



Extension FactSheet

Plant Pathology, 2021 Coffey Road, Columbus, OH 43210-1087

Head Blight or Scab of Small Grains

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Head blight or scab is an important disease of wheat, oats, barley and spelt in years when warm, wet weather persists during the heading and blossoming period of these cereal crops. Scab is not only a disease of small grains, but of many grasses including wheat, foxtail, quackgrass, crabgrass and bluegrass.

Scab is only one of several diseases of small grains caused by species of *Fusarium*. Seedling blight, due to planting scabby kernels, is an important disease effectively controlled by seed treatment fungicides. The *Fusarium* fungi also cause root rot and crown rot diseases in small grains. Corn is an important host for these fungi in the Corn Belt. On corn these fungi cause ear, stalk and root rot diseases.

The severity of scab infection varies greatly from year to year. Severe infection occurs during the flowering stage and shortly afterward when wet weather prevails. Two to three days of light rain during this period will initiate epidemics. If the weather is dry during this critical period, the grain crop will be essentially scab-free.

In Ohio, during years of favorable weather, the incidence of infected heads has been as high as 100 percent in some fields. In these cases over 50 percent of the spikelets have been destroyed. Other affects of scab include floret sterility, poor test weights due to shriveled grain and yield loss. In general, oats are less susceptible to scab than either wheat or barley.

Scab is important, not only because it reduces yield, but it reduces the quality and feeding value of the grain. The fungi causing scab may produce chemicals in the infected grain which are toxic to livestock and humans. Vomitoxin, or deoxynivalenol, contamination has been a problem in wheat in Ohio during years with scab epidemics.

Symptoms

The earliest and most conspicuous symptom of scab occurs soon after flowering. Diseased spikelets turn light-straw colored and have a bleached appearance due to premature death of tissues. Healthy spikelets on the same head retain their normal

green color. One or more spikelets may be infected, or the entire head may be diseased. When the fungus infects the stem immediately below the head the entire head may die. Infected spikelets of oats are ash-grey and those of barley are light brown.

Several days after infection masses of pink to salmon-colored spores and mycelium may form on the margin of the glumes of individual spikelets, especially near the base of the kernel. The pink spore masses are easiest to see early in the morning before the dew dries. Infected kernels are generally shrunken, wrinkled, and light in weight, with a rough, scabby appearance. These kernels range in color from light-brown to pink to grayish white. The extent of shriveling and discoloration of the kernels depends on the time of infection and the weather conditions following infection.

If the fungus invades and kills the rachis or main axis of the spike, the spikelets above that point die. The result is no grain at all or small, shriveled kernels that are lost during the threshing process. Heads with diseased spikelets may become speckled with dark purplish-black fruiting bodies (perithecia) of the fungus if the weather remains cool and moist until harvest.



Figure 1. Wheat head showing bleached out florets affected by scab. Note salmon pink spore mass on the edge of affected glumes.

These perithecia are a sign of the sexual stage, the *Gibberella* stage of the fungus.

Disease Cycle

The fungi causing scab are all members of the genus *Fusarium*, the asexual spore forming stage. The principal pathogen is *Fusarium graminearum* (the sexual stage is *Gibberella zeae*), but *F. avenaceum* (*G. avenaceum*) and *F. culmorum* (no known sexual state) have also been reported.

The scab fungi overwinter and survive between crops in infected grain and grass stubble, chaff, and cornstalk residue left on the soil surface. They survive as asexual spores (conidia), mycelium, and perithecia within which are borne the sexual spores (ascospores). The fungi are also common contaminants on seed. These fungi continue to grow and produce spores from harvest until the residues decompose in the soil.

The conidia are produced profusely during warm, moist weather on corn and small grain residues. Ascospores produced within perithecia are discharged into the air as the fruiting bodies wet and dry during fluctuations in moisture levels. Air currents carry these spores to the flowering spikelets. Ascospores and conidia have been collected in the air above wheat fields, and both are capable of causing infections. The spores germinate in free water on the surface of the spikelet and invade the flower. Infections are most serious when the anthers are exposed during flowering. Symptoms develop in as little as three days after infection when temperatures range from 77 to 85 degrees F (25-30 degrees C) and humidity is high. Within 7 to 10 days after infection, salmon-pink masses of conidia form at the base of the diseased spikelets. These conidia can be blown by the wind to the heads of other cereal or grass plants producing new secondary infections. This process continues to be repeated as long as the spikelets are susceptible and moist weather prevails. Secondary infections may occur from long distance spread of air borne conidia. Ascospores are usually produced on the heads too late in the season to function as secondary inoculum. However, ascospores may persist in crop residues and contaminate seed.

Mycotoxins in Scabby Grain

Several important mycotoxins can be produced in grain affected by scab. These toxins are produced by growth of the *Fusarium* fungi in the kernels. These mycotoxins can cause vomiting, nausea, dizziness, diarrhea, and muscle spasms in non-ruminant animals. Highly sensitive laboratory tests are currently used to detect mycotoxin contamination in grain. Therefore, the chances of toxic compounds getting into human food is almost nil. The problem arises when farm livestock are fed uncleaned scabby wheat, oats or barley. Three percent or more scabby kernels in feed may be poisonous to hogs. Hogs fed 10 percent or more scabby grain may vomit and refuse to eat the grain mixture. Cattle, sheep and mature poultry are much less susceptible to the mycotoxins. These toxins are quite stable and may remain in grain stored indefinitely.

Seedling Blight Phase of Scab

Before seed treatment fungicides were widely used, sowing scab-infected seed was a common cause of poor stands. Scabby kernels may be dead, or else germinate weakly. If the seedling manages to emerge from the soil, it frequently dies before it becomes established. Seedling blight is first noticed when infected plants appear light to reddish brown in color and may be covered with a mass of pink or whitish mold. If seedlings survive, they generally lack vigor, and frequently send up only a few tillers with small heads. A light to reddish brown root or crown rot may develop as the weakened plants mature.

Control for Head Blight

1. There are few varieties of wheat, oats or barley highly resistant to scab, but in greenhouse tests some varieties restrict the development of the disease to one, or only a few, florets per head. In the field, some varieties appear more resistant than others because they flower earlier or later than other varieties, or because they shed their anthers more quickly than other varieties. These varieties look resistant because they have escaped infection by avoiding rains that supply free water on the surface of the heads for germination of the spores. Differences in susceptibility may also be due to physical barriers to infection of spikelets. Contact the OSU Extension office in your county for a listing of varieties with some degree of resistance to scab.
2. Plant cereals as far away as possible from old corn fields if stalk residues are left on the soil surface. No-till wheat seeded in old corn residues greatly increases the chance of scab. If conventional tillage is used, clean, deep plowing of all infested stubble and straw of cereals and weed grasses, corn stalks and rotted ears is recommended. Complete coverage of crop residues reduces head blight infection by reducing inoculum levels. Manure containing infested straw or corn



Figure 2. Shriveled, discolored kernels from a scab affected wheat head.

stalks may harbor the fungus and should not be put on fields planted to small grains. When possible, plant wheat following a legume crop (soybean) and maintain a rotation with 2 to 3 years between wheat crops.

Control Seedling Blight

1. Sow only high quality seed that has been well cleaned to remove lightweight kernel. Seed treatment fungicides are available that will improve germination and control seedling blights when grain is used for seed. Obtain a copy of OSU Extension Bulletin 639, Seed Treatment for Agronomic Crops, for current seed treatment recommendations. Seed treatment will control seedling blight resulting from infested seed, but will not control head blight, foot rot or crown rot phases resulting from *Fusarium* infection.
2. Delay planting of winter cereals until the soil temperature is 60 degrees F (16 degrees C) or below to reduce chances of seedling blight. Planting should always be after the Hessian fly free date. Spring seeded grains should be sown as early as possible when soil temperatures are relatively cool.
3. Sow seed in a well prepared seed bed with adequate fertilizer to ensure good root growth and vigorous plant development.
4. Rotate small grains and corn with legumes, and leave at least

one year between cereals, grass or corn before planting small grains.

Controlling Mycotoxin Contamination

1. When a high percentage of heads in a field are affected by scab, precautions should be taken to reduce mycotoxin contamination of the harvested grain. Mycotoxin contamination is usually highest in the more heavily diseased kernels. Adjusting the combine to blow out the smaller, shriveled kernels will help reduce mycotoxin levels.
2. Dry harvested grain to 13.5 percent moisture as soon as possible after harvesting. The *Fusarium* fungi cannot grow or produce mycotoxins in grain at this moisture level.
3. Store suspect grain by itself and do not mix with good quality grain. Mixing contaminated grain with good grain will only yield a poor product that may be difficult to sell.
4. Have suspect grain analyzed by a laboratory for contamination by mycotoxins, especially for deoxynivalenol (DON), before feeding to livestock. Obtain a copy of OSU Extension Fact Sheet AC-40 for a listing of laboratories that can do the testing. For more information on mycotoxins, obtain a copy of OSU Extension bulletin 735, "Moldy Grains, Mycotoxins and Feeding Problems."

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