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G94-1207 Scab of Wheat

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Scab of Wheat

The identification of and disease cycle of wheat scab is described along with its management. Guidelines for using wheat contaminated with vomitoxin also are included.

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Scab or Fusarium head blight is an important disease of wheat, barley, oats, rye and wheatgrasses. Scab manifests itself by the premature death or blighting of spikelets in the wheat head. Direct yield losses are often minor, but can be higher than 50 percent in severely infected fields. The economic significance is magnified by the possibility that the low quality, shriveled grain also can become contaminated by mycotoxins (e.g. vomitoxin, zearalenone). The interacting factors that determine the effect of scab on production and marketing include:

1. visible head blight in the field,
2. visible kernel damage,
3. incidence of infected kernels,
4. mycotoxin level.

Figure 1. Premature ripening of scab-infected heads.

Wheat scab is caused by several species of *Fusarium* fungi. Those species most often associated with scabby grain in Nebraska are *Fusarium graminearum* and *F. moniliforme*. These fungi occur as soil inhabitants as well as saprophytes on crop residues and are always present. In addition to causing scab, they also cause seed decay, seedling blight, and crown and root rot of small grains, and stalk, ear, and head rots of corn and sorghum.

Symptom

Symptoms of scab develop on emerged immature wheat heads and are most conspicuous after the soft dough stage. Diseased heads appear to have ripened prematurely in contrast to the healthy, green heads (*Figure 1*). The fungus may attack the entire head or only part of it. If the neck becomes infected, the entire head is usually killed. During warm, humid weather infection produces a salmon orange to pink ring of mycelium and spores at the base of the spikelet or in the crease of the kernel (*Figure 2*). Infection may spread to adjacent spikelets. Infected spikelets take on a tan to brown color and are usually sterile or only partially filled (*Figure 3*).

Figure 2. Note the Pink-orange fungal growth in the crease of the kernel.

Infection of the young, developing grain results in shrunken kernels that have a dull, chalky, tombstone-like appearance (*Figure 4*). A tufty whitish pink mycelial growth may be seen on the seed.

Disease Cycle

Corn, sorghum and wheat play an important role in the survival of the pathogen and in the buildup of inoculum in areas where these crops overlap. The pathogen overwinters on wheat stubble, corn and sorghum stalks, and grass residue. Spores produced on residue of the previous crop are carried by wind to the wheat head and subsequently invade flower parts, glumes, rachis or other portions of the head. Warm rain or heavy dew provide optimum conditions for spore germination and penetration. The anthers that protrude from the florets during anthesis (flowering) are often the initial point of infection. Secondary infections by spores released from scab-infected heads may occur under optimum conditions for disease development.

Extended periods of warm (70-80F) temperatures and wet, humid weather favor infection and disease development. Because of the short period of high susceptibility during grain development, there is usually only one infection cycle per growing season. The longer the wheat plants stay wet during flowering and early seed development, the greater the chance of infection and increased severity. Head blight symptoms appear three to five days after infection.

Figure 3. A close-up of a severly infected spike.

Fusarium spores produced on seed in the scabby head are a source of inoculum for seedling blight if infected seed is planted. Blighted seedlings have a brownish, water-soaked cortical rot either before of after emergence.

Management

Unfortunately, there are no practical effective control measures against scab in the semi-arid Great Plains. Applying fungicides to protect newly emerged heads is not cost effective. Differences in wheat variety responses in a given year reflect more the coincidence of wet weather at flowering than genetic resistance. However, after the 1993 epidemic in the Upper Midwest caused over one billion dollars in losses, scab resistance or tolerance is receiving greater emphasis in wheat breeding programs.

Crop rotations in which wheat does not follow corn or sorghum present less risk from scab than when wheat is seeded into corn or sorghum residue or no-tilled into wheat stubble. However, in almost all situations adequate amounts of inoculum are usually present to cause damage. Factors such as variety, crop rotation, crop maturity and tillage usually don't affect scab incidence. Weather conditions during flowering becomes the overriding factor.

Figure 4. Shriveled, pinkish colored scabby kernels.

Since infected kernels are shriveled and light, increasing the combine airflow will remove many scabby kernels. This also will lower the level of mycotoxin(s), if present, in the harvested grain and is one reason why high concentrations of mycotoxins usually do not end up in harvested grain and eventually the milled wheat products.

Scab infested grain should not be saved for seed wheat. Any seed from scab areas should be cleaned, germination tested and treated with a fungicide containing thiram before planting.

The Mycotoxin Aspect

Scab infected grain can contain the mycotoxins, vomitoxin and zearalenone. Vomitoxin causes vomiting in nonruminant animals and is the cause of the "feed refusal factor" in swine. Zearalenone is an estrogenic mycotoxin

and may cause infertility in domestic animals. The presence of scab in grain does not ensure that mycotoxins have been produced; however, scabby grain should be analytically assayed for the presence of vomitoxin and zearalenone. In Nebraska these tests can be provided by the following laboratory:

University of Nebraska
Veterinary Diagnostic Center
P.O. Box 83097
Lincoln, NE 68583-0907
Phone: (402) 472-1434

Infection at or after the milk stage resulting in kernels large enough not to be lost during harvest often produces toxin in the grain.

Guidelines for Using Scab-Infected Grain

If scab-infected grain is to be used for feed, test the grain for vomitoxin and zearalenone. If it is to be fed to horses, include a fumonisin test. Fumonisins can cause equine leukoencephalomalacia in horses. Straw from nonharvested, scab-infected fields should not be used for bedding for swine or horses without being screened for mycotoxins. Take care when using straw from infested fields as bedding for gestating sows and piglets.

Table I offers guidelines on using scab-infected grain that contains various levels of vomitoxin.

Table I. Vomitoxin Advisory Levels for Wheat.*	
1 ppm	Finished wheat destined for human consumption flour, bran, and germ.
10 ppm	For grains and grain by-products destined for ruminating beef and feedlot cattle older than four months or chickens. Total not to exceed 50% of diet = 5 ppm in diet.
5 ppm	For grains and grain by-products destined for swine. Total not to exceed 20% of diet = 1 ppm in diet.
5 ppm	All other animals. Total not to exceed 40% of diet = 2 ppm in diet.
No advisory level issued for new wheat intended for milling. (Since blending is allowed there is no need to set a level. The only catch is you need grain free of vomitoxin for blending.)	

*There are no official tolerance levels-advisory levels have no regulatory power in the United States.

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