DISEASES OF WHEAT

Fusarium Head Blight (Head Scab)

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

This publication describes:

- How to identify the disease
- Conditions that favor disease development
- Mycotoxins produced by the fungus
- Proper handling of diseased grain
- How to manage the disease

Disease Identification

FHB symptoms are confined to the wheat head, grain, and sometimes the peduncle (stem near the wheat head). 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).

When planted, seeds infected with *F. graminearum* will have poor germination, resulting in slow emergence, and can be

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.

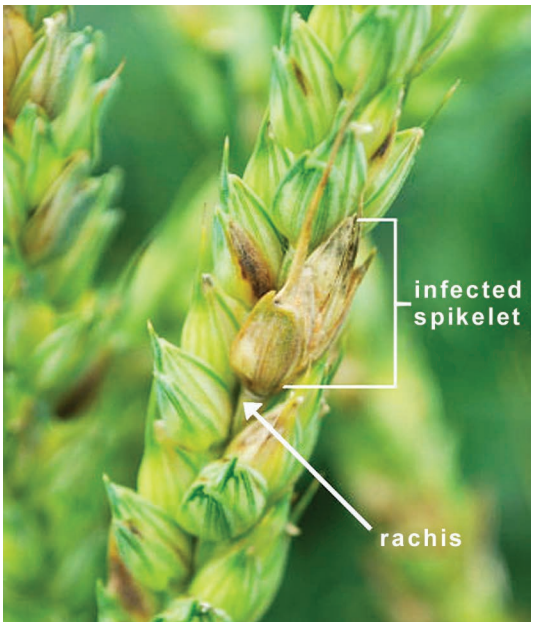

Figure 2. A bleached wheat head symptomatic of Fusarium head blight.

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.

affected by seedling blight disease. Infected seedlings will appear reddish-brown to brown, lack vigor, and tiller poorly.

Favorable Conditions

In corn, *F. graminearum* (*Gibberella zeae*) causes stalk and ear rot diseases. 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 the 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 (24°C and 29°C), 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

Fusarium graminearum produces the mycotoxin, deoxynivalenol (DON), also known as vomitoxin. The occurrence of scab does not automatically mean that DON is present, however, DON levels can be high even when disease levels are low. If harvested grain has high levels of tombstones or damaged kernels DON is likely present. The mycotoxin can continue to accumulate until grain moisture levels fall below 13 percent, so DON levels can be very high when wheat is harvested late in the season.

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.

Table 1. Dexoynivalenol (DON) levels allowed by the U.S. Food and Drug Administration in grain fed to livestock.*

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

Mycotoxin Testing

Only a chemical analysis can verify the presence and amount of mycotoxins in infected grain.

A variety of commercial laboratories and quick-test kits exist for mycotoxin analysis.

Romer Labs (www.romerlabs.com) and Neogen (www.neogen.com) sell test strips for mycotoxin analysis. To find inspectors that analyze grain and mycotoxin in Indiana, contact your Purdue Extension county office at extension.purdue.edu/Pages/countyoffices.aspx or (888) EXT-INFO.

Handling Grain Safely

The mycotoxins FHB produce are typically concentrated in shriveled tombstone kernels (Figure 4). These light-weight 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 15 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 applying fungicides 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: ag.purdue.edu/agry/extension/Pages/wheat_small_grains.aspx.

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 a nonhost or less susceptible crop (that is, soybeans) 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.

Several fungicides are now labeled for use against FHB of wheat, and they vary in how much protection they provide — see *Diseases of Wheat: Fungicide Efficacy for Control of Wheat Diseases* (Purdue Extension publication BP-162-W.

Research indicates that products within the triazole class of fungicides are most effective if applied at early flowering (Feekes 10.5.1). Fungicide applications may still be efficacious after early flowering if conditions that favor disease development occur past Feekes 10.5.1 and conditions prevent an application precisely at Feekes 10.5.1.

The online Fusarium Head Blight Risk Assessment Tool (www.wheatscab.psu.edu) can help producers assess the

risk of FHB infection prior to and at flowering and help with optiumum fungicide application timing. 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, and optiumum timing when conditions favor disease development.

Remember, the model is only one tool in the decision-making process. It is designed to assess the general risk of infection and does not serve as a guaranteed forecast. Producers also should consider a variety's susceptibility, crop production practices, and local weather forecasts when deciding whether to apply a fungicide.

Do not use fungicides that contain a strobilurin (quinone-outside inhibiting class or QoI) mode of action to manage FHB. Before applying any fungicide, always check the pre-harvest interval indicated on the product label.

Current fungicide recommendations are available in *Diseases of Wheat: Fungicide Efficacy for Control of Wheat Diseases* (Purdue Extension publication BP-162-W), available from the Education Store (www.edustore.purdue.edu).

For more information, see:

Freije, A. N. and Wise, K.A. 2015. Impact of Fusarium graminearum inoculum availability and fungicide application timing on Fusarium head blight in wheat. Crop Protection. 77, 139-147.

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