



Head Scab of Small Grains in Kentucky

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Head scab, also called head blight among several other names, is caused by various species of fungi in the genus *Fusarium*. These fungi are widely distributed in agricultural soils. In addition to causing head scab, the fungi can also cause seed rots, seedling blights and root rots in wheat and barley; and seed, root, stalk and ear/kernel rots in corn and grain sorghum.

Each year head scab is present in the Kentucky small grain crop, but the level varies from year to year. Typically, most fields sustain only minor damage and the disease has little economic impact on producers. In other years, however, head scab is severe and causes serious losses, both in terms of lower grain yields and significantly reduced test weights. The majority of the yield losses sustained are the result of reduced grain set and lightweight grain blowing out the back of the combine during harvest operations. Extremely poor test weights of harvested grain adversely affect the price offered to the producer for the grain, which then often must be sold as feed at a considerable loss. The presence in some "scabby" grain of mycotoxins produced by the head scab fungi, such as vomitoxin and zearalenone among others, can further reduce the value of affected grain sold as feed.

Severe head scab can also result in poor seed quality when grain is harvested for seed purposes. In these instances, high levels of dead and infected seed may require significant (50 percent or more) cleanout and seed treatment with a

fungicide active against *Fusarium* fungi before the seed lot meets acceptable standards for planting.

Symptoms and Signs

Head scab can be recognized after crop flowering as a tan bleaching of one or more spikelets in otherwise green heads. Under conditions highly favorable for disease development and/or multiple infections, entire heads may become blighted. When the central portion of a head becomes infected, all tissue above that area may die. When diseased areas of infected heads are closely examined, it is typical to find signs of the causal fungi. These signs are a pink to orange discoloration of infected tissues and, less obviously, tiny dark spore-producing structures of the fungi. Signs of the disease organisms are most commonly seen at the base of diseased spikelets. Once an infected crop begins to mature, head scab becomes less obvious due to the color similarity between diseased and healthy head tissue. Grain associated with infected spikelets is usually shriveled and discolored, and may be sterile.

Disease Development

The fungi that cause head scab survive in soil and in crop residues, particularly barley, corn, grain sorghum and wheat, and on various grasses. During the warm, moist weather

coincidental with crop anthesis (flowering) in the spring, the causal fungi produce infectious spores. These blow to and infect wheat and barley heads. Spores can be dispersed in significant numbers over many miles by wind currents. The fungi first attack floral parts, such as extruded anthers, in individual florets. From that point, the attack continues into the developing grain and typical blight symptoms result. Under conditions of continuous moisture (from rain or dew) and temperatures between 77 and 86 degrees F, head scab symptoms can develop within three days after infection. Once the disease organism is established within a crop, secondary spread of the disease (head-to-head and within-a-head) occurs as long as disease-favorable weather and flowering of the crop persists.

The severity of head scab in wheat and barley varies considerably from year to year. In Kentucky, severe head scab epidemics are relatively uncommon. This is despite the fact that all small grain varieties grown are susceptible to head scab, that Kentucky producers have utilized conservation tillage practices for many years and that much of the small grain acreage is planted following corn (a noted host for *Fusarium* fungi). For a serious state-wide epidemic of head scab to develop, such as occurred in the spring of 1991, three criteria must be met simultaneously:

1) *the small grain crop must be generally susceptible to the disease;*

2) *the causal fungi must be widely distributed and at high levels; and*

3) *disease-favorable conditions must exist during the flowering period for a large portion of the small grain crop.*

With the above in mind, it is generally believed that the main disease-limiting factors in most years are weather related. This is based on the fact that Kentucky small grain production systems generally favor head scab development and the unlikelihood that levels of the head scab fungi in wheat production areas change significantly from year to year. Thus, in most years, most fields simply escape head scab infection.

Control

Head scab control measures for small grains are both poorly defined and generally inadequate. Currently available foliar fungicides, when applied within label restrictions, show no activity against head scab. Moreover, all wheat and barley varieties grown in the United States are susceptible to head scab.

Limited research is being done with spring wheat varieties from China, reported to resist head scab development in some environments. In addition, breeders in Yugoslavia have reportedly enhanced resistance in some of their wheats. Consequently, the control of head scab through the use of resistance, although not imminent, is certainly possible.

Apart from genetically based resistance mechanisms, there is some evidence that certain physical or developmental traits of some varieties may positively or negatively effect head scab development. Nonetheless, research to identify specific traits which may moderate head scab development has yet to be done. Work is hampered by the sporadic nature of head scab under field conditions and the difficulty in artificially simulating head scab epidemics in the field.

Because of the widespread occurrence of head scab fungi in nature, it is unlikely that current control measures will provide much relief when conditions favor a large scale epidemic, however, adherence to the following may help limit the impact of head scab when conditions are less than optimal for development of the disease.

• **Multiple Varieties and Planting Dates** -- Utilizing multiple varieties and planting dates reduces the chances that a severe head scab problem will develop farm-wide. For example, a single wheat variety planted in various tracts of land over a short period of time will be a very uniform crop. This is both in terms of disease susceptibility and time of flowering. Then, if the variety is in flower during head scab-favorable weather, there is a better than average chance that head scab will be a severe problem. However, when multiple varieties and planting dates are used, the resulting diversity makes it less likely that head scab will be a serious problem on more than just a portion of the planted acreage.

• **Crop Rotation** -- Allow at least a one-year break between cereal and other grass crops. Because the head scab fungi can also cause disease in corn and grain sorghum, following these crops with wheat or barley, a common practice in Kentucky for logistics reasons, may result in more severe head scab than if wheat/barley were planted after soybeans, for example.

• **Tillage** -- Burying infested small grain stubble, either prior to planting or after harvest of doublecrop soybeans, may help moderate populations of the head scab fungi. Burying enhances stubble breakdown and reduces, somewhat, the source of spores available to infect subsequent corn, grain sorghum and small grain crops. Burying corn or grain sorghum residue prior to small grain planting in the fall may also be helpful. This is especially true where *Fusarium*-induced stalk, ear and kernel rots were evident in the summer crop.

With the above stated, it should be noted that crop rotation and tillage only effect within-field and within-farm levels of the head scab fungi. When neighboring farms do not follow similar practices, it is very likely that high levels of the causal fungi will still be available to infect a properly managed cereal crop if disease-favorable conditions prevail. Please recall the windblown nature of *Fusarium* as discussed under disease development. This at least partially explains why head scab, in an epidemic year, becomes established in fields seemingly independent of cropping sequence and tillage practices.