North Central Ohio
Agronomy Report
Erie Basin Extension Education & Research Area

Issue 9-11

THE OHIO STATE UNIVERSITY EXTENSION

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Dear Agricultural Producer:

North Central Ohio wheat has been harvested with reasonably good quality and fair to good yields. At the OSU Unger Farm wheat yields from the Modified Relay Intercropped plots averaged 90 bushels/acre. Many acres of double crop soybeans were planted.

Hot conditions in the past two weeks have allowed crops to play "catch-up". With the need for as much as a quarter of an inch of moisture per day by the corn crop we are starting to see moisture stress not only in corn but also somewhat in soybeans.

For the mid-May planted corn the next two weeks of rainfall will be particularly critical as we enter the pollination period for that part of the crop. Tight compacted soils can now easily be located within a field on a hot low humidity day with the rolling of leaves sometimes before noon.

Soybeans planted in mid-May are now at growth stage R1. Information about reproductive growth stages are found later in this newsletter.

Best regards,

Steven C. Prochaska, Ph.D.,
Extension Educator,
Agriculture, Horticulture and NR
Phone: (419) 562-8731
Prochaska.1@osu.edu

Howard J. Siegrist,
Extension Educator
Agriculture and Natural Resources
Phone: (740) 670-5315
siegrist.1@cfaes.osu.edu

Helpful Links:
http://www.ipm.iastate.edu
http://agcrops.osu.edu
http://fcn.agronomy.psu.edu
http://precisionag.osu.edu
http://www.ipm.uiuc.edu
http://www.oardc.ohio-state.edu/ohiofieldcropdisease
http://www.entm.purdue.edu/Entomology/ext/targets/newslett.htm

Forage Focus: New Forage Seedings, A Unique Opportunity This Summer

Stan Smith, Agricultural and Natural Resources Program Assistant, Fairfield County
Ohio State University Extension

With the weather allowing so few new forage seedings to be established in Ohio this spring, not only do many acres originally intended for forages remain unplanted, but several thousand acres intended for corn and soybeans are also still vacant. With the prime time for a summer forage seeding less than 5 weeks away, our spring weather issues offer a unique opportunity for forage growers to be prepared to make the perfect summer seeding when August arrives.

In particular, soil samples can be pulled now in order that corrective lime and fertilizer applications may be made in a timely fashion. The extra time available to prepare for new seedings this year also allows growers to eliminate perennial weeds, and control the annuals which continue to germinate while abundant precipitation persists throughout the State.

OSU Extension Forage Specialist Mark Sulc offers the following 11 highlights of key management steps toward successful establishment of perennial forages for later this summer.

1. Apply lime and fertilizer according to a soil test. Since the stand will be used for several years, ideally the soil test should have been taken within the past year. If soil pH is low, corrective applications will not take effect quickly enough for good establishment this year of pH sensitive species like alfalfa.

2. Control problem perennial weeds ahead of seeding. Be careful with herbicide selection because some have residual soil activity and will harm new forage seedings if proper waiting periods are not observed. Be sure to read the labels of any herbicides being considered.

3. Plant new perennial forage stands as soon as possible in August. Seedlings require at least 6 to 8 weeks of growth after emergence to have adequate vigor for winter survival. In northern Ohio, plant during the first two weeks of August. In southern Ohio, plant by August 30. Assuming soil moisture is present, planting earlier in August is almost always better than later. Later planting than these recommended dates may work, but there is greater risk for failure and the stand may have lower yield potential next year. The new stand should have at least six to eight inches of growth before a killing frost. Slow establishing species should be planted as early as possible. Fast establishing species like red clover, alfalfa, and orchardgrass can be seeded up to the dates listed above if moisture is present. Kentucky bluegrass and timothy can actually be seeded 15 days later than the dates listed above.

4. It is risky to place seeds into dry soil - there may be just enough moisture to germinate the seed but not enough to get the seeding established. Either plant soon after a rain when soil moisture is adequate, or when a good rain system is in the forecast.

5. No-till seedings conserve moisture and can be very successful provided weeds are controlled prior to seeding. Remove all straw from fields previously planted to small grains. Any remaining stubble should either be left standing, or clipped and removed. Do not leave clipped stubble in fields because it will form a dense mat that prevents good seed placement and emergence.

6. If you are going to use tillage, don't over-till and be sure to prepare a firm seedbed. Loose seedbeds dry out very quickly. Deep tillage is not ideal for late summer seedings. A cultipacker or cultimulcher is an excellent last-pass tillage tool. The soil should be firm enough that your footprint is no deeper than 3/8 inch.

7. Plant the seed shallow (1/4 to 1/2 inch deep) and in firm contact with the soil. Carefully check seeding depth, especially when using a no-till drill. A drill with press wheels provides the greatest success with summer seeding. Broadcasting seed on the surface without good soil coverage and without firm packing is usually a recipe for failure in the summer.

8. Use high quality seed of known forage-type varieties from reputable dealers. Cheap seed often results in lower yield and shorter stand life. Check out our variety performance trials and those of neighboring states at the following websites:

Ohio: http://oardc.osu.edu/forage2010/
Kentucky: http://www.uky.edu/Ag/Forage/ForageVarietyTrials2.htm
Pennsylvania: http://pubs.cas.psu.edu/FreePubs/pdfs/uc068.pdf
Michigan: http://fis.msue.msu.edu/

9. Make sure legume seed has fresh inoculum of the proper rhizobium to ensure nitrogen fixation. If the seed is pre-inoculated, check with the seed supplier to ensure the seed was stored under conditions that guarantees viable inoculant.

10. If planting alfalfa, don't plant new alfalfa immediately after an older established alfalfa stand. Autotoxic compounds are released by old alfalfa plants, which inhibit growth and productivity of new alfalfa seedlings. You can seed in alfalfa in late summer to thicken up a new alfalfa seeding that was made this spring. The autotoxic compounds are not present in young alfalfa plants. They are released from older, established alfalfa plants.

11. As the stand develops this fall, do not be tempted to harvest it. No matter how much growth accumulates, it is usually best to let the cover protect the new crowns during the winter. The only exception to the no fall harvest rule for late summer seedings is perennial ryegrass. If perennial ryegrass has tillered and has more than six inches of growth in late fall, clip it back to 3 to 4 inches in November or early December. Finally, scout new seedings for winter annual weeds in October. Apply herbicides as needed. Winter annual weeds are much easier to control in late fall than they will be next spring.

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Foliar Fungicides for Corn: Targeting Disease

Carl A. Bradley, Extension Plant Pathologist, University of Illinois
Paul D. Esker, Extension Plant Pathologist, University of Wisconsin
Pierce A. Paul, Extension Plant Pathologist, The Ohio State University
Alison E. Robertson, Iowa State University

To spray or not to spray . . . it's not that simple of a decision. A foliar fungicide application might be a good investment to help boost profits, *but not always*. It is important to target diseases when making a foliar fungicide application decision in corn. Spraying corn fields without considering disease risk factors or scouting observations may be like pouring money down the drain. However, in the right situations, foliar fungicides can be used to help protect against yield reductions due to diseases and boost profits. The key to better and more profitable utilization of foliar fungicides in corn is to *target disease* (Fig. 1).

Scouting for foliar diseases: Just prior to tassel emergence, plants should be examined for disease symptoms. Current disease management guidelines suggest that a foliar fungicide application be considered under the following situations*:

• *Susceptible hybrids*: If disease symptoms are present on the third leaf below the ear or higher on 50% of the plants examined.

• *Intermediate hybrids*: If disease symptoms are present on the third leaf below the ear or higher on 50% of the plants examined, ***AND*** the field is in an area with a history of foliar disease problems, the previous crop was corn, and there is 35% or more surface residue, and the weather is warm and humid through July and August.

• *Resistant hybrids:* Fungicide applications generally are not recommended.

**Note that these guidelines are targeted toward diseases caused by residue-borne pathogens such as gray leaf spot and northern leaf blight, and NOT for diseases caused by air-borne pathogens which have spores that can travel great distances such as common rust and southern rust.*

Putting it all together to make a decision: Base your decision to apply a fungicide on the presence of disease risk factors *and* on disease scouting observations. Remember that you are much more likely to increase your profits with a foliar fungicide application if

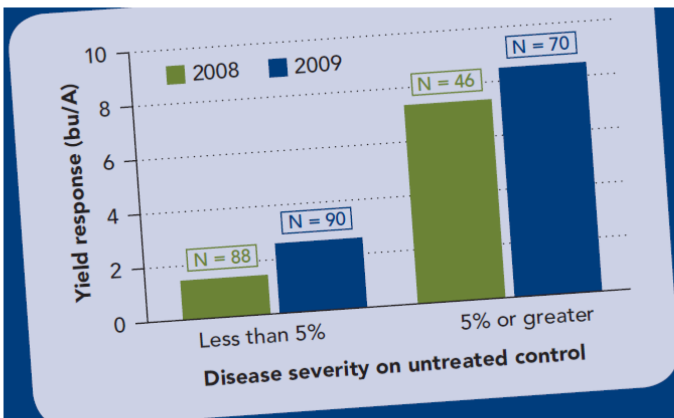


Figure 1 • Summary of University and Extension foliar fungicide research trials on corn conducted in 2008 and 2009 in the United States and Ontario, Canada. Results were summarized by Dr. Greg Shaner, Purdue University, and data were provided by University and Extension personnel in Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Minnesota, Mississippi, Missouri, Nebraska, North Dakota, Ohio, Ontario, South Dakota, Virginia, and Wisconsin. (Bars represent the average yield difference between an untreated control and Headline, Quilt, or Stratego fungicide applied between the VT and R1 growth stages under different levels of disease pressure).

you use the fungicide for disease control purposes. If the decision is made to apply a fungicide, then choose the best product available based on which diseases are present and the level of disease pressure. Check with University and Extension sources or your local agronomist for information on which foliar fungicide products are available for use on corn.

Know the corn foliar disease risk factors

Different factors can increase the risk of foliar diseases appearing in a corn field. These risks are:

1. **Susceptibility level of corn hybrid.** Corn hybrids differ in their susceptibility to foliar diseases. Information about a hybrid's susceptibility to the commonly observed diseases in a particular area should be available from the seed company. In general, hybrids that are more susceptible to fungal foliar diseases will have a greater response to a foliar fungicide (Fig. 2).
2. **Previous crop.** Because many foliar pathogens survive in corn residue, the risk of foliar diseases increases when corn is planted back into a field that was planted to corn the previous year. The more corn residue present on the soil surface, the higher the risk of some foliar diseases.
3. **Weather.** Rainy and/or humid weather is generally the most favorable for foliar disease development. In the absence of rain periods, cloudy days and extended dew periods can increase disease spread and severity. Hot and dry conditions are not favorable for most foliar diseases, and the diseases will be mostly suppressed as long as these conditions persist.
4. **Field history.** Planting corn in a field that has a history of foliar corn diseases can increase the risk of foliar diseases under favorable weather conditions. Field location can affect the risk of foliar diseases; for example, fields located in river bottoms or low areas, or surrounded by trees, may be more prone to having foliar corn diseases.
5. **Southern rust risk.** The risk of southern rust is not strongly affected by the hybrid planted, as most hybrids are susceptible; nor is the risk affected by previous crop, as the pathogen does not survive in crop residue, and as such, must blow up from the southern U.S. to affect corn fields in the North Central U.S. and Ontario. The risk of southern rust can be assessed by accessing the IPM PIPE website (www.ipmpipe.org). This site provides maps of where southern rust has been detected in the U.S. during the growing season.

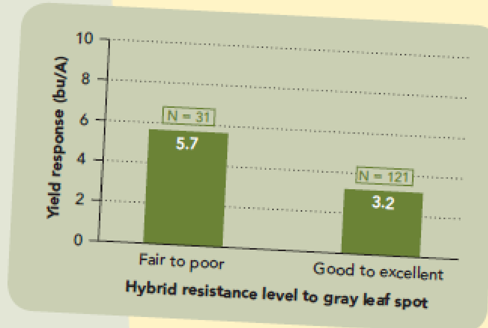
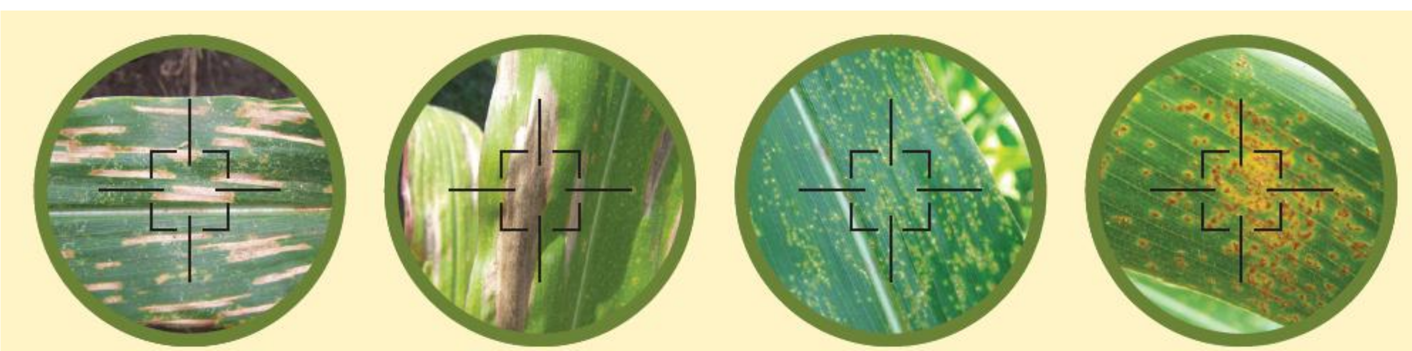


Figure 2 • Summary of University and Extension foliar fungicide research trials conducted in 2007 in the United States and Ontario, Canada on hybrids with Fair to Poor resistance and Good to Excellent resistance to gray leaf spot. Results were summarized by Dr. Carl Bradley, University of Illinois, and data were provided by University and Extension personnel in Illinois, Indiana, Iowa, Kansas, Kentucky, Maryland, Minnesota, Missouri, Nebraska, Ohio, Ontario, and Wisconsin.

Which economically-important foliar diseases can be managed with fungicides? Corn fields in the North Central U.S. and Ontario, Canada are never disease-free, but not all foliar diseases are equal in their potential to reduce yields. In addition, not all foliar diseases can be managed with foliar fungicides. Common rust, for example, often is observed in the North Central U.S. and Ontario; however, its yield-reducing potential generally is low for yellow dent corn hybrids because of their higher levels of resistance. Goss's wilt and Stewart's wilt have the potential to reduce corn yields, but cannot be controlled with a fungicide because they are caused by bacterial pathogens rather than fungal pathogens. A foliar fungicide can be a good tool to help manage gray leaf spot, northern leaf blight, and eyespot. These diseases are considered to be important yield-reducing foliar fungal diseases in the North Central U.S. and Ontario. Southern corn rust, another important foliar disease, can cause yield reductions to corn in the North Central U.S. and Ontario in certain years, but generally is not an annual occurrence.



Gray leaf spot | Northern leaf blight | Eyespot | Southern rust

(Funding for this project was the United States Department of Agriculture – National Institute of Food and Agriculture (USDA-HIFA; Award no. 2008-34103-19449) for the project entitled, "Development of IPM-based corn fungicide guidelines for the north central

states.") (Photo of Sprayer Plane by Scott Bretthauer, University of Illinois. Photos of gray leaf spot, northern leaf blight, and southern rust by Carl Bradley, University of Illinois. Photo of eyespot by Alison Robertson, Iowa State University.)

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Foliar Fungicides for Disease Management in Corn

Carl Bradley, Plant Pathologist
University of Illinois Extension

Foliar fungicides are touted for a variety of reasons, including "plant health," "yield bumps," and "yield enhancements," but sometimes the most important benefit fungicides may provide is overshadowed or lost. When foliar fungicides do provide a benefit, it is generally because they protect against foliar diseases. In Illinois, the primary foliar fungal diseases that can reduce yields are gray leaf spot and northern leaf blight. In some years, southern rust also may reduce yields if it arrives to the state early enough in the season.

Beginning in 2008, the plant pathology program in the University of Illinois Department of Crop Sciences has conducted annual foliar fungicide trials on corn in six or seven Illinois locations. A number of products--including Headline, Headline AMP, Stratego, Stratego YLD, Quilt, Quilt Xcel, and Bumper--are applied between the VT and R1 stages (tassel emergence to silking). At each location, disease severity is measured by evaluating the ear leaves of each plot and estimating the percentage of leaf area affected by diseases. These measurements are collected about 4 weeks after foliar fungicides are applied.

A summary of these foliar fungicide trials is shown in Figure 3. On the horizontal axis, the final measurement of disease severity (the percentage of ear leaf with lesions) observed in the nontreated control is divided into three levels: less than 10%, between 10% and 14%, and 15% or greater. The number of trials for each category (N) is indicated, along with the mean yield response and the frequency of achieving a yield response of at least 5 bu/A.

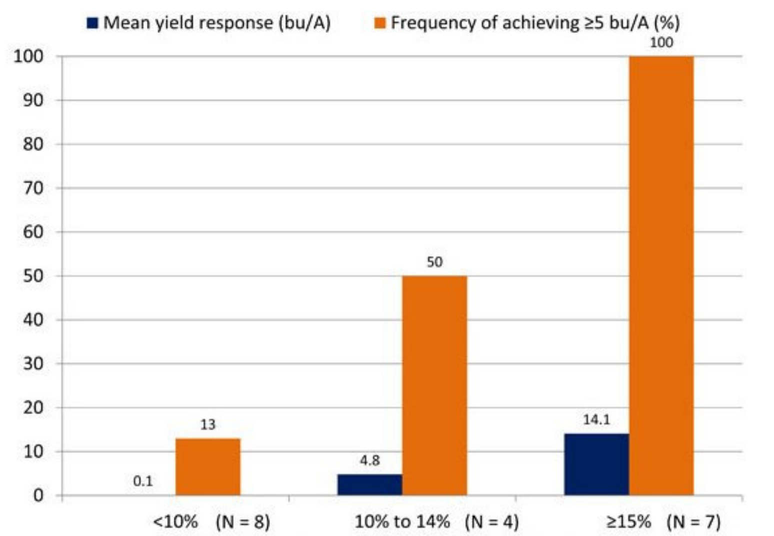

Figure 3. A summary of University of Illinois corn foliar fungicide trials conducted from 2008 to 2010. Foliar fungicides were applied between VT and R1.

The summary data indicate that disease pressure plays an extremely important role both in achieving a positive yield response with a foliar fungicide and in consistently achieving economically positive yield responses. Under low disease pressure (final disease severity of less than 10% of ear leaf area affected), the mean yield response was only 0.1 bu/A, and a yield response of at least 5 bu/A was achieved only 13% of the time (1 out of 8 times).

Under medium disease pressure (final disease severity of 10%-14% of ear leaf area affected), the mean yield response was 4.8 bu/A, and a yield response of at least 5 bu/A was achieved 50% of the time (2 out of 4 times). Under high disease pressure (final disease severity of at least 15% of ear leaf area affected), the mean yield response was 14.1 bu/A, and a yield response of at least 5 bu/A was achieved 100% of the time (7 out of 7 times). Gray leaf spot generally was the most severe disease in these trials, with northern leaf blight being present in a few trials, and southern rust proving severe in one trial (at Dixon Springs in 2009).

These results clearly reveal that final disease severity plays a critical role in the magnitude and consistency of yield response to a foliar fungicide application. The tricky part is being able to predict before the VT to R1 stages what the disease pressure will be several weeks later. To make such a prediction, one needs to consider "disease risk factors" and to scout for disease.

Disease risk factors include these:

- *Susceptibility level of corn hybrid.* Seed companies typically can provide information on the susceptibility of their hybrids to gray leaf spot and northern leaf blight. In general, hybrids that are more susceptible to fungal foliar diseases will have a greater response to a foliar fungicide (if disease pressure is high enough).
- *Previous crop.* Because many foliar pathogens survive in corn residue, the risk of foliar diseases (such as gray leaf spot and northern leaf blight) increases when corn is planted back into a field that was corn the previous year.

- *Weather.* Rainy and/or humid weather generally is most favorable to foliar diseases. In growing seasons when these conditions prevail, the risk for disease development increases.
- *Field history.* Some field locations may have a history of high foliar disease severity. Fields in river bottoms or low areas or surrounded by trees may be more prone to having foliar corn diseases.
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Scout for foliar diseases in corn just before tassel emergence. Current disease management guidelines suggest the following criteria for considering an application of foliar fungicide:

- For susceptible hybrids--if disease symptoms are present on the third leaf below the ear or higher on 50% of the plants examined.
- For intermediate hybrids--if disease symptoms are present on the third leaf below the ear or higher on 50% of the plants examined, if the field is in an area with a history of foliar disease problems, if the previous crop was corn, if there is 35% or more surface residue, and if the weather is warm and humid.
- For resistant hybrids-fungicide applications generally are not recommended.

According to the data from our corn fungicide trials, if at least 15% of ear leaf area is affected by disease at the end of the season, a foliar fungicide applied between VT and R1 would likely have been beneficial. Using the disease risk factors and scouting observations collected just before tassel emergence will help you predict how severe disease may be several weeks from the VT to R1 stages and help you decide whether to apply a foliar fungicide.

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Comparing Glyphosate Resistance in Palmer Amaranth and Marestail

Lowell Sandell, Extension Educator, Weed Science, Lincoln
Deana Namuth Covert, Plant Science Educator
Greg Kruger, Extension Cropping Systems Specialist, West Central REC
Mark Bernards, Extension Weeds Specialist, Lincoln
University of Nebraska-Lincoln

The simplicity and effectiveness of weed control in glyphosate-resistant corn, soybean, cotton, and sugarbeets have led to extensive adoption of this technology in the U.S. However, relying primarily on a single herbicide has resulted in the selection of glyphosate-resistant populations in a number of important weed species.

Weed species with populations resistant to glyphosate in the Midwest include marestail, waterhemp, common ragweed, giant ragweed, and kochia. In the southern U.S., glyphosate-resistant Palmer amaranth populations are widespread and glyphosate-resistant Johnsongrass populations have been confirmed. All of these species are present in Nebraska, although Johnsongrass is not common in production fields. Resistant populations of these species are likely to develop in Nebraska where producers rely primarily on glyphosate for weed control.

What are the ramifications if additional glyphosate-resistant weed populations develop in Nebraska?

1. Greater yield loss due to weed competition.
2. The subsequent cost of additional herbicides needed to achieve adequate control.
3. A potential reduction in no-till acres, since successful no-till is predicated on effective weed control using herbicides.
4. An increased pesticide load in the environment resulting from the use of additional herbicides necessary to control glyphosate-resistant weed populations.

This article describes how glyphosate kills plants, mechanisms by which Palmer amaranth and marestail have evolved glyphosate resistance, and management to avoid glyphosate resistant weed development.

Glyphosate Action in Plants: Glyphosate controls plants by disrupting essential amino acid synthesis. (View an animation of this process. (http://passel.unl.edu/pages/animation.php?a=EnzymeAction.swf&b=1012256780). Glyphosate binds to and disables EPSP synthase. EPSPS is an enzyme that catalyzes reactions in the shikimate pathway which forms three amino acids. When a susceptible plant is sprayed, glyphosate is absorbed by the plant and translocated to actively growing tissues, where it inhibits the necessary aromatic amino acid synthesis. In a susceptible plant, shikimate levels start to increase after application, indicating that glyphosate is working as it should. The plant undergoes a relatively slow death over the next 10-20 days.

Glyphosate Resistance in Palmer Amaranth: Palmer amaranth is an economically important weed species in row crop production, especially in the southern U.S. In 2006, Culpepper et al. reported the first glyphosate-resistant Palmer amaranth population in Georgia. More recently published work describes a genetic basis for glyphosate resistance in Palmer amaranth. In susceptible plants, there is a low gene copy number that encode for production of EPSP synthase (1 gene copy).

Gaines et al. (2010) showed that glyphosate-resistant Palmer amaranth have an extraordinarily high copy number of the EPSPS gene (5 to more than 160 copies), relative to a glyphosate-susceptible population. A high EPSPS copy number means the plant can produce enough EPSPS to support necessary amino acid production even in the presence of glyphosate. Shikimate does not build up, and amino acid synthesis occurs in spite of the uptake and translocation of glyphosate.

While individual plants of a weed species may look similar (phenotypically similar), there can be a tremendous amount of genetic variability within a population. Because of this broad genetic variability, there is a chance of selecting for a resistant individual under persistent, high selection pressure (for example, through multiple applications of glyphosate alone). In a situation of high selection pressure, resistant plants can dominate a field population in only four to five generations (years in the case of most weeds) once plant genetics are selected that confer resistance to that selection pressure (Jasieniuk et al. 1996).

Once a resistant weed population evolves, the genetics can be moved in a number of ways. Seed can be moved by tillage and harvesting equipment, animals, or wind and water. It also can be moved via pollen (genetic exchange). Palmer amaranth is a dioecious species, meaning plants are either male or female. This means that plants are obligate out-crossers (cross-pollinators), resulting in the exchange of genetic traits each year. Gaines et al. (2010) demonstrated that the increased EPSPS gene copy number is a heritable trait when plants are cross-bred. The concern for producers is that this genetic basis for glyphosate resistance can spread over any distance that the pollen can travel. Sonoskie et al. (2011) have reported movement of resistance traits via pollen up to 1000 feet from a known resistant male plant to susceptible female plants.


Glyphosate-resistant marestail from Nebraska.

Glyphosate Resistance in Marestail: Currently, marestail is the species presenting the largest glyphosate-resistant weed management problem in Nebraska. The mechanism of glyphosate resistance is not the same in all resistant weed species. In contrast to Palmer amaranth, glyphosate resistance in marestail is likely due to reduced or altered translocation of glyphosate (Feng, et al, 2004; Koger and Reddy, 2005). The glyphosate is sequestered in part of the plant, allowing unaffected plant parts to continue to grow and produce seed. This process is thought to be controlled by a single dominant or semi-dominant gene (Zelaya, et al, 2004). Because marestail is capable of both self or cross pollination, passing on resistance traits (from pollen movement) can occur rapidly in a population.

These examples illustrate the complexity of evolved glyphosate resistance in weed species. While both of these plant be considered non-target site resistance, the physiological methods by which these species avoid death by glyphosate are different.

Management: Because the movement of glyphosate resistant traits in weed populations (via pollen or seed movement) cares nothing about property ownership, fence lines, or man-made boundaries, resistance management is the responsibility of the entire ag community. This underscores the necessity of knowing the weeds present in your fields and then implementing weed management programs that are both economically effective and will reduce the potential development of glyphosate resistance.

Nebraska producers have not experienced the problems with glyphosate-resistant Palmer amaranth that those in southern states have. However, if there is over-reliance on glyphosate for weed control, it is likely that resistance will evolve in local populations. Palmer amaranth is present in the southern tiers of Nebraska counties, and becomes more prevalent as you move west.

Proper resistance management is a proactive approach to managing weeds. In fields infested by Palmer amaranth or any weed species mentioned at the start of this article, manage to prevent the development of herbicide resistance.

Use at least one PRE herbicide that is effective on all the weeds present in the field, followed by a POST application, if warranted, of a second herbicide that is effective on the same weeds. Herbicide resistance management principles apply to all cropping systems, including Roudup Ready, Liberty Link, conventional crops, and any herbicide-resistant technologies that will be commercialized in the future. Using multiple herbicide resistance traits in your crop rotation to “change-up” your herbicide program will result in delayed evolution of herbicide-resistant weed populations and greater value and longevity of the weed control tools currently available to producers.

Take Home Message: Glyphosate resistance in at least one Palmer amaranth population is due to elevated production of the EPSPS enzyme from an increased EPSPS gene copy number in resistant individuals.
Glyphosate resistance in marestail is likely due to reduced or altered glyphosate translocation.
Use at least two different herbicides that are effective on Palmer amaranth each year. Make sure the herbicides have different mechanisms of action. Do not use the same two herbicides every year. This strategy also applies to fields with marestail, kochia, ragweeds, and waterhemp.

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Corn Development: Late Vegetative – Early Reproductive

Ohio State University Extension

By V15 to V17, dissection should show that upper ear shoot is largest one now.

- This stage is about 10 to 12 days from silking
- This stage begins a period of grain yield determination most sensitive to severe moisture stress (i.e., continual wilting)
    - *two weeks prior to R1 = 3 to 4 % loss/day
    - *R1 (silking) = 3 to 8 % loss/day
    - *two weeks after R1 = 3 to 6 % loss/day
- Silks begin elongation about 7 days prior to silking
    - *dissection should show silks elongating from basal ovules first

Tasseling: Growth Stage VT (Last Tassel Branch Visible)

- Plant is nearing its full height
- Most vulnerable to hail at this stage
  (100% leaf loss = 100% yield loss)
- Pollen is contained in anthers of the tassel
    - *Anthers are the gizmos that look like the double-barrel of a shotgun
        - ~Sometimes mistaken for the pollen itself by the uneducated
    - *Pollen grains are dispersed through pore at anther tip
        - ~Outer covering is very thin membrane

~Once dispersed into the atmosphere, pollen grains remain viable for only a few minutes before they dessicate

*Pollen grain number per tassel between 2 and 5 million

- Pollen shed usually begins towards center of central spike, then progresses upward, downward, and outward over time
  *Peak pollen shed usually occurs mid-morning
    ~Onset of pollen shed may be delayed by
      ~heavy dew
      ~cool, humid conditions
  *Pollen shed does not occur during rainfall
    ~therefore, pollen is not washed off tassel by rain
- All pollen from an individual anther may be released in as little as 3 minutes

Tassel and Ear Development Prior to Pollination

Tassel Initiation

- Production of leaf primordia is usually complete by about V6.
- Tassel then begins to form at the apical meristem.
  *A small tassel can be visually detected in a dissected stalk section as early as growth stage V7.

Ear Initiation

- There are as many potential ears as there are leaves on the plant since every stalk node has an axillary bud associated with it.
  *Normally, ear shoots are detectable only at the first 8-10 stalk nodes above ground.
    ~While axillary buds exist at the upper 6-8 nodes of the stalk, they normally never become active.
    ~Initially, the lower ear shoots are bigger than the upper ones because the lower ones form first. Later on, the upper one or two ear shoots take priority over the others and become the harvestable ears.

- **Kernel row number** determination is completed by growth stage V12.
  *Row number is **determined strongly by plant genetics** rather than by environment. Exceptions include…
    ~Deep row cultivation after growth stage V8 may prune root system severely enough to hinder row number determination.
    ~Late application of Accent herbicide can decrease yield potential by altering row number determination.
    ~Nearly complete defoliation by hail prior to growth stage V12 may photosynthetically 'shock' the plant and affect row number determination.

- **Kernel number per row** is determined from about V12 until about 1 week before silk emergence occurs.
  *Kernel number (ear length) **is strongly affected by environmental stresses**.
    ~Severe stress can greatly reduce potential kernel number per row.
    ~Conversely, excellent growing conditions can encourage unusually high potential kernel number.

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Potato Leafhopper

Corn, Soybean, Wheat, and Alfalfa Field Guide: Bulletin 827
Ohio State University Extension

Identification & Incidence: Migrating PLH populations become established on Ohio alfalfa during the 2nd cutting and may reduce yields until late August. Foliar injury is indicated by yellowing of foliage, termed hopperburn, and plants are stunted. Critical periods of injury occur from 2nd cutting to early 4th cutting.

Sampling: Prediction of PLH injury depends on detection of abundant PLH presence prior to onset of foliar injury. Sweep net sampling is most effective method.

Action thresholds for control of PLH			
	Alfalfa Tolerance for Stress		
Stand Ht	Low	Medium	High
Inches	*Action Threshold of PLH/10 Sweeps*		
6	3	6	9
10	5	10	15
16	8	16	24
20+	10	20	30

Economic Threshold: Potential for economic injury exists when number of PLH per 10 sweeps exceeds height of stand expressed in inches. Threshold may be increased during periods of vigorous growth or decreased during periods of stand stress. Presence of PLH


Leafhopper Nymph

nymphs in abundance indicates high potential for injury. Action thresholds for resistant varieties are 3X the thresholds for regular varieties.

Management Options: Timely harvests will reduce PLH population development and impact. New seedings are especially vulnerable and should be monitored closely. The use of PLH resistant alfalfa is an alternative to the use of foliar treatments, although these cultivars should be watched closely during the establishment year for possible damage. For a list of labeled insecticides, see http://entomology.osu.edu/ag/ .


Leafhopper Adult

Bulletin 545 – 2011

ALFALFA

The pest complex affecting alfalfa includes a variety of insect populations of which one or more may become abundant enough to warrant insecticide treatment. In general, the alfalfa plant can tolerate a significant amount of feeding by a number of different insects before a rescue treatment is economically justified. However, insect pests such as potato leafhopper can cause significant injury to the alfalfa plant at very low population levels. Vigilance is needed to accurately determine when treatment is needed.

Following is a listing of insecticide products labeled for control of the pests that affect alfalfa (2011). Also listed in this section is information about formulation and rates of chemicals for specific pests. An asterisk (*) indicates that the use is restricted to certified applicators.

Pest	Product Name (Common Name)	Amount per Acre	Pre-Harvest Interval (days)	When to Treat
Potato Leafhopper	Ambush* 25W (permethrin)	3.2 - 12.8 oz.	0 - 14	Treatment for PLH is justified when the number of leaf-hoppers collected/10 sweeps is greater than the height of the alfalfa in inches. The PLH threshold should be increased 3 times for those varieties considered PLH resistant after the stand is established.
	Arctic* 3.2 EC (permethrin)	4 - 8 fl. oz.	0 - 14	
	Baythroid* XL (ß-cyfluthrin)	0.8 - 1.6 fl. oz.	7	
	Carbaryl (carbaryl)	1 qt. 4L	7	
	Chlorpyrifos* 4E AG (chlorpyrifos)	1 - 2 pt.	14 - 21	
	Cobalt* (chlorpyrifos & gamma-cyhalothrin)	7-13 fl. oz.	7 - 14	
	Dimethoate (dimethoate)	½ - 1 pt. 400 or 4EC ½ - 1 pt. Dimate 4EC	10 10	
	Govern* 4E (chlorpyrifos)	½ - 1 pt.	7 - 14	
	Grizzly Z* (lambda-cyhalothrin)	1.92 - 3.20 fl. oz.	7	
	Hatchet* (chlorpyrifos)	½ - 1 pt.	7 - 14	
	Imidan 70-W (phosmet)	1 - 1⅓ lb.	7	
	Kaiso* 24WG (lambda-cyhalothrin)	1.0 - 1.67 oz.	7	
	Lambda-Cy EC* (lambda-cyhalothrin)	1.92 - 3.20 fl. oz.	7	
	LambdaStar* (lambda-cyhalothrin)	1.92 - 3.20 fl. oz.	7	
	Lambda-T* (lambda-cyhalothrin)	1.92 - 3.20 fl. oz.	7	
	Lorsban* 4E (chlorpyrifos)	½ - 1 pt.	7 - 14	
	Malathion (malathion)	1½ - 2 pt. 5EC 1½ - 2¼ pt. 57 EC 1 - 2 pt. (8)	0 0 0 - 7	
	Mustang MAX* (zeta-cypermethrin)	2.24 - 4 fl. oz.	3	
	Nufos* 4E (chlorpyrifos)	½ - 1 pt.	7 - 14	
	PermaStar* AG (permethrin)	4 - 8 oz.	14	
	Permethrin* 3.2 EC (permethrin)	4 - 8 oz.	0 - 14	

Pest	Product Name (Common Name)	Amount per Acre	Pre-Harvest Interval (days)	When to Treat
Potato Leafhopper (cont.)	Perm-UP* (permethrin)	4 - 8 fl. oz. 3.2EC 6.4 - 12.8 oz. 25DF	14 14	
	Pilot* (chlorpyrifos)	½ - 1 pt.	7 - 14	
	Pounce* (permethrin)	6.4 - 12.8 oz. 25 WP	0 - 14	
	Proaxis* (gamma-cyhalothrin)	1.92 - 3.20 fl. oz.	7	
	Respect* EC (zeta-cypermethrin)	2.24 - 4 oz.	3	
	Sevin (carbaryl)	1 qt. 4F or XLR PLUS 1¼ lb. 80S	7 7	
	Silencer* (lambda-cyhalothrin)	1.92 - 3.20 fl. oz.	7	
	Stallion (zeta-cypermethrin & chlorpyrifos)	5.0 – 11.75 fl. oz.	7	
	Steward EC (indoxacarb)	9.2 - 11.3 fl. oz.	7	
	Taiga* Z (lambda-cyhalothrin)	1.92 - 3.20 fl. oz.	7	
	Tombstone Helios* (cyfluthrin)	0.8 - 1.6 fl. oz.	7	
	Warhawk* (chlorpyrifos)	½ - 1 pt.	7 - 14	
	Warrior* (lambda-cyhalothrin) Warrior II* (lambda-cyhalothrin)	1.92 - 3.20 fl. oz. 0.96 - 1.60 fl. oz.	7 7	
	Whirlwind* (chlorpyrifos)	½ - 1 pt.	7 - 14	
	Yuma* 4E (chlorpyrifos)	½ - 1 pt.	7 – 14	

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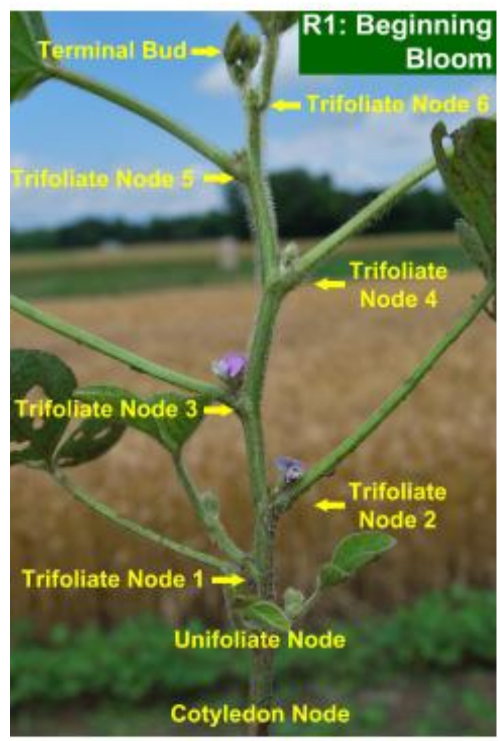
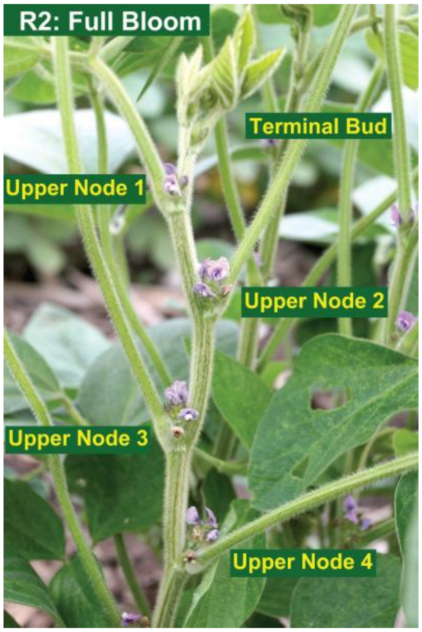
Soybean Early Reproductive Growth Stages

Shaun N. Casteel, Department of Agronomy
Purdue University Extension

Soybean development in Indiana ranges from just planted to flowering. As of the 3rd of July, 94% of the soybeans had emerged and 3% were blooming. The rate of bloom is about 10% less than the 5-year average and 20% less than last year's fast pace. Management decisions are based on the growth stage, the time of the year, and pest (weeds, insects, disease) occurrence. We will overview the early reproductive stages of soybean for proper scouting.



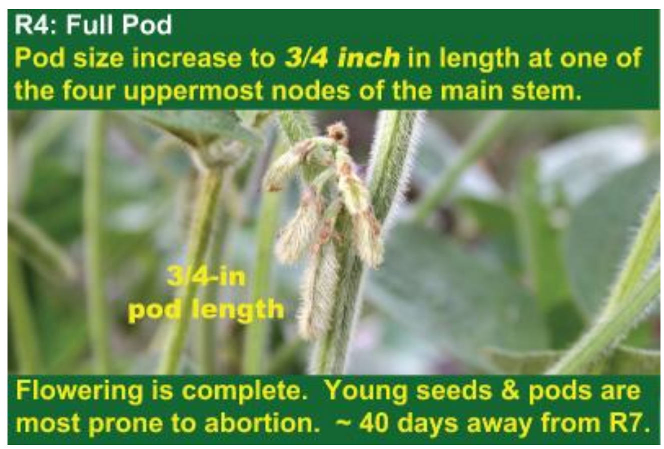
Reproductive Growth Stages:: **R1 – Beginning Bloom** is defined as any open flower(s) on any of the main stem nodes. Flowering normally begins at the third to sixth main stem node (including the cotyledon and unifoliate nodes). A node is the point where the lateral leaf branch attaches to the main stem. It will form a bump, which is helpful in determining the nodes of the cotyledons and the unifoliates. Cotyledons and unifoliates eventually abscise as vegetative growth progresses up the plant. These nodes will have a bump on opposite sides of the stem followed by alternating nodes of the trifoliates (see R1 picture). Flowering begins around six to eight weeks after emergence and it is both temperature and photoperiod responsive. Vertical root growth rate increases rapidly. Approximately 65 days away from the beginning of physiological maturity (R7).



The R1 soybean pictured has six trifoliates. The first flower was initiated at trifoliate node 2, which is node 4 when cotyledon and unifoliate nodes are included. This plant would be classified as V6 (vegetative stage 6) if there was no open flowers on the main stem.

R2 – Full Bloom is where any open flower is located at one of the two upper most nodes of the main stem. Plant has accumulated~25% of the total dry weight and ~50% of the total node number. Rapid dry weight and nutrient accumulation begins and continues until physiological maturity. Nitrogen fixation rate increases as does the plant's nitrogen demand. Approximately 60 days away from the beginning of physiological maturity (R7).

Growth Stage	**Duration Median**	**Duration Range**
	# of Days	
R1: Beginning Bloom	4	1 to 7
R2: Full Bloom	10	5 to 15
R3: Beginning Pod	10	5 to 15
R4: Full Pod	10	4 to 26
R5: Beginning Seed	15	11 to 20
R6: Full Seed	20	9 to 30



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Trochanter Mealybug: Perhaps a Reason for Yellowing of Soybeans

Christian Krupke and John Obermeyer, Department of Entomology
Purdue University Extension

It has been a couple of years since last mention, but the trochanter mealybug is still on the radar. This was first found in Indiana in 2009, though we have not had any reports since.

These are insects in the same group as aphids – plant-sucking, relatively sedentary creatures. Similar to other mealybugs in appearance, these small, whitish insects live beneath the soil surface and feed on plant juices. The above-ground symptoms are similar to K-deficiency – yellowing of foliage and stunting. If you have soybeans that exhibit these symptoms, we would recommend digging them up and inspecting for the whitish crawlers seen attached to the roots. Shaking the roots over dark-colored paper will make them more visible and the grayish-white insects will soon begin crawling around the paper. A hand lens may be required to confirm diagnosis.

Potassium deficiency symptoms could be a sign of mealybugs below (Photo credit: Ohio State University

Mealybugs, white fluffy mass on the soybean root

If you have the yellowing foliage and stunting symptoms in soybeans and think you have mealybugs, please let us know – we are hoping to obtain samples from around the state to find out the range and extent of this insect in Indiana.

Close-up of mealybugs on soybean root

Ron Hammond and Andy Michel at Ohio State are leading a project to find out more about these insects in our area (eastern corn belt) and determine their role as a potential pest. Interesting questions include whether they are a primary cause of the yellowing, or are they attacking previously-stressed plants? We are hoping to get an idea of how common these insects are throughout the state, and whether geography, soil type, maturity etc., play significant roles. Please contact us ckrupke@purdue.edu or obe@purdue.edu if you have fields that may be candidates for this project.

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