From the Editor: Special Wheat Issue and Subscription Information for the 2008 WCU

This special issue of the Weekly Crop Update focuses on a crop of particular interest right now — wheat. Gordon Johnson has posted many of these articles on his blog, but we wanted to make them available to a wider audience. (Gordon’s blog is at http://www.kentagextension.blogspot.com)

The first regular Weekly Crop Update for 2008 will be issued on March 28. The WCU will then be posted on the web, and sent to mail and fax subscribers by 4:30 each Friday until September 19. The cost of mail or fax subscription is $40. You can subscribe by returning the form available online at: http://ag.udel.edu/extension/wcu/subscription/2008WCUflyer.pdf

Crop Update is also available for free online at the following web addresses:
http://ag.udel.edu/extension/wcu/index.htm
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For those of you who access the newsletter via the internet we offer to send a weekly email reminder which will let you know when the WCU has been posted online, provide a link directly to the current issue, and give you a taste of the headlines. If you would like to receive the email reminder or if you experience problems during the season with the online WCU please contact me at emmalea@udel.edu or (302)-856-7303.

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Wheat Pests

Management of Hessian Fly in the Spring - Joanne Whalen, Extension IPM Specialist; jwhalen@udel.edu and Gordon Johnson, Extension Ag Agent, Kent Co.; gcjohn@udel.edu

Last fall, we received a number of calls regarding the need to control Hessian fly in wheat. Although we have not seen or heard of any significant damage from fall infestations, we continue to receive questions about the possibility of problems from the spring population. If stands appear thin and you are checking fields for a reason, you should consider Hessian fly as one of the possible culprits. Volunteer wheat could also be a source of spring infestations. Although the adult fly is not a strong flyer, production fields near volunteer fields that were heavily infested last fall could be at risk for a spring infestation. When the Hessian fly adults emerge from the flaxseed this spring they will seek a host upon which to lay their eggs. Wheat is the principal host plant of the Hessian fly but it may also be found on rye, barley and other wheat-related species.

Although we have not had experience controlling spring infestations with a foliar insecticide, information from North Carolina and Georgia indicated that it can be done but it will not be easy to time applications. Information from North Carolina indicates that if applied timely, Warrior® will provide control. (See link to North Carolina publication).
The following information from Dr. John Van Duyn’s Hessian Fly Management fact sheet provides information on factors to consider when attempting control of a spring infestation with a foliar insecticide. http://www.ces.ncsu.edu/plymouth/pubs/ent/HFLYupdate03.html

You must determine when the flies will emerge and begin to lay eggs. If a pyrethroid is applied as the flies emerge and lay eggs, a high level of control may be accomplished. In North Carolina, this occurs in early March; however, we do not have any experience in our area. It will be totally dependent upon weather, particularly temperature.

In this fact sheet, two items are mentioned to help time spring treatments:

1. Look for infested shoots and check for the flaxseed (pupal stage) to determine if a field will have high fly numbers. Squeeze the flaxseed and if they are creamy white it is too early to treat. If they appear orange they are about ready to emerge as adults. An application to a field at increased risk might be warranted. (Warrior label states make an application when adults emerge.)

2. You can also scout fields for eggs which will be very time consuming. Eggs are very small (about half the size of a period), almost translucent, and are laid end to end in a row between leaf veins on the upper surface of wheat leaves. Magnification will probably be needed although someone with experience may be able to see the eggs in direct sunlight. As a general guideline, a treatment may be justified if there are four or more eggs per leaf.

Information modified for Delaware from John Van Duyn’s North Carolina Fact Sheet on Hessian Fly Management and from “Questions about Spring Populations of Hessian Fly Associated with Infested Volunteer Wheat” By Doug Johnson in the February 11, 2008 issue of the Kentucky Pest News from the University of Kentucky College of Agriculture.

NOTE- Hessian Fly Alert in North and South Carolina - This new information was received from Ames Herbert in VA the afternoon of Feb 28 regarding high levels of Hessian fly in wheat in North and South Carolina. Information provided by Dr. John Van Duyn in North Carolina indicates that, in general, infested fields have been characterized by one or more factors: 1) planted with HF susceptible wheat variety 2) planted without Gaucho or Cruiser seed treatment 3) planted wheat after wheat, especially no-till 4) seedlings emerged before November 5) wheat planted close to the last wheat crop. Although we have not had reports from Delaware, if these situations fit any of your wheat fields, be sure to go to the following link for new information on timing treatments (http://www.sripmc.org/Virginia/View.cfm?lngNewsID=484)

Management of Aphids: Barley Yellow Dwarf Transmission and Direct Aphid Damage in the Spring - Joanne Whalen, Extension IPM Specialist; jwhalen@udel.edu, Bob Mulrooney, Extension Plant Pathologist; bobmul@udel.edu and Gordon Johnson, Extension Ag Agent, Kent Co.; gcjohn@udel.edu

We are starting to receive questions regarding the need to spray for aphids in late winter and early spring in regards to both barley yellow dwarf virus (BYDV) transmission and direct aphid damage. Although fall conditions were favorable for aphids (warm and dry), we did not see an increase in populations in many wheat fields until late November and early December. In addition, there have been reports of a second period of population increase in late January and early February.

All of the aphids found in Delaware wheat fields are capable of transmitting BYDV. However, the virus strains that cause barley yellow dwarf are generally transmitted to the wheat in the fall or early spring before growth stage 4. For aphids to successfully transmit the virus in the most efficient manner, they normally need between 12 and 30 hours feeding to acquire the virus, and then 4 or more hours of feeding to transmit it. However, aphids are capable of acquiring the virus after feeding on infected plants for only 30 minutes. Once they acquire the virus and it is allowed to incubate for one to four days, they
can transmit it to healthy plants for the rest of their life.

Although we have seen isolated sections of fields with high incidences of BYDV in the past, overall it has not been a widespread problem in Delaware. Typical symptoms of infection include stunting, plant yellowing and erect leaves with yellowish to reddish-purple tips. Early spring infections can result in purpling of flag leaves that resembles phosphorus deficiency. Differences in BYDV incidence from one field to another may be due to differences in efficiency of aphid transmission of the virus among fields, the source and strain of the virus being transmitted, difference in aphid mobility and feeding habits, the age and susceptibility of plants when infected, and differences in weather conditions from one field to the next.

Yield reduction due to BYDV is generally greater when infections occur in the fall compared to spring infections; therefore, the greatest concern is past. BYDV tends to be most severe in fields planted before the fly-free date at a time when aphid populations are high and aphids are still actively feeding. There is no high level of resistance to BYDV in wheat cultivars. Recent information from Alabama, Georgia, Kentucky and Virginia regarding foliar sprays has indicated that: (1) planting time and late spring (March) sprays for aphids had no effect on BYDV incidence and wheat yield and (2) well timed fall aphid sprays can provide almost complete control.

Although aphids can cause direct damage to wheat (in addition to BYDV transmission), this type of damage generally occurs when: (1) green bug aphid populations are heavy in the fall, (2) plants are drought or nutrient stressed, or (3) spring conditions are cool and dry, resulting in economic levels of aphids in wheat heads. Since the green bug aphid secretes a toxic substance into the plants, extensive feeding in the fall and early spring may result in circular yellow to brown spots with dead spots in the center. A lack of moisture in midwinter and a cool, dry spring can result in more significant damage from aphids in the spring. The most significant damage occurs when large numbers of aphids feed on the grain head causing shiveled or blasted heads.

The most common species in late spring is the English grain aphid. Heavy head infestations can reduce yields by 13%. Scouting is especially valuable in predicting problem infestations because English grain aphids are usually found in heads of plants that were infested in the lower canopy earlier in the season. Although natural enemies can keep aphids under control, cool dry weather in the spring often allows aphids to reproduce rapidly whereas their natural enemies reproduce slowly. Beneficial insects that attack aphids reproduce slowly at temperatures below 65°F, whereas aphids can rapidly increase when temperatures exceed 50°F.

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Begin checking for aphids on a weekly basis in mid-March. On tillering grain, examine 5 linear foot of row in at least 10 areas of a field. Examine areas that exhibit plant stress. At each site, count or estimate the number of aphids per linear foot of row. During heading, check 50 to 100 heads throughout a field. While counting aphid populations, be sure to check for natural enemies.

The following thresholds should only be used as a general guideline. With the recent increase in wheat prices, these numbers may need to be reduced. Also, these thresholds do not apply if you are trying to manage aphids for BYDV transmission. Since almost undetectable levels can transmit virus, entomologists in the South feel that there really is no threshold for aphids when you are dealing with BYDV transmission.

After spring growth resumes until hard-dough stage:
- 100/row-foot, plants 3-6 inches tall
- 200/row-foot, plants 7-10 inches tall
- 300/row-foot, plants 11+ inches tall

Heading - At grain head emergence, a treatment may be necessary once populations exceed 20-25 per head. If the crop is approaching the hard-dough stage and there is good beneficial insect activity, no control should be needed. Often a ratio of one predator to every 50 to 100 aphids is sufficient to achieve biological control.
A number of insecticides are labeled for aphid control in wheat including: Baythroid, Baythroid XL, Dimethoate 4E, Lannate LV, Mustang MAX, Penncap-M, Proaxis, and Warrior. Check the labels for restrictions and harvest intervals. Note that these are materials for wheat, several of these insecticides do not have barley or other small grains on their labels.

Information extracted from “Barley Yellow Dwarf Virus and Aphids on Wheat” by Ron Hammond, Pierce Paul, Andy Michel, and Bruce Eisley in the February 5, 2008 - February 20, 2008 edition of the Crop Observation and Recommendation Network newsletter from the Ohio State University Extension and Factsheets on aphids in small grains from Virginia Tech and the University of Delaware.


Winter Grain Mites - Joanne Whalen, Extension IPM Specialist; jwhalen@udel.edu and Gordon Johnson, Extension Ag Agent, Kent Co.; gcjohn@udel.edu

A number of fields were sprayed for winter grain mites in Virginia in late December and early January. In early February, a number of fields were also sprayed on the eastern shore of Maryland. Although we are now past the first generation, a second generation in March and April could cause additional damage. The following is an overview of this pest including pest identification, biology/life history and management options written by Dr. Ames Herbert from Virginia Tech.

“Winter grain mites attack small grains, including wheat, barley, and oats. Other hosts include grasses, especially bluegrass, bentgrass, ryegrass, and fescue. The mite also infests and damages legumes, vegetables, ornamental flowers, cotton, peanuts, and various weeds. Adult mites are about 1 mm long, black, with red legs and are fast moving. They quickly run to ground cover when you approach plants. As the name implies, they are winter pests. There are two generations per year. The first develops after the onset of favorable temperature and moisture conditions in late September and October with populations peaking in December and January. The second generation develops from eggs laid by the first generation reaching maximum infestation density in March and April. Populations then decrease as temperatures exceed the range of tolerance. The females of this generation lay aestivating or over-summering eggs.

“Temperature and moisture are the most important factors influencing mite development and abundance. Cool rather than warm temperatures favor their development. Egg-laying is heaviest between 50° and 60°F; the optimum conditions for hatching are between 44° and 55°F. When temperatures drop below or rise above these ranges, the mites stop feeding and descend to the ground or burrow into the soil. Mite activity in the spring drops rapidly and the eggs fail to hatch when the daily temperature exceeds 75°F.

“Aestivating (over-summering resting stage) eggs do not hatch in the fall until rains provide adequate moisture. On hot, dry days it may be necessary to dig into the soil to a depth of four or five inches to find mites. The mites are not harmed by short periods of sleet or ice cover or by ground frozen to a depth of several inches. The larvae become very active soon after hatching and begin to feed on the sheath leaves or tender shoots near the ground. The larvae as well as the adults feed higher up on the plants at night or on cloudy days. As the sun rises, the mites descend the plants and seek protection during the hot part of the day on the moist soil surface under foliage. If the soil is dry and there is little foliage cover, they dig into the soil in search of moisture and cooler temperatures. At sunset and thereafter the plants become covered with feeding mites where, with the aid of a searchlight, they can be observed feeding at all hours of the night.

“Dispersion from field to field may occur by transportation of aestivating eggs or mites on grain stubble or leaves, on soil adhering to implements that are moved about, or on forage or straw carried from infested fields in livestock feeding operations. Aestivating eggs may also be
transported on debris by wind, and local
distribution may occur by adult migration. Such
migrations to grain fields may take place from
fencerows or other uncultivated areas. Heavily
infested fields appear grayish or silvery, a result
of the removal of plant chlorophyll by mite
feeding. When high infestations feed on the
plants for several days, the tips of the leaves
exhibit a scorched appearance and then turn
brown, and the entire plant may die. These
mites do not cause the yellowing characteristic
of spider mite feeding.

“Many of the infested plants do not die, but
become stunted and produce little forage or
grain; damage on young plants, however, is more
severe than on large, healthy ones. Damage may
also be greater in plants stressed by nutrient
deficiencies or drought conditions. There are
two types of damage to the small grains,
namely, reduced amount of forage throughout
the winter and reduced yields of grain in the
spring and summer. Cropping practices have a
marked effect upon the occurrence and damage
caused by the winter grain mite. Injury by this
mite may be prevented by crop rotation, that is,
by not planting small grains more than two years
in succession.”

Although we have no experience with winter
grain mite control, materials that have appeared
to provide control in areas to our south include
the pyrethroids (Warrior, Mustang MAX) and
certain organophosphates (dimethoate). Be sure
to follow the rates and usage restrictions on
the labels.

Cereal Leaf Beetle - Joanne Whalen,
Extension IPM Specialist; jwhalen@udel.edu and
Gordon Johnson, Extension Ag Agent, Kent Co.;
gcjohn@udel.edu

In recent years, we have had fewer problems
with cereal leaf beetle due to a combination of
good biological control programs and spring and
summer weather conditions. However, each year
we still have fields with economic damage so you
still need to scout your fields in the spring as the
cereal leaf beetle larvae can cause heavy
damage and crop losses if not controlled when
present.

As temperatures increase in spring (April
normally), we begin to see adult cereal leaf
beetles, especially along field edges that border
woods or in protected areas. Adult beetles feed
along the veins of grain leaves leaving
characteristic narrow linear holes parallel to the
leaf veins. Although they do not cause much
damage, you should routinely check these areas
since this is where you are likely to find the first
eggs and larvae. Larvae can feed heavily on
leaves, especially flag leaves, and can quickly
cause significant yield reductions if they exceed
the economic threshold level.

Be sure to begin sampling fields in April for
cereal leaf beetle activity. In recent years, the
threshold for cereal leaf beetle has been
adjusted to include sampling for eggs, especially
in high management wheat fields or areas where
problems were experienced the previous year.
The eggs are elliptical, about 1/32 inch long,
orange to yellow in color when first laid,
changing to a burnt orange prior to hatching.
Check our website for pictures of cereal leaf
beetle adults, larvae and eggs:
http://www.udel.edu/IPM/facts/clbpictures.htm

Generally, eggs are laid singly or in small
scattered groups (end-to-end) on the upper leaf
surface and parallel to the leaf veins. Cereal leaf
beetle larvae are brown to black, range in size
from 1/32 to 1/4 inch long, and eat streaks of
tissue from the upper leaf surface. Since cereal
leaf beetle populations are often unevenly
distributed within the field, it is important to
carefully sample fields so that you do not over or
under estimate a potential problem. Eggs and
small larvae should be sampled by examining 10
tillers from 10 evenly spaced locations in the
field while avoiding field edges. This will result
in 100 tillers (stems) per field being examined.
Eggs and larve may be found on leaves near the
ground so careful examination is critical. You
should also check stems at random while walking
through a major portion of the field and
sampling 100 stems. The treatment threshold is
25 or more eggs and/or small larvae per 100
tillers. If you are using this threshold, it is
important that you wait until at least 50% are in the larval stage (i.e. after 50% egg hatch).

**True Armyworms and Grass Sawfly** - Joanne Whalen, Extension IPM Specialist; jwhalen@udel.edu

Each year economic levels of true armyworm and grass sawfly can be found in fields throughout the state. Field scouting is the only way to determine if economic levels are present in your fields. The following information is a review of the biology and life history of grass sawfly and true armyworm in wheat.

Grass sawfly adults emerge in early April and begin to lay eggs in the leaf margins of small grains. Most egg-laying is complete by early May. The first larvae can be found by late April feeding on the lower leaf blades. Mature larvae can be distinguished by their solid green color, amber head with a brown band and many legs. Larval development takes approximately 21-30 days. By mid-June, larvae burrow into the ground and begin a period of summer diapause (hibernation). Sawfly larvae prefer to feed on the stems and are potentially more damaging than armyworms. Larvae begin to climb and feed on stems when the larvae are half grown and the grain is in the tiller to head stage. Stem clipping often occurs before leaf feeding is complete and/or the grain reaches physiological maturity. Head clipping often peaks before peak armyworm damage.

True armyworms over-winter as partially grown larvae in the soil and in plant debris of crops and woodlands. Moths can begin emerging in early April with a peak by late April. Egg laying is often concentrated in weedy and lodged areas of a field. The first small larvae can be found on lower leaf tissue from late April to early May. Larval development takes 20-28 days. In late May through June larvae often move to other crops. Mature larvae burrow into the soil or under debris to pupate. Three to four generations occur each year, but only the first one attacks small grains. Young larvae (less than 1/2 inch long) generally feed on the upper leaf surface. Larger larvae feed heavily on the leaf blades and weeds. The last instar (1.5 inches long and greater) will consume 80 percent of all the plant material eaten during their larval development. This stage lasts six to eight days before moving into the soil to pupate. Heavy defoliation of the flag level can result in significant economic loss. Unlike the sawfly, armyworms begin head clipping only when all vegetation is consumed and the last succulent part of the plant is the stem just below the grain head. Larvae can feed on the kernel tips of wheat, resulting in premature ripening and lower test weight.

**Wheat Diseases**

**Powdery Mildew Questions and Answers** - Bob Mulrooney, Extension Plant Pathologist; bobmul@udel.edu and Gordon Johnson, Extension Ag Agent, Kent Co.; gcjohn@udel.edu

Powdery mildew has been a major disease in wheat in DE. However, we have seen relatively little in the last 2 years. Why?
The reason is the lack of favorable weather for infection and subsequent disease development. The weather has been drier and the relative humidity in the spring has been lower due to windier weather.

In what types of growing seasons should we expect more powdery mildew?
The seasons when powdery mildew is troublesome are those that are favorable for luxuriant fall growth followed by cool, wet springs.

What impact can powdery mildew have on yield if left untreated?
Powdery mildew can have a tremendous negative impact on yield if the disease is able to infect a high percentage of the leaf area on the three topmost leaves.

How do powdery mildew epidemics start and progress in a wheat crop?
Powdery mildew oversummers on old infected leaves from the previous crop. The fungus produces sexual spore producing bodies in the old infected leaves that protect these spores until fall when they forcibly eject the spores into
the air and they are carried to newly planted wheat. These primary infections occur in the fall primarily and the fungus overwinters on the infected leaves. In the spring the fungus resumes growth and begins producing large numbers of asexual spores called conidia that spread the disease within the field and to nearby fields. The amount of disease that we see depends on the weather, the nutritional status of the crop and its resistance to powdery mildew. Powdery mildew is favored by temperatures between 60 and 75 °F and periods of high relative humidity.

**When is powdery mildew control necessary?**
Powdery mildew control becomes necessary if there is ample infection present on the lower leaves, 5-10 % of the fully expanded upper leaves are infected and the weather conditions are favorable for continued infection.

**Do fall infections impact spring levels?**
In most cases, yes. Fall infections can lead to increased levels in the spring. But if weather is not favorable and the variety is moderately resistant to resistant no further infection may occur.

**How should a farmer scout for powdery mildew?**
Growers are encouraged to begin weekly scouting for powdery mildew at Feekes stage 5 (tillers strongly erect) just before jointing begins (Feekes GS6). Examine plants from 5-10 randomly selected areas within the field.

**What are the thresholds for applying controls?**
As mentioned before only apply a foliar fungicide when 5-10 % of the fully expanded upper leaves are infected and the weather conditions are favorable for continued infection.

**What are the timings for controls?**
The timing for application of fungicides is usually from flag leaf emergence through head emergence (GS 10.5), but can be applied as early as jointing if necessary.

**Many varieties have some resistance to powdery mildew. Describe the rating systems for powdery mildew in wheat varieties.**
Usually Cooperative Extension sources of information will use a scale for rating powdery mildew and other diseases. The scale usually is VS= very susceptible, S= susceptible, MS= moderately susceptible, MR= moderately resistant and R= resistant. Usually it’s the varieties that fall into the moderately susceptible rating and lower that require fungicide treatment when weather conditions are favorable for disease.

**Where can farmers find information on the powdery mildew resistance levels in their varieties?**
Extension publications and Extension and company websites are good sources of information on disease reactions of wheat varieties. You can find the ratings at this site on page 3-22 (PDF file) [http://www.ext.vt.edu/pubs/pmg/fc3.pdf](http://www.ext.vt.edu/pubs/pmg/fc3.pdf)

Sometimes varieties that are listed as having powdery mildew resistance still get the disease at threshold levels. Explain.
This can occur especially in the spring either just at jointing or later if excessive amounts of nitrogen have been applied. The succulent growth is much more susceptible to infection, overcoming the genetic resistance in the plants. The other event that can happen is a change in the fungus population. Genetic changes in the fungus can occur, sometimes rather quickly (one season), that overcome the resistance genes in the wheat variety. This allows the fungus to infect a previously resistant variety. This happens when you have a fungus that reproduces sexually like powdery mildew and has the potential to produce mutations that overcome the resistance genes. The most recent case of this was loss of resistance in ‘Roane’. The resistance really isn’t “lost” the fungus overcomes the resistance genes bred into the variety rendering it susceptible.

**Management strategies for powdery mildew include planting resistant varieties, using certain seed treatments, and foliar applied fungicides. How effective are each of these?**
Planting varieties with ratings of resistant to moderately resistant should prevent the need for other controls. It is the best and least expensive control. However, if moderately susceptible or susceptible varieties are grown fungicide seed treatments containing Baytan or the high rate of
Dividend will reduce powdery mildew levels by preventing fall infections. Foliar fungicide applications are very effective if the right fungicides are applied at the right time on susceptible varieties.

**If foliar fungicides are needed, what products are available for control? What are the critical timings? How late can they be applied? When should they not be applied?**

At the present time propiconazole (Tilt, PropiMax), trifloxystrobin + propiconazole (Stratego), azoxystrobin + propiconazole (Quilt), azoxystrobin (Quadris), pyraclostrobin (Headline) are the best products for powdery mildew control. Tilt, PropiMax, Quilt and Stratego would all be rated as very good to good for control of powdery mildew. All these fungicides can be applied up to head emergence except for PropiMax which can only be applied up to GS 8 (ligule of the flag leaf has emerged). The critical timing for application is from flag leaf emergence through heading.

**Timing for powdery mildew control is most commonly earlier than for other wheat head and leaf diseases. Explain.**

Timing is earlier because this disease is favored by cool conditions that we typically see in early spring depending on the season.

**Any final thoughts on powdery mildew in 2008?**

One of the advances in breeding for resistance to powdery mildew is the addition of genes that provide slow mildewing and the increase in varieties with mature plant resistance. Slow mildewing results in some powdery mildew being present throughout the plant canopy but infection levels increase very slowly resulting in very little to no yield loss. Adult plant resistance is increased resistance in the uppermost fully expanded leaves often just the flag leaf (sometimes it’s even triggered by temperature) but what you see is little development on the upper fully expanded leaves. This is important to know so that fungicides are not applied needlessly when light infections are present.

I would end the discussion by saying that disease control is especially important given the increased value of wheat, but remember that fungicide applications protect the yield that is present and at least as fungicides are applied on Delmarva, they do not increase yield. Fungicides protect what inputs have already been applied. The economics of fungicide application are most favorable for fields with good to excellent yield potential (>60 bu/A) and when powdery mildew is a threat to reaching the full yield potential of the crop.

Questions by Gordon Johnson, Extension Agriculture Agent, UD and responses by Bob Mulrooney, Extension Plant Pathologist, UD.

**Septoria and Stagonospora Diseases** - Bob Mulrooney, Extension Plant Pathologist; bobmul@udel.edu

The following article was reprinted with modifications for Delaware from Ohio State University Extension Fact Sheet, Plant Pathology, “Septoria tritici Blotch and Stagonospora nodorum Blotch” by Patrick E. Lipps and Dennis Mills, The Ohio State University.

Septoria and/or Stagonospora diseases can be found in nearly every wheat field in Delaware at some time during the growing season. These diseases have the potential to cause serious losses if the environmental conditions are favorable for their spread during May and early June. In years when wet and windy weather prevails during mid to late spring, losses can be as high as 20 to 30%. Greatest yield losses occur when the flag leaf and the two leaves below the flag leaf become infected by the time the wheat flowers in May. If these leaves are killed before the soft dough stage, the grain will be lightweight and shriveled. Septoria (Stagonospora) glume blotch is a leading cause of poor quality wheat seed in Delaware. It affects germination of seed and causes seedling blight when infected seed are planted without an appropriate seed treatment fungicide.

**The Fungi Causing Leaf Blotch Diseases**

Two different fungi cause leaf blotch diseases in the mid-Atlantic area: *Stagonospora nodorum* (*Septoria nodorum*), and *Septoria tritici*. 
Differences in spore shape and size separate Stagonospora from Septoria. *Septoria nodorum* was recently renamed *Stagonospora nodorum* and is the most current and correct name of the fungus that causes glume blotch. It is confusing but both will be used in this article.

In Delaware, *Stagonospora nodorum* (*Septoria nodorum*) is the most important of the two diseases. Occasionally *Septoria tritici*, which is often called speckled leaf blotch, can be found but it has never caused yield losses here. *Stagonospora nodorum* causes disease on leaves and glumes of the head, whereas *Septoria tritici* attacks leaves only.

**Symptoms of Speckled Leaf Blotch Caused by *Septoria tritici***
Wheat plants are susceptible to infection at any stage of development from seedlings to adult plants. Symptoms are usually detected on lower leaves in the fall and early spring, but as temperatures rise in May, spread of *Septoria tritici* blotch decreases. Thus, *Septoria tritici* blotch is more common on lower leaves of plants than upper leaves. The initial symptoms are yellowish or chlorotic flecks usually on the lowermost leaves, especially those in contact with the soil. These flecks enlarge into irregular lesions, brown-to-reddish brown in color. As the lesions age, the centers become somewhat bleached with gray or ash-white centers. During this time, small, dark brown to black specks form in the center. These are pycnidia or spore producing bodies of the fungus. The presence of small, black pycnidia in lesions is the most reliable character for identifying the disease.

**Symptoms of *Stagonospora nodorum* (Septoria) Leaf and Glume Blotch**
Symptoms usually appear within two or three weeks of head emergence. Leaf lesions begin as very dark brown flecks or spots, sometimes with a yellow halo. These small irregular lesions expand into oval light brown lesions with dark brown centers. On the wheat heads the lesions begin as either grayish or brownish spots on the chaff, usually on the upper third of the glume. As the lesions enlarge, they become dark brown and the centers turn grayish-white in color as tiny brown pycnidia develop within them. These pycnidia are difficult to see without the aid of a magnifying hand lens.

**Disease Cycles of Blotch Diseases**
The fungi survive on wheat stubble and other wheat residues and volunteer wheat plants. They survive from one crop to the next as mycelium (fungus threads) in living, volunteer plants or as pycnidia on wheat residues.

The fungi can survive up to three years in wheat stubble on the soil surface. *S. nodorum* infects seed and is seed borne. Studies in New York indicate that seed infection above 3% significantly contributes to fall infection of seedlings resulting in survival of the pathogen over winter and the development of epidemics in the spring. Thus, seed borne inoculum can be a sufficient source of the fungus for epidemic development.

Leaf infections require 6 hours or more of leaf wetness. After initial infection, 10 to 20 days are required before new spores are released from developing pycnidia. The wheat plant is more susceptible to infection by *S. nodorum* at later growth stages, usually during and after heading, whereas *S. tritici* is more common on plants earlier in the spring during stem elongation to flag leaf emergence. *S. tritici* is most aggressive between 50° and 68°F (15° to 20°C), whereas *S. nodorum* is most aggressive between 68° and 81°F (20° to 27°C).

Spread of both fungi is favored by wet, windy weather. During periods of wet weather, these fungi spread rapidly from the lower leaves to the upper leaves. Dry weather not only prevents infections, but also stops the development of lesions and pycnidia.

**Management of Septoria Diseases**
- Since these leaf blotch pathogens can survive in infested wheat residues for several years, a rotation where wheat is planted in only 1 of 3 years is recommended.
- Destroy volunteer wheat, rye, barley, and wild grasses in the field before planting.
- Varieties differ greatly in their reaction to infection by *Stagonospora nodorum* and
**Septoria tritici.** In areas with a history of high disease pressure, plant varieties resistant to these diseases. All varieties are susceptible to infection to some extent, but planting varieties with good levels of resistance will limit yield losses. Varieties with resistance to *Stagonospora nodorum* leaf blotch may be susceptible to the glume blotch phase of the disease and vice versa. Select varieties with moderate resistance to both phases of this disease where possible.

- Plant certified, disease-free seed that has been treated with a recommended, seed-protectant fungicide. See the agronomic crop pest guide for recommended seed treatment fungicides.

- Sow winter wheat after the Hessian fly-safe date recommended for your county.

- Fertilize wheat based on a soil test. Adequate amounts of N, P, and K should be applied at planting to insure good seedling growth in the fall. Spring top dress nitrogen at moderate levels to achieve your yield goal, but excessively high rates of nitrogen will make the field prone to damage by Stagonospora blotch. Avoid high rates of nitrogen that would increase the potential for lodging.

- Chemical control of Stagonospora leaf blotch may be necessary when environmental conditions favor epidemics. Obtain current fungicide recommendations from your local University of Delaware Extension office. Quadris, Tilt, Propimax, Stratego, Headline, and Quilt (where labeled) all are effective on these diseases.

- Irrigation does not always show an increase in yield. In fact, irrigation at the wrong time could potentially reduce yields. On average, a 3-7 bushel increase in yield has been seen with irrigation looking at yield maps. At today’s prices, a 7 bushel increase would be over $60 more per acre. This must be weighed against the cost of irrigation. Fuel costs alone to apply 1.5 inches of water would be $19 per acre.

- Wheat water use is minimal until jointing, when the plant has some height to it. At jointing, wheat will use between 0.2 and 0.25 inches of water per day. At boot and heading stages, wheat is using around a quarter of an inch a day, and during grain development through the milk stage, wheat will use about 3 tenths of an inch a day. Once wheat hits the dough stage, water use drops off considerably.

- Wheat can be very deep rooted, depending on the soil type. If you do not have restrictive layers in your soil, wheat may be able to draw moisture from as deep as 3 feet. In our silt loam soils, this means that there is as much as 6 inches of available moisture for the wheat crop if the soil moisture has been recharged by rainfall. In a loamy sand soil, there would be less than half this amount stored. In a soil with a restrictive layer or with an acid subsoil, available soil moisture may be reduced again by half. What is key is to know how much soil moisture is left in the soil at jointing. This is when the decision to begin an irrigation program should start.

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**Wheat Water Use**

**Irrigating Wheat** Gordon Johnson, Extension Ag Agent, Kent Co.; gcjohn@udel.edu

Wheat irrigation is a subject of considerable discussion. Does it pay? When should wheat be irrigated? How much should wheat be irrigated? When should you stop irrigating wheat? The following are some thoughts on the subject.
To make a decision on irrigating, check the soil moisture just prior to jointing or at jointing. If it has been a dry spring so available soil moisture is low in both the surface soil and the subsoil, irrigation should begin. Years when we go through the winter with reduced subsoil moisture and winter rainfall is not enough to recharge the subsoil completely are the most likely years when irrigation will be needed on wheat. Sandy loams, loamy sands, and soils with restrictive layers are the most likely candidates for irrigation.

Irrigation at jointing should be done to apply as much water as practical. The goal is to recharge soil moisture to the effective rooting depth. If rainfall is not received, a second application should be made at flag leaf to boot stage. Irrigation during flowering should be avoided to reduce head diseases such as head scab. However on a very droughty spring, irrigation should also be considered after flowering is complete. A final irrigation or two may be necessary after flowering is complete if the drought persists. This will help to complete grain fill and is most likely to be necessary on loamy sand soils in a spring drought. Apply at the maximum rate the soil can absorb at all irrigation timings.

Growers should consider a more aggressive fungicide program if they are irrigating to protect against foliar and head diseases.

Nitrogen Applications to Wheat in a Cover Crop Program that Restricts Fertilization until Mid-March 2008 - Richard Taylor, Extension Agronomist; rtaylor@udel.edu

A number of fields were seeded this past fall to winter wheat after being enrolled in cover crop programs that excluded fall applied nitrogen (N). Some fields were seeded quite early in the fall and tillered profusely while other fields were seeded late enough or in dry soil so fall growth, and especially tiller production, was very limited. As late-planted or untillered fields begin to emerge from winter dormancy, N availability will be critical to encourage rapid growth and tiller development in the spring of 2008 for those fields that will be allowed to be harvested for grain. Virginia Tech’s publication entitled “Intensive Soft Red Winter Wheat Production” provides some valuable information to assess the N status of wheat fields in early spring.

To use the information, growers need to determine the average number of tillers (a tiller is a shoot showing at least three leaves visible) per square foot. At normal planting populations, plants often only have two or three tillers present (counting the primary shoot). To assess the tiller count in your field, take a yard stick or dowel rod cut to a 3-foot length and randomly place it next to a typical looking row in at least five (preferably 10 to 20) places well-spaced out around the field. In each section of row, count and record the number of tillers with three or more leaves that are found within the 3-ft section of row. After you’ve counted and recorded the number of tillers in 3-ft of row from at least five locations, add up the number of tillers and divide by the number of locations to get average tiller count (per 3-ft of row). To calculate tiller density multiply the average tiller count by 4 and divide the result by the row width in inches and this will give you tiller density (tillers per square foot). For example in 5 locations you find there are a total of 450 tillers, so 450 divided by 5 equals 90 tillers, on average, per three feet of row. If you multiply 90 by 4 and divide this by the row width (7 inches), your tiller density comes to 51.4 tillers per square foot.

If the tiller density is 60 or less, you need at least 60 lbs N/acre applied as early as the cover crop contract permits. Split applications—one at green-up or around Zadoks stage GS 25 and one at Zadoks GS 30-31 or Feekes GS 4-5 or pseudo stem erection or first node detectable—can increase yields by 5 to 10 bushels per acre but the site characteristics often limit a growers options for N splitting. If you have a tiller density of 100/ft² or more, no N is needed at this stage (green-up or GS 25); but if the tiller count is 75/ft², you will need 40 lb N/acre. An N rate of 25 lb/acre will be needed if the tiller count is 85/ft². You will need to evaluate each field for the likelihood that you will have time and the ability to return and apply a second application of N to the field. If a second split is
not possible, you may decide to apply all required N as early as permitted by the cover crop contract. With the high price of N fertilizer, you should consider the likelihood that the stand will produce maximum yields or whether the yield goal should be adjusted down to a realistic level. The lower the tiller count late in the season, the less likely the field will produce maximum yield for the variety and soil type.

**Wheat Nutrition - Adding an Extra Touch**
*Richard Taylor, Extension Agronomist; rtaylor@udel.edu*

With the current wheat price, many producers may be thinking of adding extra nitrogen (N) to push yield potential to the maximum. The high cost of N actually could limit any gain from this approach since we know that in most cases what limits yield are the environmental (water—primarily—and temperature) conditions during grain fill and not N availability. Wheat yield, like corn, responds to additional N in a way that for each additional pound of N applied the incremental increase in yield becomes smaller and smaller until the point of maximum economic yield (MEY). After the MEY point, although more N may increase yields slightly, the extra N actually reduces net profit per acre.

So, what extra touch can be used to increase yield. In a four year study, Bob Uniatowski and the author found that a split application of N could on average add an extra five or more bushels to yield even at the highest N rate applied in the study (160 lb N/acre). Although the actual proportion of N applied at each split wasn’t as important as using a split application, the rate of N for the first split (mid-February to green-up in March) should be larger than the second split (growth stage Feekes 5, first node evident above the soil surface) if the plants are not yet at full tiller, were planted late, or did not have enough available N last fall to fully establish. If the first application is at a higher rate, the extra N helps the crop complete the tillering process; encourages top growth and root formation resulting in a reduced impact from late-season stresses; and, most importantly, helps insure against the possibility that weather conditions will prevent the application of the second split.

The longer the time from N application to stem elongation, the greater the risk of N loss from volatilization, leaching, or denitrification. Thus, very early applications of N (mid-January to mid-February) potentially can reduce yield if only a single application is made. Where adequate fall N is available from the soil or applied at planting, late winter/early spring crop N needs will be low, so a later first application is preferred. Many growers apply N early in the spring to stimulate tiller production. The majority of yield comes from the primary tillers laid down last fall and an early spring N application or split N application will not alter this. However, the small but significant (especially at today’s wheat price) increase we observed can be partially explained by an increase in the number of secondary, smaller heads. Another likely factor is that some of the yield increase from splitting the N into two applications comes from the conservation of fertilizer N (providing late-season N if significant leaching, volatilization, or denitrification occurs). In our study, we observed a split effect even at very high N rates so both factors likely came into play during the study.

**Wheat Nutrition - Secondary Macronutrients and Micronutrients**
*Richard Taylor, Extension Agronomist; rtaylor@udel.edu*

**Sulfur (S)**
In past years, quite a few small grain fields located on sandy soils in both Delaware and Maryland have shown large areas of yellowed, stunted plants for both wheat and barley. Usually symptoms are noticed or appear shortly after spring fertilization with nitrogen (N). In many cases, deficiency of either S or Mg has been confirmed with both tissue and soil samples. Examples of fields showing classic deficiency symptoms for S are shown in photos 1 to 4. The symptoms include stunting of plants, general yellowing or chlorosis especially of the new growth (remember that S is immobile in the plant causing symptoms first to occur on new growth but when deficiencies are severe
symptoms can involve the whole plant), and poor root development. In the barley shown in Photos 1 through 4, the root systems of the affected plants were limited to the upper 2 to 4 inches and the soil type was loamy sand.

Photo 1. Field view of barley showing sulfur deficiency (tissue test indicated 0.11% S and >5% N) on very sandy soil that had been fertilized with 20+ pounds per acre of S that likely was leached by heavy spring rains.

Photo 2. Barley showing sulfur (S) deficiency symptoms of stunted plants with generally yellowing but beginning with newly emerged leaves ((tissue test indicated 0.11% S and >5% N) on very sandy soil that had been fertilized with 20+ pounds per acre of S that likely was leached by heavy spring rains.

Photo 3. Barley showing sulfur (S) deficiency symptom of severe stunting (tissue test indicated 0.11% S and >5% N) on very sandy soil that had been fertilized with 20+ pounds per acre of S that likely was leached by heavy spring rains.

Photo 4. Barley showing sulfur (S) deficiency symptom of stunting and general chlorosis or yellowing (tissue test indicated 0.11% S and >5% N) on very sandy soil that had been fertilized with 20+ pounds per acre of S that likely was leached by heavy spring rains.

With S deficiency, the symptoms often can be attributed to a high tissue N concentration. With inadequate S uptake, plants are unable to synthesize S-containing amino acids, limiting the ability of the plant to make the proteins and enzymes that do much of the work producing
yield. In essence, a high tissue N content can worsen S deficiency.

Why does S deficiency sometimes occur? A severe winter or very cold spring can limit root development. If excessive rainfall occurs on sandy soils, S can leach below the crop rooting zone. Compaction issues that limit rooting depth also impact S availability. Many of the fields that have shown S deficiency in the past were low in soil organic matter (SOM), which supplies some S. Cold spring conditions can inhibit SOM mineralization reducing S availability. In the above case (Photos 1 to 4), S was applied along with N but heavy spring rainfall likely leached much of the S below the shallow rooting depth of the crop.

To alleviate the deficiency, sulfur should be applied as either a foliar spray for quick relief of the symptoms or as a soil application. Several products have been used including Epsom salts (magnesium sulfate), Sul-PoMag or K-Mag [Sulfate of potash-magnesia (K2SO4-2MgSO4), containing about 22% K2O (potash), 11% magnesium (Mg) and 22% S], and ammonium sulfate. Epsom salts does have limited solubility in water and ammonium sulfate can cause some plant burn if applied at high rates. All of the above products can be used to provide the needed nutrients. Each product should be evaluated on a cost per pound of nutrient basis. Don’t forget that the potash (K) applied with the Sul-PoMag or K-Mag can be used by the double-crop soybean planting.

Magnesium (Mg)
Other very sandy fields have shown both S and Mg deficiency symptoms in both barley (Photos 5 and 6) and wheat (Photos 7 and 8). In some cases, the soil pH was about 6.0. Typically, Mg deficiency is found on soils with a pH of less than about 5.2 in our area. A pH of 6.0 would indicate that both calcium (Ca) and Mg soil test levels were adequate. Why was Mg deficiency showing up where you would expect adequate soil test level of Mg? Grasses, which both wheat and barley are, often are unable to absorb adequate Mg in cool, wet springs. This situation most often is seen in forage grasses. It leads to a condition in grazing cattle called “grass tetany” characterized by low blood serum Mg levels due to poor absorption of Mg by the grass under certain environmental conditions. It is best to confirm suspected Mg deficiency with both a soil test and tissue test.

Photo 5. Barley showing sulfur (S) and magnesium (Mg) deficiency symptom of interveinal chlorosis or yellowing (tissue test confirmed S and Mg deficiencies) on a loamy sand soil near Laurel, DE

Photo 6. Field view of barley showing sulfur (S) and magnesium (Mg) deficiency (tissue test confirmed S and Mg deficiencies) on a loamy sand soil near Laurel, DE
Can anything be done about the problem or should anything be done? An S, Mg, and potassium (K) containing fertilizer (KMag or Sul-PoMag—potassium magnesium sulfate) can be applied at a very low additional cost. This fertilizer will provide K, Mg, and S to the small grain crop and more importantly to the following soybean crop. Another fertilizer option that contains S and Mg is Epson salts or magnesium sulfate. The choice between the two depends on the costs of each compound and whether soil test K levels are high or not. High levels of soil test K can inhibit the uptake of Mg by grass crops. Even with this addition of S and Mg, the upcoming soybean or other crop should be observed carefully for deficiency symptoms so early intervention can solve developing deficiencies before yield is lost. In the current crop if the crop has headed out, there may be only a minimal potential for yield increase and much of the benefit will accrue from the double-crop portion of the rotation. If applied prior to heading, the crop usually responds enough to cover the cost of both the application and the fertilizer.

The value of tissue testing has been confirmed in past years. When evaluating tissue test results, pay attention not only to the absolute concentration of each nutrient but also the relative ratios of certain nutrients. In the above cases, the relative high N content in relation to the S content confirmed a S deficiency problem. A high K concentration with respect to the Mg concentration would indicate a problem with Mg even if the absolute Mg concentration were not below the critical level.

In the above cited instances of S and Mg deficiency, growers reported exceptional responses to the nutrients applied. Deficiency symptoms did not subsequently appear on a double-crop soybean planting.

**Manganese (Mn)**

Although we sometimes find Mn deficiency in small grains in the fall, the most common time that I have observed Mn deficiency is in the spring shortly after a spring green-up N application. Wheat and particularly barley are susceptible to Mn deficiency problems especially on soils where soil pH increases with depth. This problem has decreased in the past decade since most of the lime we apply today is very finely ground limestone with low amounts of the coarser limestone fractions. Years ago in situations where the coarser fraction predominated agricultural limestone and lime was applied on a regular (every two or three year) basis, the deeper layers of soil (8-16 inches) were often much higher in pH than the surface soil.
In these instances, the deficiency showed up following spring N application since N and warming soils stimulate crop root growth into deeper soil layers where the high pH soil leads to Mn deficiency. The availability of Mn and other micronutrients not only depends on the amount of nutrient in the soil but also on the soil pH. As soil pH rises, the availability of many micronutrients and especially Mn decreases. The only micronutrient this does not hold true for is molybdenum which increases in availability as the pH approaches neutral.

To confirm the problem, the best choice is to obtain a tissue sample for testing and to pull a soil sample from the affected area and a nearby area showing normal growth. For a tissue sample, take whole plant samples from a number of affected plants across the field but avoid contamination with soil. Again, take a reference sample from an area of normal growth. You should take soil samples in four inch increments and go at least a foot deep to accurately assess the impact of soil acidity on micronutrient availability. Be sure to make note on the soil test information sheet of the depth of soil sampled. Foliar Mn application can help the crop recover but more than one application may be needed if the seedlings are very small and the leaf area available for foliar absorption is limited. We typically apply between 1 and 2 lbs of actual Mn per acre. Plant coverage with the spray is very critical for helping the crop recover. Chelated Mn can be used as well as MnSO₄ (techmangam). Both fertilizers are effective so the decision is usually made based on product cost. Chelated Mn is often much more expensive than techmangam but do not try using very low rates (0.25 to 0.5 lb Mn/acre) of chelated Mn to save on cost. Low chelated Mn rates have been shown to be less effective than techmangam. Fast action and complete plant coverage are critical factors to consider.

Copper (Cu)

Copper deficiency was last positively identified on wheat in Delaware back in the 1950s according to conversations I had years ago with Dr. Leo Cotnoir. The deficiency symptom appears as leaf tip die-back followed by a twisting or wrapping of the leaves. Copper deficiency can lead to delayed maturity and...
stunted, misshapen heads. Traditionally, this deficiency is associated with muck or organic soils but Dr. Cotnoir did observe it in northern Delaware on highly limed soils before the widespread use of superphosphate. Superphosphate (0-20-0) contained enough copper to eliminate the symptoms. Today, most producers apply triple-superphosphate that does not contain Cu. Copper deficiency is unlikely on soils that have received poultry manure and some biosolids since these products can contain enough Cu to supply crop needs. In soils where the more refined triple-superphosphate has been the sole phosphorus source for many decades or where soil pH is kept near neutral or the soil is relatively high in soil organic matter or has received applications of organic materials low in Cu, this deficiency might occur again. Copper deficiency should be confirmed with a tissue test before applying copper sulfate which is very effective in alleviating symptoms. A foliar rate of Cu is 0.1 to 0.25 lb actual Cu/acre. Document any applications of Cu since this element can easily build up in the soil to harmful levels and in certain situations Cu application is limited by law.

Fields that were no-tilled or where chickweed emerged shortly after planting in the fall are fields to check first for spring treatment. If you have wild garlic or Canada thistle, the time of application should be delayed since you need to spray these weeds when they have fully emerged. Yet, coverage is important for these species; so allow adequate emergence, but do not wait too long. If weed pressure from winter annuals is great, it may not be possible to get control of the winter annuals and perennials with one application. In that case, two applications may be required.

Harmony Extra can be applied with nitrogen. If spraying Harmony Extra with nitrogen, be sure to pre-mix it in water first. If using nitrogen as your carrier, there is no need for a surfactant unless wild garlic is over 8 inches tall. If applying Harmony Extra in nitrogen diluted with water, use a non-ionic surfactant at ½ to 1 pint/100 gallons of solution. If applying it in water use non-ionic surfactant at 1 qt/100 gallons.

Grass control in small grains is still challenging, even with a few new products. Hoelon is the only product labeled for grass control in barley, and it will only control annual ryegrass before it is more than 2 tillers. For winter wheat Osprey is also available. Fall is a better time for Osprey applications, but it will control annual ryegrass in the early spring. Osprey cannot be applied with nitrogen carrier and the Osprey application and nitrogen application must be made 14 days apart. Spray solution cannot be any more than 15% liquid nitrogen. Osprey has activity on small annual bluegrass. Large annual bluegrass control will be better with Maverick than with Osprey. However, Maverick requires that STS soybeans be used for double-cropping and does not allow for rotation to vegetables.

Finally, the following are the timing limitations for small grain herbicides. The timing restrictions are based on crop safety. 2,4-D - up to jointing stage (pre-jointing) Banvel/Clarity - up to jointing stage (pre-jointing) Osprey - up to jointing stage Buctril - up to boot stage Harmony Extra or Harmony GT - up to flag stage (pre-flag leaf)

Even More Wheat Info

Small Grain Weed Control - Mark VanGessel, Extension Weed Specialist; mjv@udel.edu

If you did treat your fields in the fall for weed control, is time to be scouting the crop. Weed control is important to achieve maximum wheat yields. There are a number of good herbicides for small grains, provided they are used at the proper time. Weeds need to be small (less than 2 inches in height or diameter) and actively growing. This often requires a separate application for herbicides since this often does not coincide with nitrogen applications. Often weeds are not actively growing during the first nitrogen application and then weeds are too large (and wheat interferes with herbicide coverage) at the time of the second application.
**Postemergence Broadleaf Weed Control**

<table>
<thead>
<tr>
<th>Weed</th>
<th>Mode of action (Group #)</th>
<th>2,4-D</th>
<th>Clarity /Banvel</th>
<th>Harmony Extra</th>
<th>Unity /Harmony GT</th>
<th>Maverick</th>
<th>Osprey¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annuals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chickweed, common</td>
<td>N</td>
<td>P-F</td>
<td>F</td>
<td>G-E</td>
<td>F</td>
<td>F²</td>
<td>F</td>
</tr>
<tr>
<td>Chickweed, jagged</td>
<td>N</td>
<td>-</td>
<td>-</td>
<td>(G)³</td>
<td>-</td>
<td>-</td>
<td>(G)³</td>
</tr>
<tr>
<td>Chickweed, mouseear</td>
<td>N</td>
<td>P-F</td>
<td>F</td>
<td>G-E</td>
<td>F</td>
<td>-</td>
<td>F</td>
</tr>
<tr>
<td>Cornflower</td>
<td>-</td>
<td>F-G</td>
<td>F-G</td>
<td>P</td>
<td>-</td>
<td>-</td>
<td>P-F</td>
</tr>
<tr>
<td>Henbit/red dead nettle</td>
<td>F</td>
<td>F-G</td>
<td>G-E</td>
<td>F</td>
<td>F²</td>
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<tr>
<td>Horseweed (marestail)</td>
<td>N</td>
<td>G-E</td>
<td>G</td>
<td>F</td>
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<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Knawel</td>
<td>-</td>
<td>P</td>
<td>F-G</td>
<td>G</td>
<td>-</td>
<td>N</td>
<td>G-E²</td>
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<tr>
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<td>P-F</td>
<td>E</td>
<td>G</td>
<td>G</td>
<td>F</td>
<td>-</td>
<td>N</td>
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<tr>
<td>Mustard spp.</td>
<td>P-F</td>
<td>E</td>
<td>F</td>
<td>E</td>
<td>E</td>
<td>G²</td>
<td>G</td>
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<td>Pansy, field</td>
<td>-</td>
<td>P</td>
<td>N</td>
<td>P</td>
<td>N</td>
<td>-</td>
<td>P-F²</td>
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<tr>
<td>Pennycress, field</td>
<td>G</td>
<td>E</td>
<td>F</td>
<td>E</td>
<td>E</td>
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<td>G</td>
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<td>-</td>
<td>E²</td>
</tr>
<tr>
<td>Shepherdspurse</td>
<td>P-F</td>
<td>E</td>
<td>F</td>
<td>E</td>
<td>E</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Speedwell, species</td>
<td>F-G</td>
<td>-</td>
<td>-</td>
<td>N</td>
<td>N</td>
<td>-</td>
<td>(G)³</td>
</tr>
<tr>
<td>Vetch, common</td>
<td>-</td>
<td>G</td>
<td>G</td>
<td>F-G</td>
<td>-</td>
<td>-</td>
<td>F-G</td>
</tr>
<tr>
<td><strong>Perennials</strong></td>
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<tr>
<td>Dandelion</td>
<td>N</td>
<td>G-E</td>
<td>G</td>
<td>F</td>
<td>P-F</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Dock species</td>
<td>N</td>
<td>F-G</td>
<td>F-G</td>
<td>G-E</td>
<td>F-G</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
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<td>N</td>
<td>F</td>
<td>F</td>
<td>G-E</td>
<td>G-E</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td>Thistle, Canada</td>
<td>N</td>
<td>F</td>
<td>G</td>
<td>F</td>
<td>N</td>
<td>-</td>
<td>N</td>
</tr>
<tr>
<td><strong>Crop tolerance</strong></td>
<td>F-G</td>
<td>P-F</td>
<td>F</td>
<td>E</td>
<td>E</td>
<td>E</td>
<td>G-E</td>
</tr>
</tbody>
</table>

*Note: N=no control, P=poor, F=fair, G=good, E=excellent, —=insufficient data (Ratings are based on weeds that are actively growing AND small/susceptible stage (no more than 2 inches in height.).

¹Osprey must be applied in a water carrier. Carrier should not contain more than 15% liquid nitrogen. Topdress applications of nitrogen should not be made within 14 days of Osprey application due to risk of crop injury. Thus, Osprey is recommend to be applied in the fall.

²Fall applications are best.

³UD data shows only fall applications are effective.
Postemergence Grass Control

<table>
<thead>
<tr>
<th>Grass Weed</th>
<th>Axial</th>
<th>Hoelon</th>
<th>Maverick</th>
<th>Osprey¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of action (Group #)</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bluegrass, annual</td>
<td>N</td>
<td>N</td>
<td>G⁴</td>
<td>E</td>
</tr>
<tr>
<td>Bluegrass, roughtstalk</td>
<td>N</td>
<td>N</td>
<td>G⁴</td>
<td>G</td>
</tr>
<tr>
<td>Brome, species²</td>
<td>N</td>
<td>N</td>
<td>G⁴</td>
<td>F</td>
</tr>
<tr>
<td>Oatgrass, bulbous</td>
<td>N</td>
<td>N</td>
<td>F-G</td>
<td>—</td>
</tr>
<tr>
<td>Ryegrass, annual³</td>
<td>G-E⁴⁄₅</td>
<td>G-E⁴⁄₅</td>
<td>G⁴</td>
<td>E⁴</td>
</tr>
</tbody>
</table>

Crop tolerance: E = good, G = excellent, — = insufficient data

Note: N = no control, P = poor, F = fair, G = good, E = excellent.

¹Osprey must be applied in a water carrier. Carrier should not contain more than 15% liquid nitrogen. Topdress applications of nitrogen should not be made within 14 days of Osprey application due to risk of crop injury. Thus, Osprey is recommend to be applied in the fall.

²Brome control is listed on Finesse and Maverick labels. In most cases, Finesse provides only suppression of downy brome when applied in the fall. (Control may be obtained depending on rate, timing, and rainfall.) Maverick provides control of downy brome when applied in the fall and suppression when applied in the spring. However, be cautious of crop rotations with Maverick, aside from STS soybeans and IR corn, most other rotational crops cannot be planted for at least 12 to 18 months or more after application.

³Annual ryegrass control is listed on Finesse and Maverick herbicide labels. However, research at mid-Atlantic universities has shown inconsistent results on ryegrass control. If these products are used, be cautious of all use restrictions. Only STS soybeans can be planted after wheat harvest when Finesse or Maverick is applied. Rotations to crops the following year may also be restricted (read the labels).

Fall applications are best.

Will not control Hoelon-resistant (Accase-inhibitor) annual ryegrass biotypes.

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Precautions for Herbicide Use with Nitrogen Applications to Small Grains - Mark VanGessel, Extension Weed Specialist; mjv@udel.edu

It is common to add herbicides when “top-dressing” nitrogen to small grains. These precautions are from manufacturers’ labels:

Harmony Extra or Harmony should be dissolved in a small amount of water first. If liquid nitrogen is less than 50% of the spray mix, then include a surfactant. For 2,4-D it varies with the formulation. The ester formulation (2,4-D ester) can be mixed directly with nitrogen, but labels recommend good agitation. Amine formulation of 2,4-D (2,4-D amine) should be mixed with 3 to 5 parts of water before adding it to the nitrogen solution. Buctril label cautions about potential leaf burn when mixed with liquid fertilizer, but leaves emerging after application are not affected. For MCPA, it varies some with the manufacturer. The ester formulation should not be applied with liquid nitrogen. The amine formulation varies, ranging from no mention of liquid nitrogen to application is allowed. Osprey restricts applications to within no less than 2 weeks of a nitrogen application. Maverick cautions about possible leaf burn and reduced growth and states that weed control is more consistent when applied with water as the carrier.

New Confusion Formulations for Small Grain Herbicides - Mark VanGessel, Extension Weed Specialist; mjv@udel.edu

Remember the good old days when someone said they used “Harmony” on their wheat and you knew exactly what they meant. Then came Harmony Extra, Harmony GT, followed by Harmony Extra XP and Harmony GT XP. Now
there is Harmony Extra SG with TotalSol and Harmony SG with TotalSol. These are new soluble granule (SG) formulations with 50% active ingredient. Granules are supposed to fully dissolve and solution will appear relatively clear. It appears to take longer to go into solution than the previous formulations, so if mixing in a 5-gallon bucket before adding to nitrogen carrier, it may take up to 10 minutes of constant stirring if the water is cold. Use patterns have not changed with the new formulation, but the concentration of the product has.

**Harmony Extra 50SG** with TotalSol is DuPont’s new formulation for the combination of thifensulfuron and tribenuron. The “old” Harmony Extra XP formulation was 75% active ingredient and the new Harmony Extra 5G is a 50% active ingredient, so the SG formulation requires more product to get the same active ingredient. (0.6 oz/A Harmony Extra 5G TotalSol = 0.4 oz/A Harmony Extra XP). The use pattern has not changed with the SG formulation.

Harmony GT XP 75% active is now a TotalSol formulation as well and is called **Harmony SG** and it is a 50% active ingredient. This requires more product as well. (0.45 oz/A Harmony SG TotalSol = 0.3 oz/A Harmony GT XP).

Gowan will be marketing their version of Harmony GT 75% called **Unity 75WDG**. It contains thifensulfuron (same as Harmony GT) and has similar uses as Harmony GT, which includes small grain, as well as soybean and corn.

Take home lesson, be sure you understand what formulation of “Harmony” you are using. In addition, when someone gives you some information about a “Harmony” product, make sure it is clear which product AND formulation is being discussed.

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**Understanding the Falling Number Wheat Quality Test** - Carl German, Extension Crops Marketing Specialist; clgerman@udel.edu

**Introduction**

Protein and moisture are key quality tests for both grade and marketing price of wheat. Farmers are most familiar with these tests since almost all SRW wheat is purchased on milling quality.

When it rains just before harvest, grain may start to germinate (or sprout) in the head. The germination causes an increase in alpha amylase, an enzyme that breaks down starch. There are also increases in enzymes that break down proteins. Of these, the starch degrading enzyme has a greater effect on reducing the quality of flour, and of products made from the flour. The longer the grain sprouts, the greater the amount of the alpha amylase formed. If badly sprouted grain is milled, the flour can cause product problems.

Falling number is a test more recently introduced into country elevators and mills. It gives an indication of the amount of sprout damage that has occurred within a wheat sample. Generally, a falling number value of 350 seconds or longer indicates a low enzyme activity and very sound wheat quality. As the amount of enzyme activity increases, the falling number decreases. Values below 200 seconds indicate high levels of enzyme activity.

Why is this important? Sprouting can affect food made from wheat in many ways. It can reduce mixing strength, cause sticky dough, and affect loaf volume and shelf life. In pasta, sprouting can reduce shelf life, increase cooking loss, and produce softer cooked pasta.

The falling number test is presently causing frustration and confusion on the Eastern Shore. That is because the level of impact of sprout damage is not fully realized until wheat is processed into bread or pasta. The falling number test does not directly measure amylase enzyme activity, but measures changes in the physical properties of the starch portion of the wheat kernel caused by these enzymes during the test.

Falling number tests can be run in remote locations like elevators or testing facilities and replicated anywhere in the world. Many buyers from export markets are said to have written minimum tolerances of 300 to 350 seconds into their purchase contracts. In the past several
years, grain buyers have discounted wheat for falling number values below 300 seconds.

How the Test is Performed
The falling number test is used to measure the effect of the enzymes on wheat quality. In the falling number method, an instrument, which measures the time taken for a plunger to fall to the bottom of a precision bore glass tube filled with a heated paste of wheat meal and water is used. The time taken (in seconds) for the plunger to fall is known as the falling number, and is 62 seconds for badly sprouted wheat.

High quality wheat makes a thicker paste, and the test then takes between 300 to 600 seconds. The greater the sprout damage, the less viscous (or sticky) the starch paste, and so the lower the falling number. Wheat with a falling number greater than 300 is quite suitable for bread making. For other milling grades, falling numbers greater than 250 are acceptable.

What Happens When Wheat Fails the Falling Number Test?
On the Eastern Shore wheat for milling that falls below 275 seconds will be rejected. Sometimes good quality wheat can be blended to bring the falling number up to the required level. At other times, wheat quality can not be improved by blending. Wheat that does not meet the falling number requirement for milling must be sold for other uses.

Testing for Falling Numbers?
Currently, a simple test kit is not readily available. Further information regarding the falling number test can be obtained at the following web site: http://www.ciilab.com. A Test Request Form can be obtained at this site. The test requires about ½ pound of wheat sample, therefore, the sample size that is mailed should be about 1 pound. It is important to note that care needs to be taken in mailing a sample. The sample should be placed and sealed in a plastic bag and then placed in an appropriate mailer (box or reinforced envelope).

Questions regarding the falling number test can be directed to the DDA, Plant Industries Seed Testing Section.

Will Spring Wheat Work in Delaware? Not Very Well – Gordon Johnson, Extension Ag Agent, Kent Co.; gcjohn@udel.edu

I have had several questions on the potential for planting spring wheat in Delaware. With the high wheat prices, the thought is to take advantage of this opportunity and then double crop with soybeans. Spring wheat varieties are not adapted this far south, would be late in coming off, and would be a large risk. I read a good article on this subject from Purdue University1. Here is some information on this topic:

1) We do not recommend growing spring wheat in Delaware. Spring wheat is not adapted for latitudes south of 43 degrees (Dover is 39 degrees).

2) Spring wheat would yield half of what our winter wheat varieties would (I would estimate that yields in DE would be between 30-40 bu/A, at best).

3) The spring wheat varieties that are available have not been developed for southern latitudes or the humid east. That means that no varieties are available that are adapted to Delaware growing conditions.

4) Spring wheat must be planted before March 20 to have a chance to produce a crop. Head initiation in spring wheat is very day-length sensitive and later plantings will be induced to go into reproductive stage prematurely. Spring wheat will not have enough chance to produce tillers and vegetative growth before initiating heads. This will limit yields.

5) Spring wheat growing points come out of the ground too quickly and can be damaged by frosts.

6) Spring wheat varieties are hard wheat types for making bread. If grown in Delaware the quality likely would not be acceptable for bread. Conversely, the quality would not be good for

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1 www.northern-crops.com/technical/fallingnumber.htm
the current uses that we have for soft red wheat (pastries, snack foods) and mills would likely not want it or would discount it.

7) Our hot weather, starting in May would cause reductions in yields of spring wheat which grows best in cooler conditions.

8) Spring wheat will mature 3 weeks later than our winter wheat.

For a good article on the subject read:
“Spring Wheat in Indiana? - Not a Good Option,”
H. W. Ohm, Agronomy Department, Purdue Univ., West Lafayette, hohm@purdue.edu
The article is available at this site

Announcements

Kent County Crop Masters VI:
Advanced Soil Fertility and Crop Nutrition
Monday, March 3, 2008  6:00-9:00 PM
UD Paradee Center, Rt 113, next to DelDOT

Guest speakers include Dr. Richard Taylor and Dr. Dave Hansen

Schedule:
5:30-6:15 Dinner
6:15-7:00 pH, Soil acidity, liming, and liming materials
7:00-7:30 Wheat nutrition – Emphasis on N, K, S, Mg, Mn, and Cu
7:30-7:40 Break
7:40-8:10 Nitrogen transformations; cover crops and nitrogen cycling; organic additions and mineralization (manures, crop residues)
8:10- 8:30 CEC, base saturation, and base saturation ratios
8:30- 9:00 Nitrogen management - Economically optimum N rates; N research at DE, slow release N, N additives

Nutrient Management (3) & CCA Credits (3)
Dinner will be provided.
Phone (302) 730-4000 to register.

Weekly Crop Update is compiled and edited by Emmalea Ernest, Extension Associate - Vegetable Crops

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