Wisconsin Crop Manager

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Vegetable Crop Update 6/22/13

The 9th issue of the Vegetable Crop Update is now available. This issue contains information on Disease Severity Values and PDays for Early Blight Management. Click here to view this update.

2013 Agronomy/Soils Field Day at Arlington on August, 28

The Departments of Agronomy and Soil Science in conjunction with the Arlington Agricultural Research Station will host their annual field day on August 28, 2013. The field day will highlight UW-Madison research with a theme of "Risk Mitigation in Today's Economic Climate". The field day will begin at 8:00 am and run until 2:30 pm. Lunch will be available for $5.

Field Crop Tour (offered two times in morning only)

1. Advancements in 80+ years of soybean genetics lessens penalty of low seeding rates and raises questions about weed suppression through canopy development (Vince Davis)
2. Can yield maps predict future yields? (Joe Lauer)
3. Soybean Potpourri: Diversity and Management of *Fusarium spp*. in WI Cropping Systems and R.O.I. for Soybean Seed Treatments (Shawn Conley, David Marburger, and Adam Gaspar)

Forage Crop Tour (offered two times in morning only)

1. Planting alfalfa with corn silage, can we get a viable alfalfa stand? (Mark Renz)
2. Weed management while establishing switchgrass (Ariel Larson, Mark Renz)
3. Oats as an emergency forage (Ken Albrecht)

Soils Tour (offered once in morning and once in afternoon)

1. Efficacy of aglime and pell lime in notill and chisel systems (Carrie Laboski)
2. Grassed waterways and other conservation practices: when, where, and why (Francisco Arriaga)
3. Performance of legume, grass, and brassica cover crops (Matt Ruark)

Luncheon Presentation

Paul Mitchell from the Department of Ag and Applied Economics will present "A first look at the Farm Bill".

Please note that the Field Crop Tour and Forage Crop Tour will only be offered in the morning. If you plan to attend all three tours, please attend the Field Crop Tour and Forage Crop Tour in the morning and the Soils Tour in the afternoon.

Potential for Nitrogen Loss Following Heavy Rainfalls

Carrie Laboski, Soil Fertility/Nutrient Management Extension Specialist

Rainfall totals over the past week (June 19 to 26) in the southern half of Wisconsin range from 1 to 15 plus inches. Many soils are saturated and some fields have had or still have standing water in all or part of the field. The million-dollar question is: How much nitrogen (N) loss should I expect from denitrification or leaching and what should I do about it? To answer this question, we'll consider each situation independently.

Denitrification

Denitrification is the process whereby nitrate is converted to the gases dinitrogen or nitrous oxide and subsequently released to the atmosphere. This conversion is carried out by soil bacteria. Denitrification can be a significant mechanism for N loss on medium- and fine-textured soil. It is generally not an issue on coarse-textured soils because they do not remain saturated for any length of time. There are several environmental factors that determine if denitrification occurs and to what extent.

1. *Nitrate.* Nitrate must be present for denitrification to occur.
2. *Soil water content and aeration.* Denitrification occurs in wet soils with low oxygen concentrations. Denitrification increase with the length of time the soil is saturated. Standing water may result in a greater percentage of nitrate being denitrified.
3. *Temperature.* Denitrification proceeds faster on warmer soils, particularly when soil temperature is greater than 75°F.
4. *Organic matter.* Denitrification occurs because soil bacteria are breaking down organic matter under low oxygen conditions and the bacteria use nitrate in a biochemical process. Nitrate that resides deeper in the soil profile (eg. below 12 inches) where there is less organic matter will have a greatly reduced or minimal probability of being denitrified.
5. *Soil pH.* Denitrification is negligible in soils with a pH < 5.0. Thus, pH likely doesn't limit denitrification on most of our cropland in Wisconsin.

Table 1 shows the combined effect of soil temperature and days of saturated soil on N loss. Current soil temperatures vary throughout the state, but have been in the 60 to 72°F range at many locations over the last week. Thus, there is the possibility for significant N loss if soils remain saturated for more than three days and soil temperatures stay warm.

Table 1. Estimated N losses from denitrification as influenced by soil temperature and number of days the soil is saturated. (From Shapiro, University of Nebraska)

Soil temperature (°F)	Days saturated	N loss (% of applied)
55 to 60	5	10
	10	25
75 to 80	3	60
	5	75
	7	85
	9	95

It is important to keep in mind that nitrate must be present for denitrification to occur. So N losses will depend on the form of N that was applied and the time between application and saturated soil conditions. Table 2 provides estimates of the time it takes for various N fertilizer materials to transform to nitrate. Conversion of ammonium based fertilizers to nitrate takes 1 to 2 weeks. Urea must first be hydrolyzed to ammonium before it is converted to nitrate. If a urease inhibitor was used with urea, then the length of time that it takes for urea to convert to ammonium may be extended 10 to 14 days depending upon the rate of inhibitor used. Injection of anhydrous ammonia increases the soil pH for several weeks, which in turn limits the amount of ammonium that is converted to nitrate. If a nitrification inhibitor was used, it will also extend the time it takes for ammonium to convert to nitrate, perhaps by as long as 30 days.Table 2. Approximate time until fertilizer N is in the nitrate form.

Fertilizer material	Approximate time until ammonium	Approximate time until nitrate
Ammonium sulfate, 10-34-0, MAP, DAP	0 weeks	1 to 2 weeks
Anhydrous ammonia		3 to 8 weeks
Urea	2 to 4 days	1.25 to 2.5 weeks
Ammonium nitrate	25% is ammonium, 0 weeks	50% in 1 to 2 weeks 50% is nitrate, 0 weeks
UAN	50% from urea in 2 to 4 days 25% is ammonium, 0 weeks	50% in 1.25 to 2.5 weeks 25% in 1 to 2 weeks 25% is nitrate, 0 weeks

Here's an example of how to estimate the amount of nitrate that might have been lost. If 120 lb N/a as UAN was applied after planting corn and four days before saturated soil conditions existed and the soil remained saturated for five days, you might expect 20-25 lb N/a to have been denitrified. 120 lb N/a x 25% = 30 lb N/a in the nitrate form, assuming minimal conversion of ammonium and urea to nitrate (Table 2). 30 lb N/a as nitrate x 75% of nitrate denitrified over 5 days = 22.5 lb N/a lost. Please note that these are estimates of N loss, and should not be considered exact.

Another method that could be used to assess the N status of your fields is to use the pre-sidedress nitrate test (PSNT). If the concentration of N in this one-foot soil sample is greater than 21 ppm, then there should be adequate N for the crop. There are a couple caveats when using the PSNT in this manner. First, it will work best if N was broadcast rather than band applied. Soil samples collected from fields where N was banded, may not accurately represent the N status of the field. Second, even in medium- and fine-textured soil, nitrate may have moved into the second foot of soil. In this case, the PSNT won't measure all of the N that is in the root zone and available for the crop.

If all or most of your N for corn is coming from an organic N source (manure and/or forage legume), then the PSNT can still be used to estimate N credits that are subtracted from your selected maximum return to N (MRTN) N rate. Note: when average May-June soil temperatures are more than 1°F below the long-term average, the N credit is often underestimated. The PSNT is not recommended on coarse-textured soils or where corn follows soybean. For more details on how to use the PSNT see UWEX Publication A2809 *Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin*.

Remember that the PSNT measures the amount of N in the nitrate form only; ammonium is not measured by the PSNT. If a nitrification inhibitor was used when N was applied, it is possible that N will still be in the ammonium form and thus available to the crop. Testing for ammonium in a PSNT sample could be useful to determine the N credit if a nitrification inhibitor was used. The total concentration of nitrate plus ammonium (in ppm), can be compared to the PSNT N credit table on page 48 of UWEX Publication A2809 *Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin*. Most soil testing laboratories will measure ammonium as well as nitrate in a PSNT sample if requested.

If all of the N was applied prior to the heavy rainfall, try to determine how much N loss may have occurred using one or a combination of the methods just described. The next step is to decide whether or not you need or want to apply supplemental N fertilizer to your corn crop. When making this decision, compare the amount of N loss (in lb N/a) that you think may have occurred to the MRTN rate and profitable range of N rates for your N:corn price ratio. For example let's say that corn follows soybean on a high yield potential soil and you applied 130 lb N/a preplant and now estimate that you lost 25 lb N/a. If your N:corn price ratio is 0.10, then the profitable range of N rates is 105 to 130 lb N/a. Thus, even with some N loss, you might still be within the profitable range of N rates. For more information on the MRTN, see UWEX Publication A2809 *Nutrient application guidelines for field, vegetable, and fruit crops in Wisconsin*.

Remember the greatest yield increase comes from the first 50 lb N/a applied to the crop. If you are uncertain how much N may have been lost and the corn is clearly deficient in N, then application of 50 lb N/a should result in profitable yield increases. If you estimate that 100 lb N/a or more may have been lost then apply supplemental N at a rate equal to about 50% of the amount of N lost.

Where the entire crop N requirement has not yet been applied and where N loss is suspected, sidedress or other postemergence applications should contain the balance of the crop N requirement plus 25 to 50% of the amount of fertilizer N that was already applied.

Options for applying supplemental N when it is needed include traditional sidedressing with anhydrous ammonia or N solutions. UAN solutions can also be applied as a surface band or as a broadcast spray over the growing crop. Dry N fertilizers (urea, ammonium sulfate, or ammonium nitrate) can also be broadcast applied to the crop. Leaf burning from solution or dry broadcast applications should be expected. Appling the dry materials when foliage is dry will help minimize burning. Broadcast N rates should be limited to 90 lb N/a for corn with 4 to 5 leaves and to 60 lb N/a for corn at the 8-leaf stage. Under N deficient conditions, corn will respond to supplemental N applications through the tassel stage of development if the N can be applied. Approximately ¼ inch of rain is needed within 2 days to minimize ammonia volatilization from surface applied urea containing fertilizers. If this rainfall is uncertain, a urease inhibitor can be applied with the urea containing fertilizer to minimize volatilization losses by extending the time before rainfall to 7 to 10 days.

Leaching

Nitrate is the form of N that can be leached when precipitation (or irrigation) exceeds the soil's ability to hold water in the crop root zone. Leaching is a much bigger issue on sandy soils that typically hold 1 inch of water per foot of soil compared to medium- and fine-textured soils that hold 2.5 to 3 inches of water per foot of soil. Rainfall totals over the past week may have caused nitrate leaching out of the root zone for corn (~36 inch root zone) grown on sandy soils. To determine if nitrate could leach out of the root zone, compare the rainfall totals in your area to the number of inches of water that your soil can hold in the crop root zone.

The amount of N loss from leaching is dependent not only on rainfall, but also on the amount of N in the nitrate form. Using the information in Table 2, it is possible to estimate how much nitrate may have been leached. Urea is highly water-soluble. If the leaching rainfall occurred before urea had time to hydrolyze (2 to 4 days), then urea may have leached. However, if there were more than 4 days between urea application and the leaching rainfall, then it is likely that all of the N would have converted to ammonium and remains within the root zone.

Nitrogen best management practices for corn on sandy soils is to sidedress or split apply N. If sidedress N applications have not yet occurred, then growers should proceed as planned. If split N applications have occurred, supplemental N should be applied and should equal the approximate amount of nitrate that may have leached out of the root zone. Corn grown on irrigated sandy soils are highly responsive to N fertilization. On non-irrigated sandy soils, water (usually too little) limits crop yield more than N. Under N deficient conditions, corn will respond to supplemental N applications through the tassel stage of development if the N can be applied.

For irrigated fields, N solutions can be injected into the irrigation water (fertigation). Water application rates should not exceed the infiltration rate of the soil and should not exceed the soil's ability to hold the water in the root zone of the crop. Thus, if the soil profile is full of water, you may need to wait a few days before fertigating. The key is to manage the water so that the N fertilizer that is being applied is not leached.

Summary

In the southern half of Wisconsin, some N losses may be expected on fields were N has already been applied. The amount of N loss will vary with soil texture, amount of rainfall, form of N applied, use of nitrification and urease inhibitors, and time elapsed between N application and rainfall. Therefore, each field may need to be assessed independently to estimate N loss and determine a course of action.

Corn and Soybean Herbicide Use Survey Participation

Vince M. Davis, Extension Weed Scientist and Ross Recker, Graduate Research Assistant

The potential increase of glyphosate-resistant weeds is a major threat to corn and soybean production across the Nation. Integrated Weed Management tactics, including diversified herbicide use, are important components of management to delay the onset of glyphosate resistance. Identifying geographies that may be most vulnerable to resistance development could help direct attention and pro-active resistance management tactics before wide-scale control failures occur. To help with this, the University of Wisconsin-Madison Field Crops Weed Science Extension program is asking for your participation in a research study investigating the weed species diversity in Wisconsin Corn and Soybean fields due to reduced atrazine use and subsequent increased use of glyphosate.

The purpose of this research is to identify areas in the state where there may be a shift to weeds that are more difficult to control with glyphosate, or where weeds that are resistant to glyphosate may first appear. This survey asks questions about target weed species and limited management history information relating to crop production fields.

There are two levels of participation in this survey. The first level simply includes filling out an on-line survey with information from ONLY ONE CROP PRODUCTION FIELD per survey form. If you are willing to provide information about more than one field, please repeat the survey.

The second level of participation, if you would please participate further, is to allow weed science research staff from the University of Wisconsin-Madison to survey your crop fields for weed escapes in late-summer months. We expect the survey to take only 5 to 10 minutes of your time, and we don't anticipate any risks to you. For fields we scout for weed escapes in the late summer, we will provide a detailed weed scouting report to participants.

You may ask questions about the research at any time by contacting Vince M. Davis at vmdavis@wisc.edu (608) 262-1392 or Ross Recker at rrecker@wisc.edu. Your participation is completely voluntary. By completing and electronically submitting this survey, you consent for participating in the first stage of the survey.

If you would like to participate in the second stage, and allow a UW weed science researcher to scout your production fields, please complete the last question of the survey by providing your contact information.

To complete the survey, please visit: https://uwmadison.qualtrics.com/SE/?SID=SV_9tSfCJeFUmT7est.

A Horseweed Population in Wisconsin is Confirmed Resistant to Glyphosate

Ross Recker (Graduate Research Assistant), Dave Stoltenberg (Professor), Vince Davis (Assistant Professor) Department of Agronomy, UW-Madison

Horseweed (*Conyza canadensis* L.), also known as marestail, is a broadleaf weed species native to North America. Increased adoption of no-till cropping systems in past decades has allowed horseweed to become a major weed problem in agricultural fields. Horseweed typically follows a winter annual life cycle, but it also has the ability to germinate and emerge in the spring competing with crops just like other summer annual weeds. The seed of horseweed is very small with a pappus which creates the ability for seed to move long distances by wind and infest new locations. Therefore, the threat of this weed spreading herbicide-resistant biotypes to new locations through naturally occurring seed movement is high.

In 2000, a biotype of horseweed in the state of Delaware became the first confirmed glyphosate-resistant broadleaf weed in the United States. Since then, glyphosate-resistant horseweed has been confirmed in 21 other states including the nearby states of Illinois, Indiana, Iowa, and Michigan. There are currently 24 different glyphosate-resistant weed species worldwide, 14 of which are in the United States. In 2012, a population of giant ragweed (*Ambrosia trifida* L.), collected from Rock county in 2010, was the first confirmed case of glyphosate resistance documented in Wisconsin. Our research has now confirmed that a horseweed population collected in Jefferson County, Wisconsin in the fall of 2012 is resistant to glyphosate.

This horseweed population was identified through the *Late-Season Weed Escape Survey in Wisconsin Corn and Soybean Fields*, which is primarily funded by the Wisconsin Corn Promotion Board. In this particular no-till soybean field where the population was found, two small patches of horseweed plants showed common phenotypic response symptoms often noticeable on glyphosate-resistant horseweed plants following exposure to glyphosate. That typical symptomology was a stacking of leaf nodes and a proliferation of branching from main stem axillary buds. Field records, as well as communication with the grower indicated these plants likely survived a postemergence application of glyphosate. To further confirm resistance, however, seeds from 35 mature plants were collected in late-August the progeny plants were subjected to further greenhouse confirmation experiments (Figure 1).

Figure 1. Horseweed plants late in the 2012 growing season that were not controlled with a previous postemergence glyphosate application in a no-till soybean field in Jefferson County, Wisconsin.

An initial glyphosate screening experiment and two glyphosate dose response experiments were conducted in the greenhouse at UW-Madison to compare the effective dose needed to reduce plant shoot biomass by 50% (ED_{50})between the collected Jefferson County population and a suspected susceptible population (Figure 2). The ED_{50} of glyphosate was estimated to be 1.59 kg ae ha^{-1} (40 fl oz ac^{-1}) and 0.28 kg ae ha^{-1} (7 fl oz ac^{-1}) for the Jefferson County and susceptible population, respectively (Figure 3). Therefore, the glyphosate-resistant plants from Jefferson County were nearly six-fold resistant compared to susceptible plants.

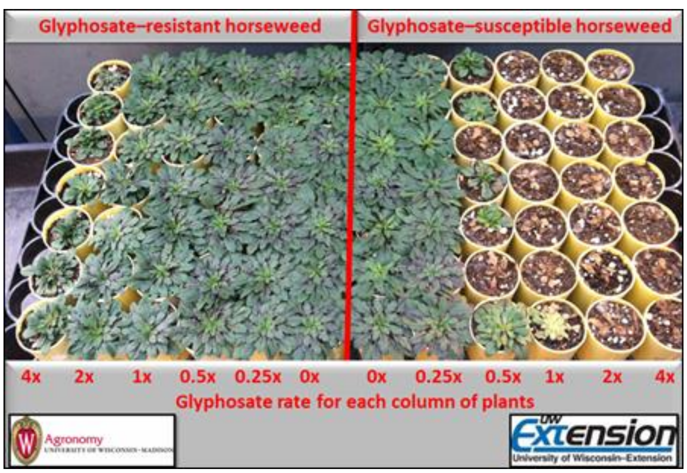

Figure 2. Horseweed plants (glyphosate-resistant) grown from the seed collected in Jefferson County, Wisconsin compared to a glyphosate-susceptible population and their response to postemergence at glyphosate in the greenhouse at rates ranging from 0x to 4x with 1x being 0.87 kg ae ha-1 (22 fl oz product ac-1). Plants were sprayed when horseweed rosettes measured 2.5 to 5 cm (1 to 2 inches) in diameter.

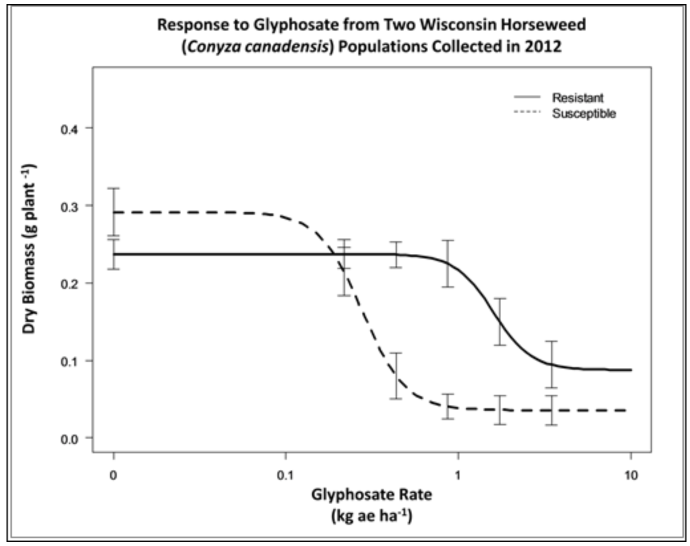

Figure 3. Shoot dry biomass of Jefferson County horseweed and susceptible horseweed following treatment with glyphosate at doses up to 3.48 kg ae ha-1 as estimated by a four-parameter log-logistic regression function.

The mechanism of glyphosate resistance demonstrated by previously discovered glyphosate-resistant horseweed has been attributed to rapid accumulation of glyphosate in the cell vacuole. Future research will be conducted to determine if this horseweed population from Jefferson County displays multiple herbicide resistances to both EPSPS (glyphosate) and ALS site-of-action herbicides.

The Weed Science Society of America has published a list of best management practices to reduce the risks of herbicide resistance in weeds which can be read at: http://www.wssajournals.org/doi/pdf/10.1614/WS-D-11-00155.1. The goal of these best management practices is to lessen the evolution of herbicide resistance by reducing selection pressure. This is done through diversification of weed control techniques, minimizing the spread of resistance genes and genotypes, and preventing additions of weed seed to the soil seedbank. One of the best management practices is to understand the biology of the weeds present. A great resource for more information about horseweed biology and control can be found as part of The Glyphosate, Weeds, and Crops Series at: http://www.extension.purdue.edu/extmedia/gwc/gwc-9-w.pdf

The survey which identified this glyphosate-resistant horseweed population will be conducted again in 2013. If you are interested in participating in this survey, please see the survey announcement here: http://ipcm.wisc.edu/blog/2013/06/corn-and-soybean-herbicide-use-survey-participation/. Moreover, if you have horseweed, or other weeds that survive postemergence applications and you have concern about glyphosate resistance, contact your local county Ag Extension Agent which can help you further evaluate the situation.

Wisconsin Pest Bulletin 6/27/13

A new issue of the Wisconsin Pest Bulletin from the Wisconsin Department of Agriculture, Trade and Consumer Protection is now available. The Wisconsin Pest Bulletin provides up-to-date pest population estimates, pest distribution and development data, pest survey and inspection results, alerts to new pest finds in the state, and forecasts for Wisconsin's most damaging plant pests.

Issue No. 9 of the Wisconsin Pest Bulletin is now available at:

http://datcpservices.wisconsin.gov/pb/index.jsp

http://datcpservices.wisconsin.gov/pb/pdf/06-27-13.pdf

Plant Disease Diagnostic Clinic (PDDC) Summary

Brian Hudelson, Ann Joy, Erin DeWinter and Joyce Wu, Plant Disease Diagnostics Clinic

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 8, 2013 through June 14, 2013.

PLANT/SAMPLE TYPE	DISEASE/DISORDER	PATHOGEN	COUNTY
FIELD CROPS			
Corn	Paraquat Injury	None	Marquette
VEGETABLES			
Basil	Sunburn	None	Dane

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

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