

# Wheat Science News

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**Mark Your Calendar**

**Wheat Field Day  
May 15  
Princeton, KY**

## Wheat Freeze Damage

Chad Lee and Jim Herbek — Extension Grain Crops Specialists

The unusually warm start to spring helped much of the wheat recover from the late plantings last fall. The small acreage of wheat that was planted early is likely ahead of schedule in growth and development. That growth and development coupled with the cold night temperatures can result in freeze damage and yield loss in wheat.

The symptoms from freeze damage to wheat appear as leaf burn, where the leaf blades appear yellow to reddish brown at the leaf edges. The reddish brown fades into yellow closer to the leaf mid-rib. The leaf burn often occurs on the upper portion of the leaves. Stem damage can occur from cold temperatures. The stems will be weak at the point of damage and may bend or break. Often the wheat will compensate for the damaged stalk and return to an upright position. However, the wheat may be more likely to lodge at later growth stages.

Freezing damage to the head is a concern. Most of the wheat in Kentucky is likely jointed at this time and the head is in the stem. Split several stems with a knife and examine the head in each stem. If the head is green and turgid, then it has survived the frost. If the head is white or brown and somewhat mushy, then it was killed by the temperatures.

Wheat yield losses from cold temperatures depend on the wheat growth stage, temperature and duration of temperature. Table 1 includes the conditions required for freeze injury to wheat as well as the expected impact on yield, while Table 2 describes several of the growth stages of wheat. Table 1 is a copy of Table 3-3 from *ID-125: A Comprehensive Guide to Wheat Management in Kentucky* and Table 2 is an abbreviated copy of Table 2-1 from the same publication.

The vague yield effects in Table 1 indicate that predicting yield from freeze damage is not an exact science. Weather conditions following freeze injury will play a role in how well the wheat recovers. Cool, damp conditions will slow recovery from the freeze injury, while warmer conditions will accelerate recovery.

If you have questions about the condition of your wheat crop, call your county extension office.

**Table 1. Freeze injury in wheat.**

<b>Growth stage</b>	<b>Approximate injurious temp. (two hours)</b>	<b>Primary symptoms</b>	<b>Yield effect</b>
Tillering (1-5) <sup>a</sup>	12°F	Leaf chlorosis; burning of leaf tips; silage odor; blue cast to fields	Slight to moderate
Jointing (6-7)	24°F	Death of growing point; leaf yellowing or burning; lesions, splitting, or bending of lower stem; odor	Moderate to severe
Boot (10)	28°F	Floret sterility; spike trapped in boot; damage to lower stem; leaf discoloration; odor	Moderate to severe
Heading (10.1-.5)	30°F	Floret sterility; white awns or white spikes; damage to lower stem; leaf discoloration	Severe
Flowering (10.51-.54)	30°F	Floret sterility; white awns or white spikes; damage to lower stem; leaf discoloration	Severe
Milk (11.1)	28°F	White awns or white spikes; damage to lower stems; leaf discoloration; shrunken, roughened, or discolored kernels	Moderate to severe
Dough (11.2)	28°F	Shriveled, discolored kernels; poor germination	Slight to moderate

<sup>a</sup> Numbers in parentheses refer to the Feekes scale (see Table 2).

**Table 2. Abbreviated Table of Wheat growth stages identified by the Feekes scale.**

<b>Stage</b>	<b>Description</b>
<b>Tillering</b>	
5	Pseudo-stem (formed by sheaths of leaves) strongly erected.
<b>Stem Extension</b>	
6	First node of stem visible at base of shoot.
7	Second node of stem formed; next-to-last leaf just visible.
8	Flag leaf (last leaf) visible but still rolled up; ear beginning to swell.
9	Ligule of flag leaf just visible.
10	Sheath of flag leaf completely grown out; ear swollen but not yet visible.

Another option to consider is cutting the wheat for hay or silage if the amount of top growth is sufficient to justify this. The forecasted curing conditions are not excellent, but good with the high amounts of radiation and wind forecast. The quality of hay or silage cut at this stage would be excellent with lower quantities of growth than when cut at a latter stage. The wheat would need to be cut before the freeze or very soon after to prevent deterioration of the quality. If the option were exercised, it would still leave the option of planting corn in a timely manner.

FOR MORE INFORMATION -

<http://www.ca.uky.edu/ukrec/newsletters/Newsfreeze98.pdf>

# Considerations When Cutting Wheat for Hay

## High Corn Prices; Poor Wheat Stands ... Consider “Cutting” Your Losses and Planting Corn

Chad Lee and Jim Herbek—Extension Grain Crops Specialists  
Bill Bruening—Small Grain Variety Testing Program

Some wheat fields were planted late last fall due to wet weather and very few days suitable for planting. Some wheat stands were flooded in areas resulting in patchy fields. Anytime these scenarios occur, farmers question whether to keep the wheat or “burndown” the field and put another crop in. When corn approaches \$4/bushel, more wheat fields are called into question. An option to burning down the field is to harvest the wheat for a forage crop and then plant corn.

Wheat will be in the joint stage near the first week of April and will reach boot stage near the last two weeks of April. Wheat harvested for forage ideally occurs at the boot stage of growth. Harvesting wheat late in April must be balanced against the window for planting corn. Corn planting should be completed by May 1 in western and central Kentucky and by May 15 in eastern Kentucky for optimal yields.

Wheat harvested in early April near the joint stage will yield about 30% to 50% of wheat harvested in late April at the boot stage. Crude protein values would be expected to be 20 to 25% at the joint stage and 11 to 18% at the boot stage.

Wheat that has regrown from the cutting will need to be controlled with herbicides (see related article in this newsletter).

While forage yields of wheat at the joint stage are nothing to brag about, harvesting a poor stand of wheat may be more valuable than burning down the entire field. More information about wheat as a forage crop is included in this newsletter.

1. Lyon, D.L., D.D. Baltensperger, and M. Siles. 2001. Wheat grain and forage yields are affected by planted and harvest dates in the Central Great Plains. *Crop Sci.* 41: 488-492.

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## Nutrient Removal

Lloyd Murdock & Greg Schwab—Extension Soils Specialists

The nutrients removed by a wheat hay crop will depend on the stage of growth and the amount of vegetation removed as hay. Most of the nutrients are taken into the plant between jointing and boot stage. In the table below are estimates of the amount of nutrients in the above ground vegetation at boot stage. The estimates are for a high and a moderate yielding crop. If a particular estimated yield potential is different from the 2 in the table below, it can be adjusted by raising or lowering the nutrient uptake at the same ratio the yields are adjusted upward or downward.

Nutrients in Wheat in the Boot Stage of Growth		
Nutrient	Nutrient Removal (lb/ac)	
	100 bu/ac	50 bu/ac
N	70	35
P <sub>2</sub> O <sub>5</sub>	45	23
K <sub>2</sub> O	125	62



The nitrogen rates for a corn crop planted after a wheat hay crop should not be adjusted from the recommendations found in AGR-1. The phosphorus and potassium recommendations for the corn should be according to a soil test taken near hay cutting time or from the fall soil sample taken for the wheat. Use the corn fertilizer recommendations in AGR-1 and adjust for any phosphorus and potassium added in the fall and that removed by the hay crop. For soils testing high in phosphorus or potassium, no phosphorus or potassium fertilizer is required, regardless of the amount removed with the hay.

# Wheat Forage Production

Bill Bruening-Small Grain Variety Testing Program

Wheat is an important source of forage for many Kentucky producers. Approximately 25% of Kentucky's annual wheat acreage is not harvested for grain, but utilized for other purposes, primarily forage production. Several advantages of utilizing wheat for silage, green-chop, or hay production are that forage production can be double-cropped with corn or full season soybeans. Additionally, wheat provides a reliable source of quality forage in the spring when other fall/summer sources are low in quantity and have deteriorated in quality. Wheat's good forage potential allows growers some flexibility in crop utilization. Many acres are planted specifically for forage or grain production, but factors such as corn/wheat grain prices, forage supply/prices and crop condition may affect end-use decisions based on potential profitability.

Wheat forage production management practices are variable among producers. Typically wheat is seeded in mid-October for silage/hay or mid-September for fall/winter grazing plus silage/hay production at a seeding rate of about 1.5 times the rate for grain production. Fertilizer and lime application should be based on soil test data using standard wheat recommendations. Typical recommended N rates are 20-30 lbs N per acre in the fall and 40-60 lbs N per acre in late winter/early spring. Phosphorus and potassium (K) should be applied at or before seeding. Note that wheat harvested for silage/hay removes a large quantity of K from the soil (approx. 50 lb K<sub>2</sub>O per acre). Therefore fall-applied K should be based on the needs of the wheat crop rather than the following summer crop.

The time to harvest wheat forage is an important decision. Harvest timing is often dependent on if the crop is part of a double-crop system, weather conditions, labor/equipment issues, and the end use requirements of the crop (high quality forage or greater yields of lower quality). A wheat silage crop should be cut at the late boot or early heading stage. At this stage the levels of energy, protein (11-18 %) and digestibility are high (similar to corn silage or alfalfa haylage). It is possible to double-crop with corn when harvested at this stage.

It is common, however to harvest at later stages of development (up to the dough stage). Biomass yields increase throughout the reproductive growth period, but the quality declines throughout this period. Wheat cut at mid-dough stage produces what is considered average quality hay. Fiber content is higher and digestibility and protein (6-8 %) are lower, but dry matter tonnage will be 30-60 % greater than silage cut at the boot stage. Only awnless (smooth) head type varieties should be used if harvesting at this stage.

In a wheat forage double-crop system with corn or soybeans, re-growth will occur from wheat stubble and the utilization of glyphosate resistant grain crops provides the simplest system for timely planting and controlling re-growth.

Silage cut prior to soft-dough stage will be high in moisture and should be wilted to 35% dry matter. Direct-cutting immature plants will cause excessive seepage, nutrient loss and will produce an acidic, less palatable silage. Silage chopper knives should be sharp and adjusted for 1/2-inch cut to allow good packing of ensiled material and spoilage minimization. If it is not possible (equipment, weather) to readily cut, wilt, and pick up, then cutting should be postponed until dough stage and direct-chopped.

When feeding wheat forage, mineral supplementation is required and the need for supplementation increases as the crop develops beyond the mid-heading stage. Contact your county extension office for rationing/ supplementation recommendations.

Forage yields vary widely among wheat varieties. UK Variety test data on forage yield potential are available at [www.uky.edu/ag/WheatVarietyTest](http://www.uky.edu/ag/WheatVarietyTest). Data on varietal differences in forage yield potential at heading, winter grazing potential and head type (bearded / awnless) are presented. For additional information, see *AGR-160 Managing Small Grains for Livestock Forage*, also available at the fore mentioned website.

# Weed Control Issues

James R. Martin—Extension Weed Control Specialist

There are certain weed management issues that should be considered when transitioning from wheat hay to no-till corn or soybeans.

If wheat has been treated with an herbicide, then it is important to consider label restrictions concerning feeding and rotational crops. The following table addresses these issues for wheat herbicides commonly used in Kentucky.

<b>Feeding and Rotational Crop Restrictions for Wheat Herbicides</b>			
Herbicide	Preharvest Interval for Hay	Rotational Crop Interval	
		Field Corn	Soybean
Axial	50 days	120 days	120 days
2,4-D	2 weeks	7-14 days	7-30days
Buctril	*	30 days	30 days
Clarity	37 days for lactating animals if rate $\leq$ 1pt/A	0 days May plant any time after application.	14 days Consult label for more details.
Finesse Grass & Broadleaf	*	Conduct field bioassay the following year.	9 months for STS soybean
Harmony Extra	Do not harvest for hay. Harvested straw may be used for bedding or feed.	45 days	45 days
Harmony GT	Do not harvest for hay. Harvested straw may be used for bedding or feed.	0 days May plant any time after application.	0 days May plant any time after application.
Hoelon	Do not harvest hay before grain harvest	*	*
Prowl	28 days	Not approved for the same year.	0 days May plant any time after application.
Osprey	60 days	12 months	90 days
Sencor	*	4 months	4 months
* No Information on label.			

There is a chance wheat will initiate tillers after it is harvested for hay. While these may not be as competitive relative to fully tillered wheat, they can compete for soil moisture and be a concern during a dry spring. In order to control re-tillering wheat, it is important that plants have some vegetation in order to allow for optimum uptake of foliar-applied herbicides. This will require waiting several days for wheat to regenerate new growth.

One option is to delay planting, before applying a burndown treatment. When applied alone, glyphosate is usually preferred over paraquat for controlling wheat. When rotating to corn, the addition of atrazine may help in burndown control of wheat with paraquat. However, including atrazine with glyphosate may inhibit the speed or degree of control. Including ammonium sulfate with glyphosate may limit tank-mix antagonism problems.

Another option is to plant Roundup Ready corn or soybeans immediately after harvesting wheat for hay and allow time for regrowth before applying a 'delayed' burndown treatment of glyphosate. Other herbicides may be included with glyphosate depending on weeds present. Consult labels for approved tank mixes and herbicides.

## **Folicur 3.6F and Orius 3.6F Approved by EPA for Managing Fusarium Head Blight and Deoxynivalenol in Wheat**

Don Hershman, Extension Plant Pathologist

Fusarium head blight (FHB) of wheat, and deoxynivalenol (DON) accumulation in harvested grain, are periodically very serious problems in Kentucky. There was very minimal FHB in 2006 and Kentucky had the highest state wide yield average in its history. But each year brings new possibilities, so we must be on guard for FHB/DON in 2007 and not become complacent.

On March 26, 2007 the Environmental Protection Agency (EPA) granted the Kentucky Department of Agriculture's section 18 request to allow applications of Folicur 3.6F or Orius to suppress FHB/DON in Kentucky during 2006. Folicur 3.6F is manufactured by Bayer and Orius 3.6F, a subregistration of Folicur, is distributed by Makhteshim Agan of North America. This is the fourth consecutive year that EPA has granted our request to allow producers to apply tebuconazole in Kentucky. The section 18 expires on May 30, 2007.

This year, we had to jump through some additional "hoops" to get this section 18 request renewed. The reason is that another Bayer product, Proline 480 SC, has just been granted a section 3 registration by EPA and once it is approved by Kentucky officials, Proline will also be available for use by Kentucky wheat producers. The active ingredient in Proline is prothioconazole, which is another triazole fungicide. Research has shown that prothioconazole is actually slightly better at suppressing FHB/DON than tebuconazole, but the cost of Proline is expected to be significantly higher than Folicur and Orius. This significant price discrepancy was the basis of our argument to EPA that our producers needed to have access to tebuconazole. Plus, prothioconazole is not as effective at controlling leaf rust as tebuconazole. This is a weakness of Proline and is the reason why Bayer intends to make a future mix product of prothioconazole + tebuconazole (i.e., Prosaro) their main product for use on wheat in the US. That registration, however, has been held up in EPA for the time being.

The proper use of Folicur or Orius will help suppress FHB and DON when used with other FHB/DON management tactics (see <http://www.ca.uky.edu/ukrec/newsletters/news03-2.pdf>).

Neither Folicur nor Orius are not a "silver bullet" for managing FHB/DON. A great deal of research suggests that about 30-40% reduction in FHB symptoms and DON accumulation is a reasonable expectation for winter wheat. Sixty percent control or more has been achieved in rare field studies in

the U.S., but these are atypical results. In other words, do not expect Folicur or Orius to provide the same level of FHB/DON control as you have come to expect when fungicides are used to control other wheat diseases. The key is to think in terms of disease suppression, not control. Nevertheless, a 30-40% reduction in FHB and DON can have a significant economic impact locally, statewide, and regionally if FHB is moderate to severe in 2007. But be advised that significant losses due to FHB and/or DON may occur even where Folicur or Orius are applied if FHB is severe this spring,

The section 18 label allows for a single ground or aerial application of 4 fl oz/A of Folicur or Orius 3.6 F to wheat through very early flowering (Feeke's stage 10.51) or May 30<sup>th</sup>, whichever comes first. Applications cannot be made within 30 days of harvest. A copy of the section 18 label must be in your possession at the time of application.

Excellent fungicide coverage on wheat heads is crucial to achieve the greatest possible FHB/DON suppression. This is no small challenge since most spray systems used in wheat were developed to deliver pesticides to foliage (horizontal structures). In order to maximize coverage on heads (vertical targets), significant changes may need to be made to the sprayer boom system. Also, discipline must be exercised to ensure that proper sprayer pressure and volumes are used.

For ground application, research has shown that best head coverage is achieved with a double-swivel nozzle configuration of XR8001 flat-fan nozzles oriented forward and backward at a 45 degree angle. Acceptable coverage can also be achieved with a single nozzle configuration using TwinJet TJ8002 nozzles. When using either the double-swivel nozzle or the single TwinJet configuration, best head coverage is achieved when the boom is set 8 to 10 inches above the heads, spray pressure is 30 to 40 psi, and fungicides are delivered in 15 or more gallons or water/A (ground). Speed should not exceed 8 mph.

For aerial application, nozzles should be angled to direct spray 90 degrees to the direction of travel. Spray droplet size should range from 300 to 400 microns and Folicur should be delivered in no less than 5 gallons of water/A. It is best to spray early in the morning or at other times when heavy dew is present. This will facilitate fungicide coverage on heads.

Regardless of the method of application, be sure to tank mix the lowest rate of a non-ionic spray surfactant with Folicur or Orius to enhance coverage and optimize treatment effectiveness.



Folicur or Orius must be applied at a specific time, early flowering, in order to be effective against FHB/DON. The optimal time for application is 25% of primary heads, scouted at several random sites in a field, showing anthers (pale, yellow-green structures about 1/8-in-long). Much beyond 25%, and it may be too late. The flip side - applying Folicur or Orius **before** full head emergence/early flowering can seriously compromise FHB/DON suppression. This brings up a point of tension that wheat producers may face this spring. Delaying application to achieve FHB/DON suppression could allow for excessive build-up of other fungal diseases. Conversely, application of the fungicides before full head emergence will control other diseases, but will have little impact on either FHB or DON. I would advise growers that foliar disease development should take precedence since little is to be gained by suppressing FHB/DON if serious losses are incurred by allowing fungal diseases to develop.

One desire we all have is for fungicides to be used only when needed. Regular field scouting for foliar fungal diseases has been successfully used by growers for many years to determine if and when to spray fungicides. However, this is not possible with FHB since once symptoms are present it is TOO LATE to spray. Below are some general guidelines to help you determine if you should spray Folicur or Orius for FHB/DON suppression this spring:

- Soil moisture has been good and rain is expected in the near future (relates to spore production, dispersal of *Fusarium graminearum* spores, and crop infection).
- Crop has good yield potential (relates to economics and crop density, which increases canopy humidity and may increase spore production, facilitate spore dispersal, and encourage crop infection).
- Temperatures 68-86 F (relates to spore production and crop infection).
- Humidity is high (80% day or night) and/or free water (such as dew) is present on the heads during this period (relates to spore production, dispersal, and crop infection).
- Rain showers and/or free water were available 5-7 days before flowering (relates to spore release, dispersal, and crop infection).

If most or all of the above conditions exist when the crop is at 10-15% flower, you should consider spraying Folicur or Orius within one or two days.

An exciting new tool that can be used to help determine the FHB risk is a new web-based, disease forecasting model recently made available by Penn State University, Ohio State University, and the U.S. Wheat and Barley Scab Initiative. This forecasting model, which is reported to be 80+% accurate in predicting conditions conducive for FHB epidemics, utilizes real-time weather data from numerous

National Weather Service stations within each state. When you enter into the "Risk Map Tool" section of the FHB prediction center home page, you will be asked if you are growing winter or spring wheat. At that point you will come to US map and are asked to click on your state. This will bring you to the main FHB Risk Management Tool page.

The FHB Risk Management Tool page will have a map of Kentucky showing the locations in the state where the weather data are being retrieved. To the upper left corner of the page is a calendar section labeled "Flowering Date". This section needs a bit of explaining. You will note right away that the model will only let you input a "flowering date" as late as the current day. It also covers the preceding 7 days. So, if you estimate your crop will flower on May 7, but it is only May 3, the best you will be able to do is to determine if the weather on May 3 is favorable for FHB, and establish what the FHB risk has been for the preceding 7 days (April 26 - May 2). Of course, since your crop is not flowering, the real FHB risk is zero, no matter what the forecast model says. Nevertheless, that information will tell you if FHB is brewing or not. My advice is to begin determining the FHB risk using this model several days out from crop flowering. Keep checking your wheat and keep checking the model every 1-2 days. By the time your crop reaches 10-15 % bloom, you will have a good feel for the FHB risk in your area. If the forecast model says the FHB risk is high (medium if you are not a risk taker), and the forecast matches your local weather reality, then you might consider spraying Folicur or Orius within 1-2 days.

The web address for the FHB Prediction Center is <http://www.wheatcab.psu.edu/>. Check it out. Once you actually see it and play around with it, what I have said above will make much more sense. The model does have several practical limitations in predicting final FHB levels; these are clearly discussed within the Prediction Center web site. Perhaps the greatest limitation of the model is that it does not account for weather conditions during flowering and grain fill. Specifically, disease-favorable weather occurred during late flowering and grain fill and greatly impacted final FHB/DON levels. As I said earlier, the forecast model is 80+% accurate, so final FHB/DON conditions will not always be reflected by the model's risk output. The authors of the model discuss this limitation under "Reality Check" in the "Model Details" section of the Prediction Center.

We all hope that FHB is non-existent this spring and growers achieve record yields and grain quality as they did in 2006. However, if this is not the case, wheat producers now have an additional tool to consider, and possibly use, to minimize FHB and DON development this spring.

**For More Information, Contact:**

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