Vegetable Crop Update

A newsletter for commercial potato and vegetable growers prepared by the University of Wisconsin-Madison vegetable research and extension specialists

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Notes from the Nitrogen Summit: The unseen nitrogen– Matt Ruark, Assistant Professor & Extension Soil Scientist, UW-Madison, Dept. of Soil Science, 608-263-2889 (office), Email: mdruark@wisc.edu, Website: ruarklab.soils.wisc.edu

The most common problem for farmers and crop consultants when determining an optimal nitrogen (N) rate for corn is that they never truly know if and by how much they "over" applied their N fertilizer. Under-application of N is readily seen in corn plants through classic N deficiency symptoms of yellowing of the midrib on lower leaves, likely resulting in reduced yields (http://www.agronext.iastate.edu/soilfertility/photos/photossdef.html). There are a few metrics used to determine if N was over-applied, such as the corn stalk nitrate test (https://store.extension.iastate.edu/Product/pm1584-pdf) and end-of-season soil nitrate test. These tests require extensive sampling, only pertain to corn, and the relationship between stalk or soil nitrate values and crop yield are not well documented in Wisconsin. What I suggest here is the use of nitrogen use efficiency (NUE) calculations as simple metrics that can be used to understand how efficient you are (and can be) with N fertilizer.

The partial nutrient balance. One way that farmers and crop consultants can "see" the unused nitrogen is through nitrogen use efficiency calculations. There is no one specific calculation that is the true NUE, but instead the term NUE represents a suite of calculations that each have a specific meaning. The simplest calculation is the **partial nutrient balance (PNB)**, which is the amount of N removed in the grain divided by the N applied (http://go.wisc.edu/1467hc). A PNB of 1 (or slightly less) is considered ideal (i.e. system sustainability). If the value is much less than one, then this indicates there are opportunities for improvement. The PNB is a calculation that can be done by all growers on a field-by-field basis as long as they know their yield and the amount of N applied. Based on average N concentrations from corn samples analyzed at the University of Wisconsin Soil and Plant Analysis Laboratory, 0.70 lb-N is removed with 1 bu of corn grain (at 15.5% moisture). Therefore, multiplying 0.70 by the yield (bu/ac) gives an estimate of the amount of N removed. This calculation can also be used to "see" a simple N budget for the field (N input vs. N output) by subtracting the N removal from the N applied; if it is negative, more N was removed than what was applied. If it is positive, this is the amount of N remaining in the soil system. However, a lot of this N can still be tied up in the crop residue and

for many systems there is a limit on how close we can get this value to 1. More accurate PNB values can be determined if the actual N concentration of the grain is known.

The value of the zero-N check strip. To get a sense of how much N is available from the soil, we can use the amount of N taken up by the corn plant (ears, stalks, and leaves – the entire above ground biomass) when no fertilizer is applied. This will involve cutting a whole plant at ground level, drying, and analyzing for total N; this is obviously not a standard sample practice. This value (total N uptake in unfertilized corn) can then be subtracted from the N in the above ground biomass from fertilized corn and then divided by the amount of N applied to give us the **apparent crop recovery efficiency (RE)**. It is called the "apparent" crop recovery efficiency because we aren't using the N taken up in root biomass and we are making assumptions about the fate of the applied N. In this case a value of 1 would indicate that the increase in N uptake from unfertilized to fertilized was the same as the amount of N applied (this is an unrealistic system). Snyder and Bruulsema (2007) provide some context, stating that values of 0.5 to 0.8 represent corn systems under best management practices. So, the value of the zero-N check strip allows you to know how much of your N was "needed" by the crop. This is in contrast to the partial nutrient balance calculation, which doesn't indicate anything about crop need of the fertilizer, only the N balance of your soil and cropping system.

Recovery efficiency verifies the need of the fertilizer. Different soils will supply different amounts of N. For example, in an N rate trial conducted in 2011, corn fertilized **with 150 lb/ac of N** at the **Lancaster Agricultural Experiment Station had a RE of 63%** while corn grown at the **Arlington Agricultural Experiment Station had a RE of 28%**. This indicates that we would want to think about altering our N rates at Arlington because less than 30% of the N that was applied was taken up. At Lancaster, we may not be able to improve much as nearly 70% of the N applied as take up by the plant.

Another useful comparison is between the RE and the PNB. A stark contrast between these two calculations can be seen with **irrigated sweet corn in the central sands** in 2011. Yields without N were incredibly low, leading to **RE of 88%,** while the **PNB was only 43%** (150 lb/ac of N was used in this example). The 43% PNB is quite low, indicating a lot more N is applied to the system than is removed. However, a large percentage of the N applied ended up being taken up by the crop. Thus, for sweet corn on sandy soil, the PNB alone doesn't tell the whole story regarding efficiency and fate of the N applied.

Overall, you'll notice that I've used a lot of terms like "estimate" and "apparent" throughout the past few paragraphs. These calculations are not meant to be the last word on how efficient you are with your N fertilizer, but simply provide a tool for farmers and crop consultants to assess the current state of their N management. These measures need to be conducted across many growing seasons to get a range of efficiency values across different rainfall patterns. But, if we can make the "unseen" nitrogen "seen", this will give both farmers and consultants more confidence with continuing their current N management plan or identify fields on which improvement strategies are warranted.

For more information on nitrogen use efficiency calculations see http://go.wisc.edu/1467hc. For more general information on nitrogen in soil check out Soil and Applied Nitrogen (http://www.soils.wisc.edu/extension/pubs/A2519.pdf).

Vegetable Disease Update – Amanda J. Gevens, Assistant Professor & Extension Vegetable Plant Pathologist, UW-Madison, Dept. of Plant Pathology, 608-890-3072 (office), Email: gevens@wisc.edu.

Vegetable Pathology Webpage: http://www.plantpath.wisc.edu/wivegdis/

Early season disease considerations in vegetables: Often the earliest disease concerns in vegetable crops include damping-off and/or poor stand or emergence. Early season damping-off and seedling failures are often caused by one or more soilborne pathogens that are promoted by cool, moist soils. Slow or delayed growth of early planted seeds or transplants contributes to damping-off and seedling failures. Fungi and fungus-like pathogens that may be involved in disease include Pythium species (fungus-like 'water mold'), Rhizoctonia (fungus), and Fusarium (fungus). Each of these pathogens can overwinter in the soil or in infected plant debris and are typically 'weaker' pathogens that require a stressed plant to thrive. This group of pathogens can continue to be problematic even as plants mature; typical symptoms are root and crown rots.

Symptoms of damping off include soft, brown roots, collapse of lower stem or stem below soil line, and eventually plant wilting and death. The seeds themselves can be infected as soon as moisture enters the seed coat or as radicle emerges, resulting in pre-emergence damping-off which may be mistaken as poor germination or seed viability. Damping-off can be mistaken for plant injury caused by insect feeding, over-fertilization, high levels of soluble salts, extreme temperatures, excessive or insufficient soil moisture, or chemical toxicity in air or soil.

Management of damping-off requires several approaches including: 1) purchase of disease free plants and seeds, 2) fungicide seed treatments, 3) plant into well-drained soil, 4) avoid setting transplants too deeply in the soil (avoid crowns below soil line), 5) avoid overcrowding plants to promote good airflow, 6) practice good crop rotation (rotate by plant families on a 2-3 year schedule), and 7) fungicides at-plant or in banded application. Be sure your transplants receive appropriate fertilizer at time of transplant, and it is often a good practice to allow time for plants to 'harden off' under outside field conditions prior to transplanting. This can be achieved by moving transplant flats outside of the production greenhouse to an area that may be sheltered from direct wind, but provides temperature conditions similar to the open-field setting. Once soil temperatures warm up above approximately 50ºF, incidence of pre- and post-emergence damping off is drastically reduced.

Snap beans showing damping off symptoms due to presence of Pythium, Rhizoctonia, and Fusarium at roots. Note variability in symptom expression. Photo taken at Hancock Ag Research Station in 2011 (Gevens disease evaluation plot).

Wisconsin fungicide information can be found in the University of Wisconsin Extension Publication entitled "Commercial Vegetable Production in Wisconsin," publication number A3422 (http://learningstore.uwex.edu/assets/pdfs/A3422.PDF) and additional information is

provided in weekly newsletters during the growing season (provided at the vegetable pathology website: http://www.plantpath.wisc.edu/wivegdis/).

Disease Forecasting: *What are DSVs and P-days?:* As we are gearing up for field season and generation of disease forecasting information, and have added new newsletters subscribers, it is necessary to provide some explanation of the late blight and early blight disease forecasting concepts. Locations of in-field weather stations/disease forecasts will include: Antigo, Plover, Hancock, and Grand Marsh. Blitecast (late blight forecasting): Computation of 18 disease severity values (DSVs) relies on maximum and minimum temperatures each day, the duration of relative humidity periods above 90% and the maximum/minimum temperatures during the relative humidity periods above 90%.   For a given day, up to 4 DSVs can accumulate. We start the severity value calculations at approximately 50% crop emergence. When we reach a total of 18 severity values, we issue a warning which indicates that environmental conditions have been met which favor late blight. At 18 DSVs, the recommendation for preventive applications of effective late blight fungicides is made. An additional alert is issued when the first symptoms of late blight appear anywhere in the state. The determination of late blight management recommendations is made by taking into consideration DSVs, projected weather forecast, and presence/risk of inoculum. This information is published in our newsletter and will be disseminated in various other outlets as the season progresses.

Last year, we began offering an additional late blight forecasting tool which applies the same Blitecast concepts (described above) to forecasted weather. This information will be offered with fluid updates at the UW-Vegetable Pathology website in 2014 – and in static form in the once-a-week issue of the UW-Vegetable Crop Updates newsletter. This tool utilizes weather data from a state-wide (and national) network of information, rather than from in-field weather stations. Maps generated from this forecasting approach can be very useful in quickly identifying regional patterns of increasing disease risk – and can aid in planning of preventative fungicide applications should forecasted weather turn inclement.

Cornell University has been developing an enhanced late blight forecasting tool that also offers a Blitecast for forecasted weather. Dr. Bill Fry and his research group have been integrating additional parameters in the forecasting tool which modify the spray recommendation based on varietal resistance and previous fungicide applications (and likely residues). Here in WI, we are working with this tool for potato late blight management in comparison to our in-field forecasting and current management approaches. For more information on Cornell's Late Blight Decision Support System (DSS) tool, please refer to link below.
http://newa.cornell.edu/index.php?page=potato-late-blight-dss

Growers have been very careful to plant disease-free seed, to destroy cull potatoes prior to new crop emergence, and to control volunteers. Other potential sources of late blight in WI come from overwintered infected tomato plants, nightshade weeds, and the introduction of infected transplants. No reports of late blight infected seed potatoes or tomato transplants have emerged from WI at the time of this report.

To aid in the reporting of late blight in the U.S., a reporting platform (website) and working group has been established through a federally-funded coordinated agricultural project led by Dr. Howard Judelson at the University of California-Riverside. The website:

http://www.usablight.org/ indicates location of positive reports of late blight in the U.S. and provides further information on disease characteristics and management. My UW-Plant Pathology program is collaborating on this project along with 15 other institutions. At this time, potato and tomato late blight has been reported in several Florida counties. In all cases, the genotype of the late blight pathogen has been US-23 – the type that predominated most of the US and WI diseases cases in 2013.

The Potato P-Day accumulator is based on potato physiological development ('Russet Burbank') and accumulated weather conditions to generate early blight recommendations. Once we reach 300 P-Days, calculated from emergence onward, our spray recommendations take both the P-Day and severity value totals into account to generate 5 day, 7 day or 10 day spray interval recommendations. The interval is variable depending on prevailing weather conditions and the presence of disease in the area. Typically, P-Day 300 is reached in early July and when potato rows are just beginning to touch (row closure).

We will being posting our disease forecasts once our production season gets underway.