive growth. For most well-fertilized and watered crops, biomass accumulation will be more rapid than nutrient uptake during much of the critical growth periods when yield potential is set and will cause plant tissue concentrations to decline continuously as the plant develops.

Many of the recommendations being made for foliar feeding simply have little defensible merit, which suggests there is a lot of misinformation being passed about or sales tactics involving ultra-high yield potential, fear of crop failure, or low cost per acre are being used to promote and sell products. A recent tissue analysis for corn recommended the grower apply 1-2 quarts per acre of two different products near the R1 growth stage that would have added the equivalent of 0.68 pounds K2O and 0.30 pounds Mg/acre, which represent less than 0.5 percent of the total aboveground K and Mg content required to produce the typical 220 bushels per acre corn crop. If K and Mg were indeed deficient, the amounts recommended are too small and maybe too late to benefit crop growth, development and yield in our opinion.

Micronutrients and yield

Foliar application of micronutrients is an accepted and more logical practice since much smaller amounts are needed to satisfy plant requirements — compared to macronutrients — but tissue testing and substantiating the need for foliar micronutrient application is not without challenges. With the exception of a few micronutrients that are frequently deficient in particular crops (e.g., zinc in corn and rice) and have established fertilization recommendations, the problem with tissue analysis and foliar feeding of micronutrients is twofold. First, deficiencies of many of the essential micronutrients are rarely observed and there is little or no published research verifying significant yield benefits resulting from soil or foliar application. Thus, it is virtually impossible to answer the questions of what is the frequency and magnitude of benefit from fertilization with such nutrients. Second, the textbook critical tissue concentrations for all micronutrients are not always correct and many are based on the normal distribution from a survey that was previously described.

In the early 2000s, when boron deficiency of soybean was recognized as a major limitation to soybean production in parts of eastern Arkansas, research showed no consistent and significant yield benefit by rice or wheat to soil or foliar boron fertilization in the same fields where soybean showed severe deficiency the previous year. The research did show that tissue concentrations of these crops tended to be near or below the textbook critical concentration suggesting that the textbook critical concentration is likely too high for the particular crop. The textbook critical leaf boron concentrations for rice have not changed but continue to be used to make foliar recommendations to growers. A number of the nutrient solutions marketed for foliar application contain extremely low amounts of a suite of micro and macronutrients and their application is supposed to provide some insurance that these nutrients will be plentiful enough to ensure no yield limitation.

Tissue testing is a great idea and when done properly the results can help identify potential problems that require additional research, or crop management adjustments and in some cases a research-based recommendation can be implemented to correct an existing nutrient deficiency. While we would encourage tissue analysis at the appropriate critical growth stage, mid- to late-season foliar-feeding based on tissue analysis results we believe are largely unwarranted. The reasoning for foliar application of many nutrient solutions and biostimulants is simply based on the low application volume and low cost per acre coupled with the product being piggy-backed on the field with another planned application of herbicide or fungicide (e.g., application is free).

At the end of the day, this is still a cost that slowly adds up across applications and acres and depletes funds that may be needed for fundamental components of crop management.

Plant analysis are you using it and interpreting the results correctly?

Carrie Laboski, Professor & Extension Soil Fertility/Nutrient Management Specialist

Over the last two weeks I have received several calls/emails regarding interpretation of plant analysis results. In all situations, the agronomist asked how it was possible for corn plant sample results to come back saying that many nutrients were deficient or would be responsive to added fertilizer. One specific example had optimum or better soil test levels and a spring application 14,000 gal/a of dairy manure. Kind of hard to believe that V5 corn would be limited by N, P, S, Ca, Zn, B, and Mn in this situation. Lab results had been interpreted using guidance developed by an ag inputs company. I evaluated the lab results using the UW plant analysis interpretation guidelines. The agronomist and I were not certain how tall the plant was when sampled or what plant part was sampled (a third party agronomist sampled the field). Nitrogen and P were borderline deficient assuming that the plant was 12" tall or smaller and the whole plant was sampled. If the plant was more than 12" tall and the youngest leaf with collar exposed was sampled, then all nutrients were sufficient. A very different interpretation using UW plant analysis guidelines. The agronomist collected another tissue sample when the crop was at V7 and sent it to a lab that uses UW plant analysis interpretation guidelines. The crop was sufficient or high for all nutrients. I plan to follow up on this field after harvest.

Because there have been so many questions recently about plant analysis, I think it's important to reiterate a few key points on the use the plant analysis. I will also

Table 1. Plant sample collection guidelines along with UW plant tissue sufficiency ranges for alfalfa and corn.

Crop	Alfalfa	Field corn	Field corn	Field corn
Growth Stage	Bud to 1st flower, prior to any cutting	12" tall or smaller	Pre-tassel	Tassel to silk
Plant Part to Sample	Top 6"	Whole plant	Leaf below whorl with collar exposed	Ear leaf
Number of plants to sample	35	20	15	15
	Nutrient Sufficiency Ranges			
N, %	2.5 - 4.0	3.5 - 5.0	3.0 - 3.5	2.5 - 3.33
P, %	0.25 - 0.45	0.30 - 0.50	0.25 - 0.45	0.25 - 0.34
K, %	2.25 - 3.50	2.5 - 4.0	2.0 - 2.5	1.75 - 2.63
Ca, %	0.7 - 2.5	0.30 - 0.70	0.25 - 0.50	0.30 - 0.55
Mg, %	0.25 - 0.70	0.15 - 0.45	0.13 - 0.30	0.16 - 0.34
S, %	0.25 - 0.50	0.15 - 0.50	0.15 - 0.50	0.16 - 0.25
Zn, ppm	20 - 60	20 - 60	15 - 60	19 - 34
B, ppm	25 - 60	5 - 25	4 - 25	6 - 13
Mn, ppm	20 - 100	20 - 300	15 - 300	19 - 68
Fe, ppm	30 - 250	50 - 250	10 - 200	21 - 170
Cu, ppm	3 - 30	5 - 20	3 - 15	3 - 7.5

Table 2. Plant sample collection guidelines along with UW plant tissue sufficiency ranges for soybean and wheat.

Crop	Soybean	Wheat	Wheat
Growth Stage	Prior to or at initial flowering	Tillering	Prior to heading
Plant Part to Sample	Newest fully developed leaf (trifoliate + petiole)	Newest fully developed leaf	Newest fully developed leaf
Number of plants to sample	25	50	50
	Nutrient Sufficiency Ranges		
N, %	4.2 - 5.4	1.75 - 3.0	2.5 - 3.5
P, %	0.3 - 0.70	0.20 - 0.50	0.20 - 0.50
K, %	2.15 - 3.25	1.5 - 3.0	1.5 - 2.5
Ca, %	0.80 - 1.3	0.20 - 0.50	0.20 - 0.50
Mg, %	0.23 - 0.55	0.15 - 0.50	0.16 - 0.30
S, %	0.38 - 0.50	0.15 - 0.40	0.2 - 0.40
Zn, ppm	25 - 88	15 - 70	20 - 70
B, ppm	27 - 224	3 - 20	2 - 25
Mn, ppm	54 - 300	25 - 100	25 - 100
Fe, ppm	50 - 300	25 - 100	20 - 250
Cu, ppm	6 - 15	5 - 25	5 - 20

provide the sufficiency ranges that UW uses to interpret tissue test results for corn, soybean, wheat and alfalfa. Before I get to that, I'd like direct your attention to a newsletter article published last week by soil fertility specialists at University of Arkansas. The article is titled "Research lacking to back claims for foliar-applied fertilizers". This is a well written article that is very applicable to Wisconsin. You can read the full text here: http://www.arkansas-crops.com/2016/06/23/research-applied-fertilizers/

Key points for plant analysis.

- Nutrient concentrations in the plant vary during the growing season and also vary among plant parts. Interpretations of nutrient sufficiency ranges were developed for specific growth stages and specific plant parts. Erroneous interpretations can be made by sampling the wrong part of the plant and/or sampling at the wrong growth stage. Based on questions I receive, plant samples are often collected improperly, especially for soybean.

- Plant nutrient uptake is influenced by location, hybrid/variety, soil test levels. Samples collected from several hybrids/varieties growing in the same field will have a range of nutrient concentrations in the plant. The same hybrid/variety grown on several fields with the same soil test levels will have different nutrient concentrations within the plant. The same is true if soil test levels varied among fields. Thus, nutrient concentrations just below the sufficiency range are not always limiting yield. The concentrations may just be part of natural variation.

- The sufficiency range is a range of nutrient concentrations that are considered adequate for high yields. Ideally, sufficiency ranges are developed through research that includes field trials where nutrients are or are not applied and yield is measured. Sufficiency ranges developed through surveying nutrient concentrations are limited because it is unknown if addition of nutrients would have resulted in greater tissue nutrient concentrations or yield.

- Sampling a field that looks good in an effort to find "hidden hunger" that is limiting yield is not suggested because of the points listed above.

- Plant analysis is best used when samples are collected from "good" and "bad" areas of the field along with soil samples collected from the same areas. The comparison of results along with field history information is very useful to understanding the problem in the field.

The correct plant part and growth stage at which to collect samples along with UW plant tissue sufficiency ranges for alfalfa, corn, soybean, and wheat, are provided in Tables 1 and 2. Please note that Wisconsin Department of Ag, Trade, and Consumer Protection certifies soil test labs, but they do not certify plant analysis labs. What this means is that each lab is free to interpret plant analysis results as they wish. The UW Soil and Forage Analysis Lab in Marshfield (715-387-2523, http://uwlab.soils.wisc.edu) interprets plant analysis results as described in Tables 1 and 2.

What is happening in the corn plant during the month of July?

Joe Lauer, Wisconsin Corn Agronomist

The corn plant during July transitions from developing vegetative structures to reproductive structures. It is significant for yield in that two of the three components of yield are set up during this month. In the first half of the month, the number of potential ovules that could develop into kernels is determined. In the second half, the number of potential cells in the kernel endosperm, which ultimately affects kernel weight, is determined. However, everything is predicated on the success of pollination and fertilization of the ovules on the topmost ear from pollen released by the tassel (see "Methods for determining corn pollination success").

During early July ear development is rapid and prior to tasseling (V18). The upper ear shoot is developing faster than other shoots on the stalk. Brace roots are now growing from nodes above the soil surface. They will scavenge the upper soil layers for water and nutrients during reproductive stages. Moisture deficiency will cause lag between pollen shed and beginning silk ("nick"). Usually the largest yield reductions will result from this stress. The plant is using 0.30 inches of water per day. Lodging will cause 12-31% yield reduction. Frost (<28 F) will cause 100% yield loss due to plant death (see "Frost"). Hail will cause 100% yield loss when completely defoliated (see "Hail damage on corn"). Drought will cause 4% yield loss per day due to drought or heat when leaf rolling occurs by mid-morning (see "Drought"). Flooding (<48 h) will not affect yield, however, other management options need to be considered (see "Flooding effects on corn").

At the silking (R1) stage the actual kernel number and potential kernel size is determined. R1 begins when any silks are visible outside the husks. Pollen shed begins and lasts 5-8 days per individual plant. Silk emergence takes 5 days. Silks elongate from base of ear to tip of ear. Silks elongate until pollinated. Silks outside husks turn brown. The plant has now reached its maximum height. First 7-10 days after fertilization cell division occurs within kernel after which kernels begin to fill with starch.

The plant must have a healthy root system because proper uptake of moisture and nutrients are critical at this time. Hot and dry weather results in poor pollination and seed set. Drought dehydrates silks (delaying silking) and hastens pollen shed causing plants to miss window nick for pollination. Drought decreases yield 7% per day (leaf rolling by mid-morning). Rootworm beetle clips silks which prevents pollination if less than a half-inch of silk is showing

Nitrogen applied through irrigation water, should be applied by V18. Rootworm beetle control should be implemented if 4-5 beetles are observed feeding near ear tip. Stresses that reduce pollination result in a "nubbin" (an ear with a barren tip).

Wisconsin Northern Corn Leaf Blight Update – June 29, 2016

Damon L. Smith, Extension Field Crops Pathologist,
University of Wisconsin-Madison

Since the first 2016 confirmation of northern corn leaf blight (NCLB) in Wisconsin on June 16, we have received additional corn samples from other areas of the state in my laboratory and also in the University of Wisconsin Plant Disease Diagnostic Clinic. All confirmations have been made in the laboratory, confirming the presence of the pathogen. Figure 1 shows counties, highlighted in red, where corn samples originated and were confirmed with NCLB.

While it is unusually early to find NCLB at this incidence level in Wisconsin, I continue to urge you to remain patient. All samples that we have examined have had low severity (very few and/or small lesions present on a single leaf). In addition, most of the damage has been

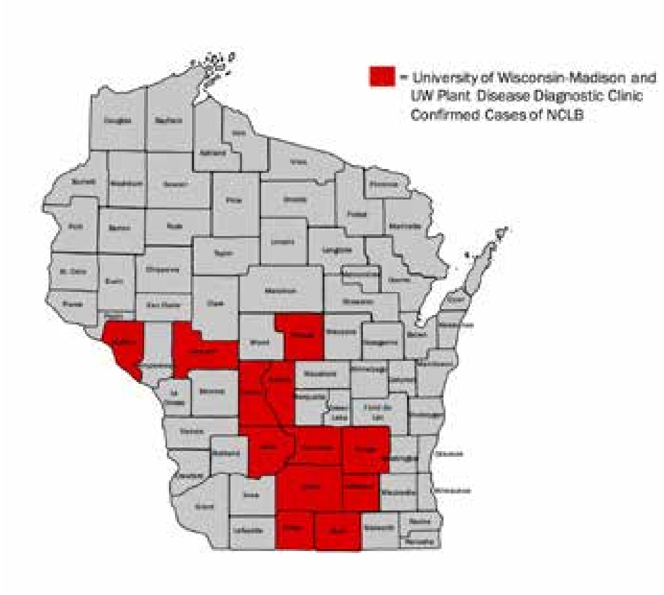


Figure 1. Wisconsin Counties Where NCLB has been confirmed as of June 19, 2016.

confirmed on lower leaves which do not contribute as much to yield as the ear leaves eventually will. As I mentioned in my previous post on June 16, Our economic analyses indicate that the likelihood of positive return on investment from a fungicide will be higher when the application is made as close to the tasseling period as possible. Considering that the weather this week is very dry and severity of NCLB has been relatively low, I would encourage growers to wait until closer to tasseling before making the decision to apply fungicide. If weather over the next week or two begins to turn continually wet, then this decision should be re-evaluated at that time. To learn more about NCLB and return on investment when using fungicide CLICK HERE. To watch a video about corn diseases in Wisconsin and fungicide use in corn, CLICK HERE. Remember to continue to SCOUT, SCOUT, SCOUT!

Irrigation / Evapotranspiration (ET) Software Tools Update

By John Panuska and Amanda Gevens

For growers using ET tools to schedule irrigation you have likely experienced issues with the ET data service. The reason for the service interruption is the unexpected failure of the system software following a campus power outage in mid-June. After several failed attempts to restart the 30+ year old system it appears to have found the end of its useful life. Luckily, anticipating this date was near, development work began on a new replacement system about a year ago and the good news is that the new service is now operational. So what was initially planned as a testing season has now become a replacement season for the new Ag. Weather Data Service.

In addition to the software failure, staff changes in the Department of Soil Science, where the system has been historically housed and maintained, have resulted in the loss of an in-house programmer to maintain the system. We have therefore been working with a private sector software developer to develop the new Ag. Weather System and will likely rely on this vender for future upgrades and maintenance. So to sum it up it's been a challenging year for ET tools at UW.

The user interface for the new Ag. Weather tool is identical to old system interface. The new system can accessed at: http://agweather.cals.wisc.edu/sun_water/. Select the Wisconsin and Minnesota link. To retrieve ET values, you simply enter the latitude and longitude for your pivot and date range for which you want ET data, press the Get Data Series button and the values will appear on the screen. We intend to continue working to restore more functionality to the site over the next several months and retire the old system this fall.

For those growers using the WISP irrigation scheduler you may interested to know that there is a new version of WISP (Version 2.0) being tested this summer with plans to upgrade the existing WISP 1.1.0 this winter. The look and feel of version 2.0 has not changed, however the multiple field grouping functionality has been restored and the authentication process has been simplified and no longer uses Google. You simply enter your email address and a password. The password is independent of the old version so you can reuse that password if wish. If you forget your password the system will email you a link to reset it and the WISP 2.0 also appears to be running faster than its predecessor. The software upgrade was also needed for better security. Look for the WISP 2.0 next spring.

UW-Madison/Extension Plant Disease Diagnostic Clinic (PDDC) Update

Brian Hudelson, Sean Toporek, and Ann Joy

The PDDC receives samples of many plant and soil samples from around the state. The following diseases/disorders have been identified at the PDDC from June 18, 2016 through June24, 2016.

Plant/Sample Type, Disease/Disorder, *Pathogen*, County

Field Crops
Corn, Northern Corn Leaf Blight, *Exserohilum turcicum*, Dane, Juneau, Jackson
Corn, Seedling Blight, *Pythium sp., Fusarium spp.*, Dodge, Iowa
Soybean, Root Rot, *Pythium sp.*, Walworth

Fruit Crops
Cherry, Cold Injury, None, Dane
Raspberry, Herbicide Damage, None, Dane
Raspberry, Root/Crown Rot, *Pythium sp., Rhizoctonia sp., Fusarium spp.,* Waushara
Strawberry, Common Leaf Spot, *Myscosphaerella fragariae,* Jackson

Vegetable Crops
Cucumber, Damping-Off, *Pythium sp., Fusarium sp.*, Waushara
Garlic, Stem and Bulb Nematode, *Ditylenchus dipsaci,* Dane
Pea, Ascochyta Blight, *Ascochyta sp., Richland*
Potato, Black Leg, Dickey sp., Portage
Potato, Early Blight, *Altemaria solani,* Columbia
Tomato, Bacterial Canker, *Clavibacter michiganensis subsp. michiganensis*, Outagamie, Winnebago
Tomato, Tomato Spotted Wild, *Tomato spotted wilt virus*, Dane

Soil
Alfalfa Soil, Aphanomyces Seedling Blight, *Aphanomyces euteiches race 1 and race 2,* Dane
Soybean Soil, Soybean Cyst Nematode, *Heterodera glycines*, Jefferson

For additional information on plant diseases and their control, visit the PDDC website at pddc.wisc.edu.

Wisconsin Fruit News: Volume 1 Issue 6– June 24, 2016

Janet van Zoeren, Christelle Guédot, and Amaya Atucha, University of Wisconsin – Madison, Departments of Entomology and Horticulture

The 6th issue of Wisconsin Fruit News is now available. You can read about:

- Plant Disease Diagnostic Clinic update
- Insect Diagnostic Lab update
- Spotted wing drosophila in Dane County
- Exclusion barriers for management of spotted wing drosophila
- Cranberry degree-day map and update
- Grape disease update
- Grape developmental stages
- Grape insects pest scouting report
- Tissue analysis of cold-hardy wine grapes
- Reduced risk insecticide: Exirel
- Going soft on apple diseases?
- Apple fertility considerations for orchards with variable crop loads
- Door County spotted wing drosophila update

Click here to view this newsletter.

Wisconsin Winter Wheat Disease Update – June 29

Damon L. Smith, Extension Field Crops Pathologist, University of Wisconsin-Madison

Brian D. Mueller, Graduate Research Assistant, University of Wisconsin-Madison

This will likely be the last winter wheat disease update for 2016, as the University of Wisconsin Field Crops Pathology team has nearly finished winter wheat disease ratings for 2016. In our travels this season we have determined that the major disease of concern was stripe rust. We were able to find stripe rust in every field we visited this season. In the variety trials throughout the state, stripe rust hit some varieties very hard, causing significant damage and early defoliation. Other varieties did fair well, so genetic resistance was obviously a big player for us this season. In production fields that did not receive an application of fungicide, stripe rust was often moderate to severe. Fields with resistant varieties and/or that received a well-timed fungicide had low levels of stripe rust and will yield well.

Unlike 2015, Fusarium head blight (FHB or scab) has been relatively minimal. In the southern and eastern wheat production areas of the state we could find some low levels of FHB, however, severity is fairly minimal. This is likely due to the fact that the weather was very hot and mostly dry during the anthesis period in this part of the state. Further to the north and closer to Lake Michigan, we have found higher levels of FHB. In a production field

Winter Wheat Grown in Wisconsin

near Marshfield, in central Wisconsin, FHB levels were significantly higher than observed in other parts of the state. Incidence was around 25-30% with severity averaging 15-20%. These higher levels of FHB likely resulted from more favorable weather for the FHB fungus during anthesis in this part of the state. For more information about how to handle FHB as we approach harvest CLICK HERE.

Septoria leaf blotch was present in low levels in some fields. However it won't be a substantial yield-reducer in 2016. Powdery mildew was nearly non-existent in the state for the fourth season straight.

2016 Wisconsin Cover Crop Conference

The 2016 Wisconsin Cover Crops Conference will be held Tuesday August 30 in the Lancaster area. The one-day conference, whose theme is "Coupling soil health and economics," will feature a bus tour highlighting the operations of several local cover crop users, both dairy/livestock and cash grain, as well as cover crop research

at the Lancaster Research Station. Special emphasis will be placed on using cover crops to improve the "bottom line." Continuing education credits for agricultural professionals will be available.

The conference is a joint effort of the Michael Fields Agricultural Institute, Wisconsin NRCS, UW-Extension and UW Agricultural Research Stations. Information for the full program and additional details will be published soon. For more information please contact Jim Stute, (262) 642-3303, jstute@michaelfields.org

Vegetable Crop Update June 24, 2016

15th issue of the Vegetable Crop Update is now available. In this newsletter we focus on:

- Potato disease forecasting (PDays for early blight/ DSVs for late blight)
- Late blight and cucurbit downy mildew national updates
- Accessing evapotranspiration (ET) values and other Ag Weather tools
- Goss's Wilt update for sweet (and field) corn

Click here to view this update.

2016 UW-Extension Summer Hop Field Day

The 2016 Summer Hop Field Day will be held Friday, July 8, 2016 in Rosholt, WI. Peggy and Randy Urness, Fine Bine Farms will host the meeting which will begin at 9:30 am. Fine Bine Farms is located at 6001 Ice Age Lane, Rosholt, WI.

This year's program will include:

- Dr. Amanda Gevens, UW-Extension Horticulture Plant Pathologist
- Dr. Jed Colquhoun, UW-Extension Horticulture Weed Specialist
- Michelle Marks, WI SARE R&E Hop Research Project
- Dr. Carrie Labowski, UW-Extension Fertilizer Specialist
- Tours of harvester and processing equipment
- Field tours of hop yard

Cost is $20 (cash or check) payable at the door. Please register by June 30th to ensure adequate copies of materials. carl.duley@ces.uwex.edu or call 608-685-6256

Click here to view the flier.

Organic Grain Field Day Series, Summer 2016

High demand for organic livestock feed and food-grade grain along with continued double-digit growth in the organic marketplace are creating opportunities for more farmers to grow organic—opportunities that are even more appealing in light of the current low prices for commodity grains. To help farmers learn about growing organic grain, the Organic Grain Resources and Information Network (OGRAIN) and the Midwest Organic and Sustainable Education Service (MOSES) are offering four field days this summer covering the tools, activities and inputs needed for successful organic grain production.

"Whether you're a conventional producer interested in exploring the transition to organic grain production, a livestock or produce farmer curious about adding grain to your system, or a new farmer wanting to start with organic grain, you'll find what you're looking for in these field days," says Anders Gurda, Associate Researcher in the Organic and Sustainable Cropping Systems lab at UW-Madison and program coordinator for OGRAIN.

Each field day will feature invited speakers including farmers, researchers, agency personnel and industry representatives. While some events will begin with more conventional presentations, all will incorporate engaging farm tours and plenty of unstructured time for discussion and networking.

The field days will collectively cover many agronomic aspects of organic food- and feed-grade corn, soybean, and small grain production. Depending on the field day, attendees will also learn about marketing opportunities, organic transition and certification, Whole Farm Revenue Protection crop insurance, and enterprise budgeting.

Significant barriers prevent many producers from making the leap to organic grain production. "Farmers are concerned about yields in organic systems, the organic transition process, and the skills and knowledge necessary for managing a successful organic grain operation," Harriet Behar, Organic Specialist with MOSES explains.

"Farmers can avoid the roller coaster of commodity prices from year to year by growing and selling organic grain, with the added bonus of producing the crops in an environmentally responsible manner. These field days will be time well-spent for all attendees," says Gurda.

Field days are available to anyone with an interest in learning more about organic grain production. However, the events emphasize the needs of beginning farmers who have been farming for fewer than 10 years.

The field day series is made possible by a grant from the USDA Beginning Farmer and Rancher Development Program. OGRAIN is a collaborative effort of the UW-Madison Center for Integrated

Agricultural Systems (CIAS), the Farm and Industry Short Course (FISC), the UW-Madison Organic and Sustainable Cropping Systems lab, and the Midwest Organic and Sustainable Education Service (MOSES).

OGRAIN/MOSES field day calendar:

- July 7, 2016 (10-3pm) – Organic Small Grains Production, Milling, and Marketing Dolan Farms, Dodgeville, WI and Lonesome Stone Milling, Lone Rock, WI
- July 28, 2016 (9-4pm) – Managing Risk in Organic Production; Goldmine Farms, Pana, IL
- August 11, 2016 (9-4pm) – An Organic Grain Toolbox: weed control, crop rotations, cover crops, soil health, human health, and enterprise budgeting; Cooksville Community Center/Doudlah Farms, Evansville, WI
- September 15, 2016 (1-4pm) – Managing Organic Crops on A Large Scale; Fairview Farm, Cottonwood, MN

For more information about the field days and to register, visit mosesorganic.org or call 715-778-5775. Some field days require pre-registration and/or a fee for a lunch.

For more information about OGRAIN and its programs, contact Anders Gurda, agurda@wisc.edu, 612-868-1208.

Click here to view the flier.

Follow us on