

DISEASES OF WHEAT

# Fusarium Head Blight (Head Scab)

Authors:

Kiersten Wise

Charles Woloshuk



www.btny.purdue.edu



Photos by Kiersten Wise  
& Greg Shaner (Figure 4)

In Indiana, Fusarium head blight of wheat (FHB), also called head scab, is caused mainly by the fungus *Gibberella zeae* (also known as *Fusarium graminearum*). This disease periodically causes significant yield loss and reduced grain quality. *Gibberella zeae* also produces mycotoxins, which are chemicals that are toxic to humans and livestock.

This publication describes:

1. How to identify the disease
2. Conditions that favor disease development
3. Mycotoxins produced by the fungus
4. Proper handling of diseased grain
5. How to manage the disease

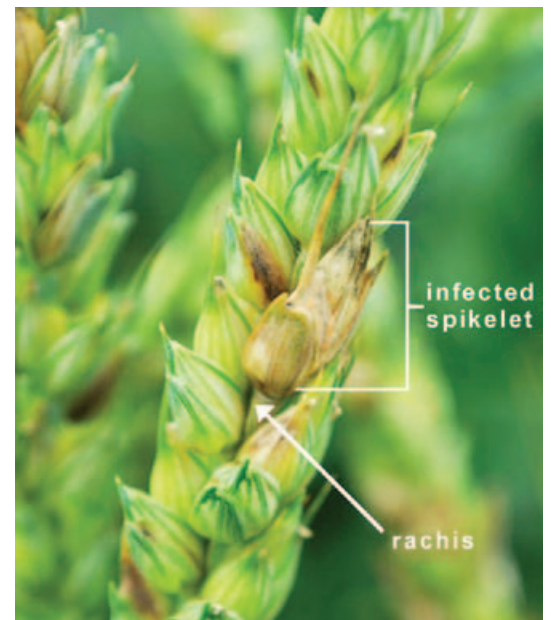
## Disease Identification

FHB symptoms are confined to the head, grain, and sometimes the peduncle (neck). Typically, the first noticeable symptom is bleaching of some or all of the spikelets while healthy heads are still green (Figure 1). As the fungus moves into the rachis, spikelets located above or below the initial infection point may also become bleached (Figure 2).

If examined closely, pink to orange masses of spores may be visible on infected spikelets. These spore masses are produced during wet, humid weather (Figure 3). Infected kernels, commonly called tombstones, appear shriveled, discolored, and are lightweight (Figure 4).



**Figure 1.** An individual spikelet infected with *Fusarium graminearum*. During favorable conditions, the fungus may spread into the rachis and infect spikelets above or below the infection point.



**Figure 2.** A bleached wheat head symptomatic of fusarium head blight.



**Figure 3.** Pink to orange masses of fungal spores may be present on infected spikelets.



**Figure 4.** Bleached and shriveled tombstone kernels (left) compared to healthy wheat kernels.

Seed infected with *Fusarium graminearum* can produce seedlings affected by seedling blight when planted. Infected seeds will have poor germination and the resulting seedlings may be slow to emerge. Infected seedlings will be reddish-brown to brown, will lack vigor, and will tiller poorly.

### Favorable Conditions

In corn, *Gibberella zeae* also causes stalk rot and ear rot. In Indiana, the fungus survives through the winter primarily in infected corn residue. The following spring, the fungus resumes growth on the corn residue and produces spores. High humidity and frequent rainfall promote production and dispersal of spores from

infected residue, and air currents transport spores to wheat plants. Wheat is susceptible to FHB infection at flowering (Feekes 10.5.1) through early dough stage (Feekes 11.2).

As little as two or three days of light to moderate rainfall can favor infection. Optimum temperatures for infection are between 75°F and 85°F, but during prolonged periods of high humidity and moisture, infection will occur at lower temperatures. The initial infection on the wheat head may produce additional spores that can infect other wheat heads. This secondary infection can be especially problematic in uneven wheat stands with late flowering tillers.

Infection will continue as long as weather conditions are favorable and wheat plants are at susceptible growth stages.

### Risk of Mycotoxins

*Gibberella zeae* produces the mycotoxin, deoxynivalenol (DON), also known as vomitoxin. The occurrence of scab does not automatically mean that DON is present, but high levels of tombstones or damaged kernels in the harvested grain should be suspect.

Hogs are most sensitive to DON and may refuse to consume DON-contaminated grain, which will result in poor weight gain (Table 1.). DON affects cattle, sheep, and poultry less. Diluting scabby wheat with normal quality grain may reduce DON content in the ration to a safe level.

### Deoxynivalenol (DON) Advisory Levels for Animals\*

Animal	Maximum DON Level Allowed
Swine	<b>5 ppm</b> Not to exceed 20 percent of ration with finished feed = 1 ppm
Ruminating beef and feedlot cattle (more than 4 months old)	<b>10 ppm</b> Not to exceed 50 percent of diet with finished feed = 5 ppm
Poultry	<b>10 ppm</b> Not to exceed 50 percent of diet with finished feed = 5 ppm
All other animals	<b>5 ppm</b> Not to exceed 40 percent of diet

\*These levels have been established by the U.S. Food and Drug Administration.

The fungus may also produce another mycotoxin, zearalenone, however this mycotoxin is not as common in wheat as DON. Zearalenone has estrogenic properties, which means it can cause infertility, abortion, or other breeding problems. As little as 1 to 5 ppm zearalenone in a feed ration may produce an estrogenic effect in swine.

### Mycotoxin Testing

Only a chemical analysis can verify the presence and amount of deoxynivalenol (DON) in infected grain. Your Purdue Extension county educator can help you with testing options.

To find your educator, visit or call toll free:

[www.extension.purdue.edu/counties.html](http://www.extension.purdue.edu/counties.html)

(888) EXT-INFO

The Indiana Animal Disease Diagnostic Laboratory (ADDL), and Indiana Crop Improvement Association (ICIA) perform toxicology services (including DON analysis) on grain samples.

ADDL (West Lafayette, Ind.) • (765) 494-7440

ADDL (Dubois, Ind.) • (812) 678-3401

[www.addl.purdue.edu/Users/TOX/Tests.asp](http://www.addl.purdue.edu/Users/TOX/Tests.asp)

ICIA (Lafayette, Ind.) • (866) 899-2518

[www.indianacrop.org](http://www.indianacrop.org)

There are a number of commercial laboratories that analyze grain for DON. Two that test grain in the central and north-central regions of Indiana are:

East Indiana Grain Inspection, Inc.

(765) 744-6425 • [dwgross@comcast.net](mailto:dwgross@comcast.net)

Titus Grain Inspection, Inc.

(765) 463-3713 • [titusgraininsp@aol.com](mailto:titusgraininsp@aol.com)

Quick test kits are available from:

Romer Labs • [www.romerlabs.com](http://www.romerlabs.com)

Neogen • [www.neogen.com](http://www.neogen.com)

Charm Science • [www.charm.com](http://www.charm.com)

More information about DON, other mycotoxins, and other commercial laboratories is available from:

Mycotoxins: Biosecurity and Food Safety  
(Purdue Botany and Plant Pathology)

[www.btny.purdue.edu/NC1025](http://www.btny.purdue.edu/NC1025)

### Handling Grain Safely

The mycotoxins FHB produce are typically concentrated in shriveled tombstone kernels (Figure 4). These lightweight kernels can be separated from healthy grain at harvest by increasing the combine's fan speed.

After harvest, it is critical to properly store diseased grain to prevent further contamination. Dry infected grain to less than 18 percent moisture to stop growth of the pathogen and mycotoxin production, and then dried to less than 13 percent moisture to prevent spoilage by storage fungi.

DON is an extremely stable mycotoxin and drying and storing grain will *not* reduce DON levels in harvested grain. However, DON concentration will not increase in properly stored grain.

When storing infected grain, avoid mixing it with good quality grain. The light, tombstone kernels caused by the disease tend to accumulate in the center of storage bins, and hot spots may occur if higher moisture fine material is present in the core as well. Use a cleaner to remove fines from the wheat before binning and a grain spreader to distribute infected kernels more evenly to minimize spoilage risks. If a cleaner and a spreader are not available, remove the central core of wheat as soon after binning as possible.

### Disease Management

Effective FHB management requires an integrated approach: selecting resistant wheat varieties, practicing cultivation, planting high-quality seed, and fungicide applications as needed. No single disease management tactic will provide adequate control of the disease, especially if environmental conditions favor disease development.

#### Select Resistant Varieties

No commercially available wheat varieties are highly resistant to FHB, but moderately resistant varieties are available. Producers are encouraged to select varieties that have some level of FHB resistance.

Resistance ratings are available from seed dealers and the annual Purdue Wheat Improvement Program Performance Trials:

[www.agry.purdue.edu/ext/smgrain](http://www.agry.purdue.edu/ext/smgrain)

### Manage Residue

When possible, tillage following a corn rotation is encouraged. Managing corn residue will reduce the amount of overwintering inoculum that can infect a subsequent wheat crop. Planting wheat into corn stubble greatly increases the likelihood of FHB development, so wheat should follow non-host crops (such as soybean) whenever possible.

### Plant High-quality Seed

Planting high-quality seed can minimize seedling blight. Before planting, clean seedlots with symptoms of FHB and conduct a germination test to determine seed vigor. Fungicide seed treatments can help reduce seedling blight caused by infected seed, but they will not protect flowering wheat against infection in the spring.

Check with your Purdue Extension county Educator or field crop diseases Specialist to learn more about seed treatment options and recommendations.

### Use Fungicides Effectively

A fungicide's ability to effectively suppress FHB depends on application timing, spray coverage, and disease pressure. The online Fusarium Head Blight Risk Assessment Tool ([www.wheatcab.psu.edu](http://www.wheatcab.psu.edu)) can help producers assess the

risk of FHB infection prior to and at flowering. The tool uses weather data to predict the level of risk for infection. This information can help producers determine whether or not fungicide applications are warranted.

Remember, the model is only one tool in the decision-making process. Producers also should consider a variety's susceptibility, crop production practices, and local weather forecasts when deciding whether to apply a fungicide.

Several fungicides are now labeled for use against FHB of wheat, and they vary in how much protection they provide. Research indicates that products within the triazole class of fungicides are most effective if applied at early flowering (Feekes 10.5.1). Do not use fungicides that contain a strobilurin mode of action to manage FHB. Before applying any fungicide, always check the pre-harvest interval indicated on the product label.

Current fungicide recommendations developed by the North Central Regional Committee on Management of Small Grain Diseases are covered in publication NCERA-184:

[www.ppd.purdue.edu/ppdl/wise/NCERA\\_184wheatfungicides.pdf](http://www.ppd.purdue.edu/ppdl/wise/NCERA_184wheatfungicides.pdf)

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