Recent rains have caused flooding and ponding in many cornfields. Growers are concerned about corn growth and development and any yield effects that might occur from short periods of flooding. Many crop fields were completely destroyed, while others were left with varying degrees of damage. Before making any decisions about your fields, you should document and report any crop damage to your local U.S. Department of Agriculture Farm Service Agency (USDA FSA) office, your crop insurance agent and the Wisconsin Department of Agriculture, Trade and Consumer Protection.

You are strongly encouraged to take “time-dated” photos of any damage. Such information may be critical in federal emergency determinations and your eligibility for these programs.

The extent to which flooding injures corn is determined by several factors including: 1) timing of flooding during the life cycle of corn, 2) frequency and duration of flooding, and 3) air-soil temperatures during flooding (Belford et al., 1985).

Flooding at any time when the growing point is below the water level can kill the corn plant in a few days, especially if temperatures are high. Growing point tissues are depleted of oxygen. After a storm event we need to be patient and let plants respond. Plants can usually survive short periods of flooding of less than 48 hours (Wenkert et al., 1981).

Respiration is the plant physiological process most sensitive to flooding. Flooding reduces the exchange of air (oxygen) between soil and atmosphere eventually leading to decreased total root volume, less transport of water and nutrients through the roots to the shoot, and formation of sulfides and butyric acid by microorganisms that are toxic compounds to plants (Wesseling, 1974).

Soils contain pores filled with gas and/or water. The two main gases important for respiration are oxygen and carbon dioxide. The pathway for oxygen into the plant is from the atmosphere through soil pores to a thin water film surrounding plant root hairs. It is relatively easy for oxygen to diffuse into soil when pores are filled by air, but oxygen does not easily diffuse in water so the main constraint to oxygen movement is the thin water film surrounding root hairs. This boundary is magnified in flood/pond conditions. Carbon dioxide rarely accumulates to toxic levels in soil (Wesseling, 1974).

Roots are injured if the soil remains waterlogged. Continued poor aeration causes cell death and even death of roots. Measurable short term reductions for root and leaf growth rates begin immediately within 1-12 hours, but tend to recover quickly within 2-3 days (Wenkert et al., 1981).

All biological processes are influenced by temperature (Wesseling, 1974). Wet soils have a large heat capacity and considerable amounts of heat are required to raise their temperature. Thus, usually wet soils are cold and corn growth is slower. Drainage lowers the moisture content of the upper soil layers so air can penetrate more easily to roots, and transport carbon dioxide produced by roots, microbes and chemical reactions to the atmosphere. Lowering soil moisture content also leads to higher soil temperatures and faster growth.

**Evaluating damage from flooding**

The growing point of corn is metabolically active and is near or below the soil surface prior to V6 (6 visible leaf collars). Within about 48 hours the oxygen supply in a flooded soil is depleted (Purvis and Williamson, 1972; Fausey and McDonald, 1985). Without oxygen, the growing point cannot respire and critical functions are impaired. If temperatures are warm during flooding (greater than 77 degrees F) plants may not survive 24-hours. Cooler temperatures prolong survival. If flooding in corn is less than 48 hours, crop injury should be limited.

To confirm plant survival, check the color of the growing point. It should be white to cream colored, while a darkening and/or softening usually precedes plant death. Also look for new leaf growth 3 to 5 days after water drains from the field. Once the growing point is above the water level, the chances of survival improve greatly.

**Things to look for later during the growing season**

Even if flooding doesn’t kill plants, it may have a long-term negative impact on crop performance. Excess moisture during the early vegetative stages retards root development (Wenkert et al., 1981). As a result, plants may be subject to greater injury later during a dry summer because root systems are not sufficiently developed to contact available subsoil water.

A considerable amount of oxygen is required in the soil for mineralization of nutrient elements from organic matter by microbes. Oxygen deficiencies reduce microbe activity, decreasing the rate at which ammonium and nitrate are supplied to plants resulting in nitrogen deficiency in waterlogged soils (Wesseling, 1974). Additionally, flooding can reduce the activity of mycorrhizae essential for symbiotic phosphorus uptake (Ellis, 1998). Flooding can also result in losses of nitrogen through denitrification and leaching. Where estimated nitrogen loss is significant in fields not yet tasseling and yield potential is reasonable, corn may respond to additional applied fertilizer.

Flooding causes greater crop yield losses when it occurs early in the season (Meyer et al., 1987; Kanwar et al., 1988; Mukhtar et al., 1990; Lizaso and Ritchie, 1997). When six-inch corn was flooded for 24, 48 and 72 h corn yields were reduced 18, 22, and 32% at a low N fertilizer level. At a high N level, these reductions ranged from 19 to 14% one year and <5% in another year (Ritter and Beer, 1969). When corn at a height of 30 inches was flooded for 24 and 96 h, yields were reduced 14 to 30%. With a high level of N in the soil, very little yield reduction occurred even with 96 h of flooding. When flooded near silking, no reduction in yield occurred at a high N level, but yield reductions up to 16% occurred with 96 h of flooding at the low level of N.

Mud and sediment caking leaves and stalks could damage plant tissue and allow development of fungal and bacterial diseases not typically seen. Due to early season stress the plant may be predisposed to root and stalk rots later and harvest timing of fields may need to be adjusted accordingly. A disease problem that may become greater due to flooding and cool temperatures is crazy top, a fungus that depends upon saturated soil conditions to infect corn seedlings. With warmer, wet or humid conditions Pythium can reduce stands despite fungicide seed treatments. There is limited hybrid resistance to these diseases and predicting damage is difficult until later in the growing season.

Below are best management guidelines for harvesting, storing, and feeding flooded field and forage crops including corn, hay crops and pasture.

- Protect yourself from the harmful effects of silt dust on your health. If you do harvest your flooded crop, use a dust mask (N-95 or higher) or filtered cab to avoid breathing in dust.
- Flooded crops should be stored separately from the rest of your feed. In cases of production problems, this allows for feeding or disposal options without affecting your good feed.
- Flood water from streams and silt can be a source of pathogens. Farmers are strongly encouraged to work closely with their veterinarian and animal nutritionist when determining which vaccination and feeding protocol to use to further protect the herd from possible health issues associated with feeding flooded crop material.

**Harvesting Corn for Silage**

- No matter how bad the field looks take the time to properly assess the damage in each field and determine harvestability. Because each field and/or farm is affected differently, no one prescription fits all situations.
- If possible it is best to avoid chopping corn with large amounts of dirt or silt on it. Soil contamination is the primary source of Clostridium bacteria which increases the risk of poor fermented silage. Clostridial fermentation can also increase the risk of botulism toxins.
- It is generally recommended to not harvest corn with significant moldy ears. Mold lowers feed value and increases the risk of mycotoxins. However, do not assume that all flooded corn will have moldy ears. Ears with tight husks show no or few signs of mold. It
is important to monitor the corn regularly to assess mold growth and development. You may consider an early harvest if the mold worsens.

- Silt is abrasive, so it will be very hard on machinery. Operators will need to take extra care to ensure knives are sharp. Be prepared for extra repairs.

- Try to cut the corn above the silt line or at least above any heavy silt line. In areas where plants are heavily silted it may be more advantageous to harvest the corn as high moisture ear corn or snaplage. This process requires only the ear to be removed and leaves the remainder of the plant in the field.

- Good silage fermentation kills or inhibits the growth of many pathogens; therefore, follow all best management practices to promote good fermentation by harvesting at the correct moisture content (62 – 68% Moisture content, 32 – 38% DM), proper chop length, high filling rate, extra packing, and a tight seal to exclude oxygen. In addition, silage inoculants properly applied can help promote good fermentation by assuring adequate populations of lactic acid bacteria and silage preservatives such as buffered acids can help prevent mold and yeast growth.

- If possible the field should be left to reach the proper harvest moisture for silage. Do not chop immature corn unless necessary. Chopping immature corn can lead to other fermentation issues. If fungal growth seems imminent or increasing on the ears or in the stalk and you still intend to harvest, harvesting slightly earlier that you typically would can reduce the chances of an unacceptable mycotoxin load.

- Crop dry down rate may be faster than normal, so monitor plant maturity and whole plant moisture content routinely and be prepared to harvest when ready.

- Because of the relationship between packing density and oxygen exclusion, it may be better to err on the side of harvesting at slightly higher moisture levels than usual. Chopping corn at excessively high dry matter content will reduce lactic acid bacterial growth and likely inhibit proper fermentation allowing more spoilage.

- It is advisable to inoculate with lactic acid bacteria from a reputable company. It may cost a little more for a good inoculant, but do not skimp on rate or quality. If harvested at the proper moisture content, it is generally recommended to inoculate with a combination of homolactic lactic acid bacteria (to lower and stabilize the pH of the silage) and L. buchneri (to increase acetic acid formation which extends bunk life and reduces feed out losses). Growth of molds and fungi are inhibited by acetic acid. Including L. buchneri in the inoculant can cause excessive production of acetic acid if the corn is harvested below 32% DM. However, for specific products, talk to your inoculant dealer about any modifications in inoculant rate and type. Distribution of inoculants within the forage is also critical so talk to your dealer about applicators.

- Acetic acid and buffered propionic acid products are also effective to limit mold and yeast growth, but should not be mixed with bacterial inoculants in the same applicator tank. Follow specific product recommendations.

- Remember to store flood damaged corn separately from undamaged corn. If production problems are detected from this forage then there are options to either feed it to other livestock or plan to spread it on your fields as you would manure.

- Avoid feeding for 4 to 6 weeks to allow adequate time for good fermentation. Some mycotoxin levels can actually decline over time in the silo.

- Before feeding, collect a representative sample and have it tested for mycotoxins

### Flooded Stored Forages

- Before feeding the flooded crop, collect a representative sample and have it tested for mycotoxins.

- For stored silage that was exposed to flood waters, it is important to dig into the silage (or open up a few bales) and assess the damage. Check the smell and color. If it looks and smells good, then it may be fine. Watch for mold growth.

- Discard forage that is visibly contaminated with silt or mold. In some cases, silt will even be found inside wrapped bales with the plastic still intact.

- For round bale silage, re-wrap or patch torn bales to avoid heating and spoilage and plan to feed these out soon. Flooded wrapped bales are apt to spoil; even if your bales look fine right after the flood, check a few in about a month to look for changes.

- Limit the amount of this feed in the ration mixing it with other good feeds. Monitor your animals closely.

### Feeding Flooded Forage

- Flooded forage should be analyzed for nutritional value and mycotoxins. With added silt, you may find a higher dry matter and ash content and a lower protein and energy concentration.

- Frequency of testing will be determined by field risk assessment as well as by evaluation of the feed’s visual appearance and smell.

- Blending or diluting flooded feed with uncontaminated forage may be one means to reducing impact on herd health. However, check with your nutritionist and veterinarian to interpret mycotoxin test results before mixing feeds.

- Once you start feeding any flooded material, watch your animals closely. Mycotoxins and other potential...
Sampling and Testing for Mycotoxins

The risk of mycotoxin development may increase in crops that have been flooded and covered in silt. Mycotoxins are poisons that are produced by fungi. These toxins can be detrimental to both animal and human health. Mycotoxins can cause problems in production, reproduction and intake problems, as well as possible irreversible damage to cows’ organs, including the liver and kidneys.

Fungi in the Fusarium family produce many of the common mycotoxins. The fungi itself is ubiquitous and found in the soil, plant residue and even blown around through air currents. Mycotoxins associated with Fusarium™ are zearalenone, T-2 toxin, fumonisin, and deoxynivalenol, also called DON or vomitoxin. The following are mycotoxin risk levels for dairy cattle, expressed on a total ration, dry-matter basis.

- DON (vomitoxin); less than 5 to 6 parts per million
- Fumonisin; less than 25 parts per million
- T-2 toxin; less than 100 to 200 parts per billion
- Zearalenone; less than 300 parts per billion

Aflatoxin produced by the fungi Aspergillus, the most serious carcinogen, has been found in high levels in peanuts, corn, cotton seed, and grain and can contaminate milk. This toxin is a serious problem for human and animal health and can contaminate corn in warmer growing regions. Aflatoxin requires warm (85°F) and moist conditions. Where fall conditions are cool, aflatoxin is rarely found.

All flooded forages should be tested for mycotoxin after complete fermentation but soon enough so you have time to obtain feed if it has unacceptable levels. Samples should be taken from the storage facility and the TMR if available. The sampling strategy and frequency will depend on herd health monitoring. Mycotoxin analysis can be completed at many commercial labs.

Forage Inventory and Farm Decisions

Take an accurate inventory of your volume and quality of stored forage. Estimate how much feed you will need this winter and whether it is possible to avoid using the flooded forage. Talk to your feed consultant about cost-effective options for replacing lost feed. Right now is the time to make the calculations. If you find you will have to borrow money to buy feed, talk to a banker early.

Vegetable Crop Update 5/31/14

The 7th issue of the Vegetable Crop Update is now available. This issue contains information on Blitecast and P-Days for late blight and early blight management, National late blight updates for the week, Spotted Wing Drosophila update for fruit, and the WI Irrigation Scheduler Program advertisement. Click here to view this update.

Timely Video: Anthesis (Flowering) in Wheat

Shawn Conley, Soybean and Wheat Extension Specialist

Anthesis (flowering) in wheat; how to identify this important growth stage. Dr. Shawn Conley, the Wisconsin soybean and small grains Extension specialist, visits a wheat field to demonstrate the process. For more information from Dr. Conley, visit http://www.coolbean.info

To view the video click on the image below.

Plant Disease Diagnostic Clinic (PDDC) Update

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

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

FORAGE CROPS,
Alfalfa, Root/Crown Rot, Pythium sp., Fusarium sp., Iowa

FRUIT CROPS,
Apple, Sphaeropsis/Botryosphaeria Canker, Sphaeropsis sp., Washington

VEGETABLES,
Basil, Sunburn, None, Columbia

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

Wisconsin Winter Wheat Disease Update – June 2, 2014

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

Winter wheat in the southern portion of Wisconsin is at, or past, the flag leaf stage of growth. Disease reports have been few and far between this year. This is because wheat looks very healthy. No diseases where observed on the wheat I inspected this weekend. Septoria leaf blotch I had observed very early this season has subsided and cannot be found
now. No powdery mildew was observed in these fields. However, there have been several reports of very minor powdery mildew on wheat near the Janesville area. Weather conditions have been very conducive for powdery mildew, so continue to scout for this disease. If powdery mildew is observed at high levels of severity on flag leaves, then a fungicide application might be warranted.

No wheat rusts have been observed in the fields I have scouted this season. I have received no reports of rusts on wheat in Wisconsin either.

In the next week or two, much of the wheat in Southern Wisconsin will be heading and flowering. This is a critical time to control Fusarium head blight (scab). If conditions are wet and warm during the flowering (anthesis) period, the risk for scab will be higher. To assist in making decisions about scab management, consult the Fusarium Head Blight Prediction Center at http://www.wheatscab.psu.edu. Currently, the risk for scab is low in most of the state. However, as temperatures get warmer and if it continues to rain, the risk can increase quickly.

If a fungicide is warranted for control of scab, products such as Prosaro, Caramba, or similar that contain triazole active ingredients can offer suppression of scab and reduce deoxynivalenol (DON) accumulation in harvested grain. These products should be applied within a week or so of the beginning of flowering for reasonable control. Products containing strobilurin fungicides should be avoided on wheat that has headed. Research has demonstrated that levels of DON can be higher after treatment with strobilurin products after heading.

Continue to scout wheat regularly over the next couple of weeks. This will be a critical time to make in-season disease management decisions.

2014 Pest Management Field Day
Bryan Jensen, IPM Program

Please join us June 26 for the Pest Management Field Day. This field day will be held at the Arlington Agricultural Research Station and features UW staff and student who will provide information on current pest management topics and research results.

Tours will leave the Public Events Building promptly at 8:30 am and conclude by noon. A light lunch will be served at the conclusion. In the event of rain, speakers will present their topics inside the Public Events Building.

No preregistration is required and CCA Credits will be applied for.

Please note! Wisconsin Crop Weed Science (WCWS) herbicide evaluation results and plot tour: Vince Davis, Extension Weed Scientist, with his staff and students will lead an informal tour of the weed science field research plots after lunch.

Speakers and Topics include

| Shawn Conley, David Marburger and Adam Gaspar, Dept. of Agronomy | Environmental Impacts on Soybean Management Decisions |
| Mark Renz, Dept. of Agronomy | Pest Management Mobile |
| Chris Bloomingdale and Damon Smith, Dept. of Plant Pathology | Thrips Dispersal and Soybean Vein Necrosis Virus (SVNV) in Wisconsin Soybean |
| Damon Smith, Dept. of Plant Pathology | 2014 Alfalfa Fungicide Evaluation |
| Jamie Wilbur and Damon Smith, Dept. of Plant Pathology | Soybean White Mold Research Update and Treatment Evaluation |
| Tommy Butts, Dept. of Agronomy | Herbicide Resistance Research Update for Wisconsin Palmer Amaranth and Water hemp Populations |
| Dave Stoltzenberg and Stacey Marion, Dept. of Agronomy | Update on Giant Ragweed Resistance in Wisconsin |
| Liz Bosak, Dept. of Agronomy | Take Action Against Herbicide Resistance; Resources and Pigweeds Research Update |
| Joe Lauer, Dept. of Agronomy | The Value of Transgenic Hybrids in an IPM Program |

The Public Events Facility is located on the Arlington Agricultural Research Station, N695 Hopkins Road. If traveling from the south, exit I 90/94 onto Hwy 51 North. Look for the Arlington Ag. Research Station sign north of DeForest. Turn left (west) onto Badger Lane. Travel 1 mile and turn left (south) onto Hopkins Rd. If traveling from the north, exit I 90/94 onto Hwy 60. Travel east through Arlington and turn south onto Hwy 51. For more detailed driving direction click on http://www.ars.wisc.edu/arlington/directions.html
Pest Management Mobile, a Resource for Insect Management in Agronomic Crops

Eileen Cullen and Mark Renz, Extension Specialists; University of Wisconsin Extension

Pest Management Mobile provides access to a range of pest management information found in a3646 (Pest Management in Wisconsin Field Crops) through a mobile website http://pmm.uwex.edu. Below is a highlight of how to use this website for alfalfa insecticide treatment decision support. Users can also access information with respect to insecticides on corn and soybean and select fungicides (corn). Additional pest/crop combinations will be added later this summer.

Quick reference to key information about an insecticide: if you need to check on an attribute of an insecticide use the product details search feature. Simply start to type in the product name and as the product name becomes available from the list, select it from the drop down list of product names that appears. The resulting page will display key attributes of the product, such as active ingredient(s), restricted use pesticide status, restricted entry interval, and manufacturer (Figures 1A). By scrolling down (Figure 1B) and clicking on the tabs key information with respect to product use in registered crops can also be accessed (see Figure 1C for an example in established alfalfa).[1]

[1] If boxes contain a large amount of text like in Figure 1C, rotation of the smartphone or tablet to landscape will improve the readability of this information.

Interactive search for pest management options:
Insecticides can also be compared by conducting an interactive search of products registered for user identified pests. For example, if interested in products registered for alfalfa weevil follow the steps (and Figures) below:

1. Select established or establishing alfalfa pests (Figure 2A),
2. Then select the insect pest(s) of interest = alfalfa weevil(Figure 2B).
3. A list of insecticides registered for the pest(s) on the crop will be displayed (Figure 2C).

Insecticide products are listed alphabetically. Key information about each insecticide can be accessed by clicking on the product name (see figure 1C for an example of the result). As the key determinant for an insecticide treatment decision is whether the insect pest population has reached economic threshold level in the field, this information is also available in Pest Management Mobile. It can be viewed by selecting the insecticide of interest after the product search and pest query (Figure 2D).

Feel free to utilize this free UW Extension resource to improve pest management decision support in the field. This information is not new, but found in Pest Management in Wisconsin Field Crops (a3646). For a copy of the print version or a free PDF of this publication please visit the extension publications website: http://learningstore.uwex.edu/Pest-Management-in-Wisconsin-Field-Crops2012-P155.aspx

Follow us on
Assessing Flood Damage to Soybean

Shawn Conley, State Soybean and Wheat Specialist University of Wisconsin, Madison
Grover Shannon, University of Missouri, Division of Plant Sciences

Severe flooding has many low-lying soybean fields underwater. As the water dissipates yield potential and replant questions will arise. Flooding can be divided into either water-logging, where only the roots are flooded, or complete submergence where the entire plants are under water (VanToai et al., 2001). Water-logging is more common than complete submergence and is also less damaging. Soybeans can generally survive for 48 to 96 hours when completely submersed (Image 1). The actual time frame depends on air temperature, humidity, cloud cover, soil moisture conditions prior to flooding, and rate of soil drainage. Soybeans will survive longer when flooded under cool and cloudy conditions. Higher temperatures and sunshine will speed up plant respiration which depletes oxygen and increases carbon dioxide levels. If the soil was already saturated prior to flooding, soybean death will occur more quickly as slow soil drainage after flooding will prevent gas exchange between the rhizosphere and the air above the soil surface. Soybeans often do not fully recover from flooding injury.

Image 1. Flooded soybean field located at Arlington WI, June 8th 2008.
Crop injury from water logging is difficult to assess. Water-logging can reduce soybean yield 17 to 43% at the vegetative growth stage and 50 to 56% at the reproductive stage (Oosterhuis et al., 1990). Yield losses are the result of reduced root growth, shoot growth, nodulation, nitrogen fixation, photosynthesis, biomass accumulation, stomatal conductance, and plant death due to diseases and physiological stress (Oosterhuis et al., 1990; VanToai et al., 1994 and 2003). A significant amount of genetic variability for flooding tolerance among soybean varieties occurs in maturity groups II and III (VanToai et al., 1994) and likely exists for maturity group I soybeans as well.

Increased disease incidence in the surviving plants may also occur and limit yield potential. The main culprit will likely be phytophthora given the warm wet weather; however phythium, rhizoctonia, or fusarium may also occur. Differential response among varieties will be tied to the sources of genetic resistance to these diseases.

Once we can get back into the fields the decision to replant will be based on the yield potential of the current stand relative to the cost and yield potential of the replanted soybean field (Table 1). Before any decision to tear up a field is made make sure you contact your crop insurance agent to discuss coverage and you have the replant seed on your farm or at least en route. As we all know seed supplies are tight and replant acres will be high. Also remember to check herbicide labels for plant back restrictions if you are planning to plant soybean into a flooded corn field.

Table 1. Expected relative soybean yield at four replanting dates compared to predicted yields for a range of plant populations resulting from an optimum planting date of May 1-20 for full season maturity or short season maturity varieties.

<table>
<thead>
<tr>
<th>Early plant population</th>
<th>May 1-20</th>
<th>June 1</th>
<th>June 10</th>
<th>June 20</th>
<th>July 1</th>
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</table>

\(^1\)Yield potential of full season varieties are in bold while yield potential of earlier maturity group soybeans are given in normal text.

Since full season maturity group soybeans are unrealistic for planting this late only early and mid-group soybean cultivars should be considered. The average yield potential for soybean planted in late June in southern WI is in the 30 to 35 bu yield range (Figure 1). For yield potential and harvestability, (a combine may not be able to pick up the lower pods) a grower should plant if possible a mid maturity group soybean instead of an early maturity group for their geographic area.
Figure 1. Planting date effect on grain yield of early to mid maturity group soybeans (0.4 to 1.8 RM) in southern WI (Data from early 1990s planting date study).

To maximize yield potential in late planted soybean, a minimum of 180,000 plants per acre is required in a drilled system as yield potential in rowed beans would be significantly reduced due to decreased canopy development. To achieve 180,000 plants per acre a grower may have to seed as many as 225,000 seeds per acre.

Literature Cited:


