UK COOPERATIVE EXTENSION SERVICE
University of Kentucky – College of Agriculture

LEXINGTON, KY 40546

# Wheat Science News

Research & Education Center, Princeton, KY 42445 June 4, 2009 Volume 13, Issue 2

***In This Issue:***



## Wheat Fusarium Head Blight (FHB) Widespread in Kentucky

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The title of this article will not take many in Kentucky by surprise. FHB, also called head scab, has been on the front burner in wheat production circles for the past month. Presently, there are a large number of fields with 30-70% disease incidence; some have less disease and some have more. Many fields were treated with a fungicide in a timely fashion, and this has certainly helped keep disease levels down (by 30-50%). However, many applications were made late and/or under less than ideal conditions. As a result, FHB control is not very good in some treated fields. In addition, many fields were planted last fall to varieties that have reduced susceptibility to FHB; this has really helped. However, the overriding factor which seems to have played the greatest role in determining FHB level is when the field flowered relative to wet periods. The period just before to just after flowering is the time when wheat is the most susceptible to infection by the FHB fungi (primarily, *Fusarium graminearum*). Generally, fields that flowered during the last week in April through the first 10 days in May seem to have the most FHB. Unfortunately, a large percentage of the Kentucky wheat crop flowered during this period.

If you recall, there was great concern last year that we would have a lot of FHB, but it never happened. In fact, 2008 was one of the lowest FHB years on record. When I checked through weather records for Princeton, Caldwell County, KY for the period April 26 – May 28, 2008 vs 2009 (the critical period for FHB infection and development), there was not a great deal of difference in the number of wet days and total rainfall (6.82 inches of rain and 14 wet days in 2008 vs. 7.67 inches rain and 18 wet days in 2009). However, there was a significant difference in average temperature and timing and arrangement of wet days between the two years. In 2008, the average temperature for this period was 4°F ***lower*** than in 2009. Also, in 2008, most rain events were followed by warm, sunny, windy days which tended to dry the crop out between rain events. Both situations apparently kept the FHB risk down. In addition, most wheat fields in 2008 flowered when conditions were, more or less, dry and sunny. This year, there was a block of seven straight days of precipitation, with a one day break, followed by another four days of rain from April 28 - May 9. This block of nearly 11 consecutive days coincided with the onset of flowering in most wheat fields. It is no wonder we have a great deal of FHB this year compared to last.

The potential for an FHB "situation" was indicated by the FHB Risk Assessment Tool (www.wheatscab.psu.edu/), but it did not provide

producers with much advanced warning. As of May 2, the FHB Risk Assessment Tool map (Figure 1) was showing low risk for most of the state, with few small spots of moderate risk. At that time, wheat in the far southwestern part of the state was in early flowering, but most wheat in the state (including Princeton) was in various stages of head emergence or extremely early flowering (<1% of main tillers with anthers).

Two days later, on May 4, there was a significant shift towards an increased FHB risk **(**Figure 2).

By May 6, conditions deterioriated even further, and a moderate to high FHB risk existed across much of the state (Figure 3).

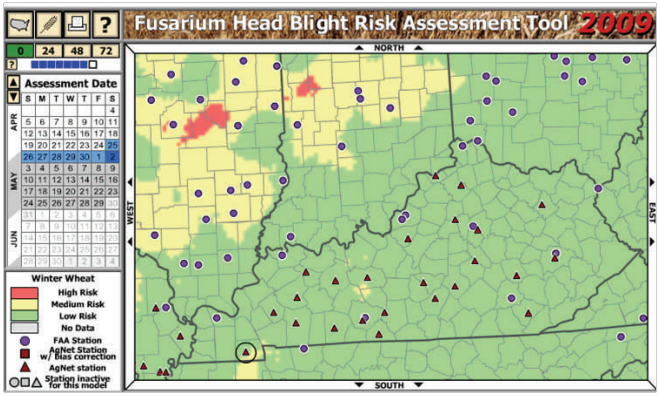


**Figure 1.** FHB risk as of May 2, 2009.

So, the FHB Risk Assessment Tool was accurate, but it was not very helpful because by the time the disease prediction models finally "kicked in" and showed an elevated FHB risk, fields were beginning to flower and were at peak susceptibility to infection. At the same time, wet weather greatly hindered attempts to get fields sprayed with a fungicide. As a result, many fields either did not get sprayed, or applications were compromised in some way. Fortunately, many growers were able to do a good job with applying fungicides.

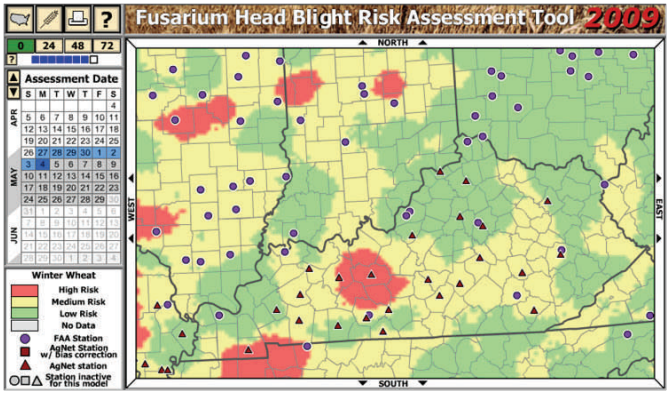


**Figure 2.** FHB risk as of May 4, 2009.

As of this writing, the extent of FHB damage in KY is still not known. Some fields are infected, but are still in the process of expressing symptoms. As a general rule of thumb, maximum symptom expression usually occurs 21 days after infection or the soft dough stage, whichever comes first. Once a field begins to dry down, it is nearly impossible to see FHB symptoms. However, if you take a few hand-fulls of heads from several locations in a field, crush the heads in your hands, and blow the chaff away, you will see the telltale evidence of FHB: scabby grain (Figure 4).

Grain severely impacted by FHB will be shriveled and will have a low test weight. Grain will also be contaminated with a mycotoxin called deoxynivalenol (DON). Grain with a low test weight and excessive DON can greatly limit the marketability and end-use of grain (feed and food). If the FHB problem extends beyond KY and becomes a regional concern (i.e., re-

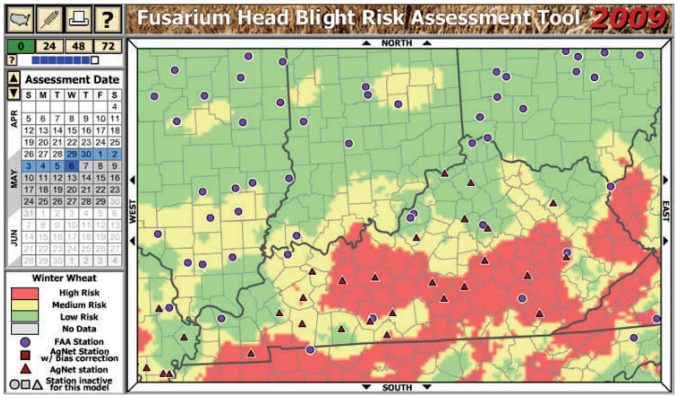


**Figure 3.** FHB risk as of May 6, 2009.

gional soft red winter wheat crop), grain prices received throughout the region may be negatively impacted as the market employs a "regional discount" in order to make up for increased cost (storage, blending, etc.). If FHB turns out to be a mostly Kentucky problem, elevators will apply discounts to grain lots that are substandard. Seed producers should be aware that germination and vigor are also seriously reduced in scabby grain. For non-seed producers, seed shortages of certain varieties and reduced seed quality are often common following a major FHB episode.

**Figure 4.** Scabby grain (left) vs. healthy, plump grain (right). Scabby kernels are shriveled and frequently have a faint pink or salmon discoloration.

At this point there is no way to alter the course of FHB in a field; however, there are several steps producers can take to minimize the impact of FHB. That is the goal of this issue of the Wheat Science Newsletter. Look for much more information to become available in the coming weeks and months to help you reduce the potential for FHB to occur next year.

Deoxynivalenol (DON) or vomitoxin, may be present in high concentrations in scabby grain. If the grower has insured the wheat crop and has determined that DON levels exceed 2 ppm, then certain insurance adjustments are possible. This information may be accessed from the special provisions portion of the RMA website: http://www.rma.usda.gov/

It is recommended, however, the growers in this situation speak to their agents and adjustors to get information that is relevant to their crop.

## Check Your Wheat Hay Before Feeding

***Chad Lee, Extension Agronomist***

Some farmers are cutting scab-infested wheat for hay rather than taking yield losses on grain. Scab-infested wheat usually has elevated levels of deoxynivalenol (DON or vomitoxin) which can be toxic to beef and dairy cattle as well as swine. Another toxic compound is zearalenone, but it rarely is produced in wheat. There is some evidence to suggest that DON might also be a marker for several other mycotoxins as well. The U.S. Food and Drug Administration (FDA) set advisory levels for DON in feed (Table 1).

Some farmers are used to ensiling wheat forage to help reduce nitrate levels. Ensiling will do nothing for the toxin levels, but it will preserve the forage. If you regularly ensile forages, then ensiling is fine in this case. Ensiling will not affect toxin levels so a forage test conducted before or after ensiling should have similar results.

There is no method to visually determine toxin levels in wheat and any wheat cut for hay this season should be tested in a laboratory **before** being fed. Whole plant samples should be tested since toxin levels can be different in the wheat heads and straw. Ideally, collect a whole plant sample of wheat, let it dry down several days and send it to one of the laboratories for analysis (Table 2).

Please recognize that a test result is only as good as the sample sent in for analysis. If you happen to send in one sample with low vomitoxin levels, that does not mean that your entire supply of wheat hay is safe. You should pull samples from several fields and test them for toxins.

Blending wheat hay with other feed sources may be a good idea, even on wheat tested safe this season. For more information about testing wheat hay or feeding wheat hay to livestock this season, contact your county extension agent.

**Table 1.** U.S. FDA advisory levels for deoxynivalenol (vomitoxin) in livestock feed (Henry, 2006). (also available at: http://www.extension.org)

| Class of Animal | Feed Ingredients and Portion of Diet | DON levels in Grain and Grain By-Products and (Finished Feed) |
|---|---|---|
| Ruminating beef and feedlot cattle older than 4 months | grain and grain by-products not to exceed 50% of the diet | 10 ppm (5 ppm) |
| Chickens | grain and grain by-products not to exceed 50% of the diet | 10 ppm (5 ppm) |
| Swine | Grain and grain by-products not to exceed 20% of the diet | 5 ppm (1 ppm) |
| All other animals | Grain and grain by-products not to exceed 40% of the diet | 5 ppm |

**Table 2.** Facilities that test for vomotoxin (DON) in wheat. This is not necessarily a comprehensive list; check with your county extension agent and veterinarian for other testing facilities. Any errors in prices are the fault of the author and not any laboratory. Please call the facility before sending in samples to confirm prices.

| Laboratory | Fees and other comments |
|---|---|
| Cumberland Valley Analytical Services, Inc.<br>Hagerstown Forage Lab<br><br>U.S. Postal Mailing Address<br>Cumberland Valley Analytical Services, Inc.<br>P. O. Box 669<br>Maugansville, MD 21767<br><br>Shipping Address for UPS/FEDEX<br>Cumberland Valley Analytical Services, Inc.<br>14515 Industry Drive<br>Hagerstown, MD 21742<br><br>(800) 282-7522 | Full toxin screen, including vomitoxin (DON): $64.50<br>vomitoxin, only: $36.50 |
| Murray State University<br>Breathitt Veterinary Center<br>PO Box 2000<br>715 North Drive<br>Hopkinsville, KY 42241-2000<br><br>(270) 886-3959 | $10 accession fee and $35 per test |
| University of Kentucky<br>Livestock Disease Diagnostic Center<br>1490 Bull Lea Rd.<br>Lexington, KY 40511<br><br>(859) 253-0571 | One accession will cost a grower $25 when target species is a food animal (i.e. beef, dairy, poultry and swine). Multiple samples per accession are allowed as long as the samples are from the same producer.<br>Samples at LDDC will be sent to North Dakota for testing, but billing will occur through LDDC. Billing must be to the producer. |
| Waters Agricultural Laboratories, Inc.<br>2101 Calhoun Rd.<br>Owensboro, KY 42301<br><br>(270) 685-4039 | Vomitoxin: $48.00<br>Zeralenone: $48.00<br><br>We have supplies (bags, boxes, etc.) available upon request. We have a 24-48 hour turnaround on results. |

**References:** Aakre, D., G. Flaskerud, K. Hellevang, G. Lardy, M. McMullen, J. Ransom, B. Sorenson, A. Swenson. 2005. DON (Vomitoxin ) in Wheat: Basic Questions and Answers. North Dakota State University Extension Service, North Dakota State University.

Henry, M. H. 2006. Division of Animal Feeds, Center for Veterinary Medicine, Food and Drug Administration, Mycotoxins in Feeds: CVM's Perspective, Presentation for Risk Management Agency, August 23, 2006, in Austin, Texas, http://www.fda.gov/AnimalVeterinary/Products/AnimalFoodFeeds/Contaminants/ucm050974.htm

Whitlow, L.W. and W.M. Hagler, Jr. 2008. Mold and Mycotoxin Issues in Dairy Cattle: Effects, Prevention and Treatment, Last updated: Nov. 12, 2008. http://www.extension.org/pages/Mold_and_Mycotoxin_Issues_in_Dairy_Cattle:_Effects%2C_Prevention_and_Treatment

Wright, C., A. Garcia, J. Held, B. Thaler, R. Daly and M. Draper. 2005. Feeding scab-infested wheat to livestock. Extension Extra. South Dakota Coop. Extension Service. South Dakota State University.

## Harvesting, Drying and Storing Wheat Suspected of Vomitoxin Contamination

*Sam McNeill, Extension Agricultural Engineer*

**Background**

Fusarium head blight (FHB) has threatened this year's wheat crop in Kentucky, causing concern among growers, crop advisors and grain buyers. While the impact of this disease is yet to be determined, it more than likely will vary from farm to farm and region to region. Knowing how the disease impacts seed quality can help growers deal with it in their operation.

Wheat kernels that are infected early (while the head is maturing) will likely be smaller in size, have a shrunken appearance and slightly discolored. However, if wheat heads are infected during field dry down, kernels that may contain mycotoxins may look normal to the naked eye resulting in the possibility of leading one to a false sense of security.

Prolonged conditions in the right combination can result in elevated levels of FHB (and other diseases). Molds responsible for mycotoxin production generally prefer warm, humid conditions (temperatures > $60^{o}$ F and relative humidities > 70%) for extended periods of time to actually produce vomitoxin, (zearalenone or fumonisin). However, under ideal conditions that are specific to each type of mold, mycotoxins can be produced in a matter of hours!

For this reason, diligence is essential when managing any crop that is suspected of being contaminated with mycotoxins. Extra care must be taken when harvesting, handling, drying and storing the crop to minimize the cost penalties associated with discounts from excessive toxin levels or poor wheat quality. Test kits are available to determine mycotoxin levels and should be used to screen any suspected fields for damage (see accompanying article from North Dakota State University Extension Service).

**Harvesting**

Consider harvesting wheat early if sufficient drying capacity is available on the farm or commercially. Early harvest may help reduce the spread of head scab and other diseases within individual fields, and can also prevent field sprouting, boost test weight and perhaps most importantly, increase soybean yield when double-cropping. Also consider segregating wheat by field or variety to prevent mixing sound wheat with diseased wheat. It may be best to harvest diseased wheat last to avoid the time consuming task of cleaning out the combine, carts/wagons, trucks, conveyors and other handling equipment between fields.

Proper adjustments to the sieving and cleaning section on a combine are critical when dealing with a contaminated wheat crop. Most wheat diseases turn plump healthy kernels into small, shriveled/ "tombstone" kernels, so typical recommendations for a conventional combine are to increase fan speed and manage the load of straw, chaff, weeds and foreign material on the sieves. If the fan is set too low, the walkers/sieves will fill up with straw and all wheat kernels will ride out the back on a mat of chaff. If fan speed is too high it will blow sound and shriveled kernels out the back.

Under normal harvest, fan speed should be set to provide good separation between sound kernels and straw or chaff. With 'scabby' wheat that may contain vomitoxin, fan speed should be increased to remove light weight kernels. Operators should monitor grain in the tank often to determine machine settings for best performance, and recall that ground speed should be adjusted to match yield within fields so that a near-constant feed rate is achieved through the combine.

**Drying**

Wheat fields that are suspected of having high levels of vomitoxin or fumonisin should be scouted or monitored prior to harvest to determine if segregation or early harvest is needed. With the right combine adjustments, wheat can be harvested above 20% moisture if sufficient drying capacity is available on the farm or commercially. Contaminated wheat should be dried to 13% within 24 hours and held separately from the rest of the crop. High temperature bin dryers or stand-alone automatic batch or continuous flow grain dryers are all adequate for drying high moisture wheat quickly. [For bin drying, grain depth must be managed to provide a minimum airflow rate of 5 cubic feet per minute (cfm) per bushel. A general rule of thumb for a given amount of airflow is that doubling the depth of grain requires 10 times more fan horsepower. For example, delivering 5 cfm per bushel (cfm/bu) in a 30-foot diameter bin filled with 3 feet of wheat (1700 bu) requires a 2.5 HP fan…but a depth of 6 feet in the same bin (3400 bu) requires 25 HP! Thus, bin dryers are limited to small batches for timely processing with limited heat to prevent over-drying the bottom layer of

grain. Several bins are needed to add drying capacity.]

Table 1 shows the moisture content that soft winter wheat will approach with sufficient exposure to the temperature and relative humidity conditions shown. Daily average air conditions during late June and early July are generally near 75 degrees with 65 percent humidity. Under these conditions, wheat will approach 12.5 % moisture which is safe for storage.

In contrast to bin dryers, self-contained automatic batch or continuous flow dryers have inherently high airflow rates (50 to 125 cfm/bu) so drying wheat in these units is often done with little or no additional heat. If heat is used, limit drying temperatures to 120 $^0$F (110 for seed wheat).

**Storing**

It is best to store sound wheat separately from diseased wheat and clean handling equipment between loads to avoid contamination. The next best option is to clean mixed wheat as it is moved into storage to remove shriveled kernels. If this isn't practical for your farm, keep in mind that lighter wheat kernels will tend to collect in the center of a storage bin during filling, which restricts airflow in this region. For wheat that isn't cleaned, core the bin soon after filling to remove trash and smaller kernels to improve airflow. Also, don't fill a bin past the top ring to allow room for adequate ventilation in the head space and for grain inspections. Always be aware of the entrapment hazards associated with flowing grain and wear dust protection masks when working inside bins and other enclosed spaces where grain is stored. More information on harvesting, drying and storing wheat is available at county extension offices and online (www.uky.edu or http://www.bae.uky.edu/ext/Grain_Storage/PDFs/Wheat_HDS_ID-125.pdf).

**Table 1.** Equilibrium moisture content of soft red winter wheat at different air temperatures and relative humilities.

| Temperature $^0$F | Relative Humidity, % | | | | |
|---|---|---|---|---|---|
| | 20 | 35 | 50 | 65 | 80 |
| | Grain Moisture, % wb | | | | |
| 40 | 9.3 | 10.8 | 12.1 | 13.7 | 15.7 |
| 60 | 8.4 | 9.9 | 11.3 | 12.9 | 15.0 |
| 80 | 7.7 | 9.3 | 10.7 | 12.3 | 14.4 |
| 100 | 7.1 | 8.7 | 10.1 | 11.7 | 13.8 |
| 120 | 6.6 | 8.2 | 9.6 | 11.3 | 13.4 |

## For More Information:

## DON (Vomitoxin) in Wheat Basic Questions and Answers

**http://www.ag.ndsu.edu/pubs/plantsci/pests/pp1302.pdf**

**NDSU Extension Service**