



Agronomic Spotlight

Head Smut and Common Smut in Corn

- In the United States, head smut generally occurs in the Pacific Northwest and in the Plains states from Texas to North Dakota and into Canada.
- Common smut occurs worldwide wherever corn is grown and is often found in corn growing areas throughout the United States.
- Yield loss varies between the two diseases and depends on when plants were infected and the extent of infection.

Head Smut

Symptoms. Head smut in corn is caused by the fungus *Sphacelotheca reiliana*. The fungus infects corn plants during the early vegetative stages and grows systemically in the plant. Symptoms are not evident until plants reach reproductive stages. Infected ears and tassels are replaced by smut sori (spore masses). Smut sori are covered by a thin membrane, which easily ruptures to reveal masses of dark brown to black spores called teliospores.⁶ Smutted ears may be rounded and do not produce silks. Infected tassels are completely or partially covered by sori and normally do not produce pollen. Thread-like strands of vascular bundles surrounded by black spores are characteristic of head smut galls (Figure 1). These strands are remnants of the vascular tissue of the corn plant. Individual spikelets of the tassel may be infected, forming a shoot like structure. Infected plants may also produce strange leafy structures on either the ear or tassel.

Life Cycle. Although teliospores can be transmitted on the surface of the seed, the primary source of inoculum is teliospores in the soil. Spores may be transported into a field by contaminated harvesting, planting, or cultivation equipment. They can remain dormant in the soil for at least four years. The disease is favored by low soil moisture and temperatures between 70 and 82° F. Head smut is more common in clay loam soils and in soils with nitrogen deficiency.

Common Smut

Symptoms. Common smut in corn is caused by the fungus *Ustilago maydis* (also known as *Ustilago zeae*). Any actively growing portion of the plant may become infected.³ Galls on ears are the most dramatic in appearance; however, potential yield losses are greatest when young seedlings are infected. In this case, plants grow abnormally and may not produce ears or plants die, resulting in reduced stands. Smut galls are a combination of host and fungal tissues. Young smut galls are firm and covered with a periderm.⁵ They are greenish white or silvery white in appearance as they develop.⁴ As they mature, the fungal tissues begin to turn black with the development of teliospores (Figure 2).

Upon maturity the periderm ruptures and releases the powdery black teliospores. Galls that form on leaves usually remain small and dry out and turn hard without rupturing.



Figure 1. Corn ears (left) and tassels (right) infected with head smut. Photo on the right courtesy of William, M. Brown Jr., Colorado State University, Bugwood.org.



Figure 2. Galls on corn ears infected with common smut. Each gall represents a single kernel (right).

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Life Cycle. Spores overwinter in the soil and can remain viable for several years. They are spread by wind and rain. With warm, moist conditions, infection can occur on corn leaves, stalks, tassels, silks, or ears; however, each infection is a separate event. The fungus does not grow systemically in corn plants. Infection of seedlings and plants growing vegetatively is often associated with wind and blowing soil, which creates wounds exposing meristematic tissues to the fungus. Infection of kernels on ears can occur whenever conditions result in poor pollination.³ Conditions include drought or rainy weather that results in poor pollen production and inhibits normal pollen release. Silks that are not pollinated remain susceptible to infection for an extended period of time. Poor pollination, caused by a drought that is followed by warm, rainy conditions that spread smut spores, can significantly increase kernel infection. Additionally, damage from insects, wind, cultivation, herbicide, animals, or hail can create an entry point for the fungus and increases the likelihood of infection of various plant parts.

Distinguishing between Head and Common Smut

Although it can be difficult to tell the difference between galls of head smut and common smut once they rupture, there are several important differences between the diseases:

- Head smut systemically infects corn seedlings; however, symptoms are primarily evident on ears and tassels. Common smut infects leaves, stalks, ears, and tassels. Unlike head smut, common smut does not infect systemically. Each smut gall is from an individual infection point.
- Head smut galls contain thread-like vascular strands surrounded by a mass of black-brown spores. In the galls of common smut these vascular bundles are absent.



Figure 3. Comparison of corn tassels - healthy (left), infected with common smut (middle), and head smut (right). Photo courtesy of William, M. Brown Jr., Colorado State University, Bugwood.org.

- The galls of common smut are covered in a distinct periderm, which is glossy and white in color. This obvious white membrane is absent in head smut (Figure 3).

Disease Management

Head Smut. Plant corn products with resistance to head smut. Products with rapid seedling emergence may avoid infection. Because infection occurs in the seedling stage, treating seed with a systemic fungicide can reduce infection. In-furrow fungicide treatments can be effective, but may not be economically feasible in areas with only sporadic disease incidence. As teliospores can survive for several years in the soil, crop rotations are not effective in reducing the disease. Where feasible, remove and burn smutted ears before the dispersal of spores. Head smut has been reported to be more serious when there is a lack of nitrogen, so maintain a balanced fertility program.

Common Smut. Fungicides do not effectively control common smut.³ Crop rotation is not a feasible option because the fungus is widespread and remains viable in the soil for several years. If possible, grow corn in fields with no history of common smut. In fields with high levels of common smut, deep tillage can bury the fungus, which might reduce the level of inoculum available for the following year. During cultivation, avoid injury to roots, stalks, and leaves. Plant products that are less susceptible to common smut. Excess nitrogen tends to increase the incidence and severity of the disease, so maintain balanced fertilization.

Sources:

¹Munkvold, G. 2001. Common smut more common than usual. Iowa State University Extension. Integrated Crop Management. <http://www.ipm.iastate.edu/> (verified 7/30/13).
²Miller, S.A. et. al. 1996. Common smut of corn. The Ohio State University Extension. Fact Sheet HYG-3119-96. <http://ohioline.osu.edu/> (verified 7/30/13).
³Pataky, J. and Snetelaar, K. 2006. Common smut of corn. Plant Health Instructor. <http://www.apsnet.org> (verified 8/5/13).
⁴Compendium of Corn Diseases. 1999. The American Phytopathological Society. Additional sources:
Mohan, S.K. et. al. 2013. Corn Smuts. A Pacific Northwest Extension Publication, PNW 647. <http://ir.library.oregonstate.edu> (verified 7/30/13).
Corn head smut. UC IPM Pest Management Guidelines, Publication 3443. <http://www.ipm.ucdavis.edu> (verified 7/30/13).
Jackson, T. Head Smut. University of Nebraska. <http://pdc.unl.edu>.
French, R.D. and Schulz, D. 2010. Head smut of corn. Texas A&M AgriLife Extension. <http://amarillo.tamu.edu>.
Corn smuts. 2005. Washington State University. <http://www.spokane-county.wsu.edu>.
Das, B. Head smut. CIMMYT. <http://maizedoctor.cimmyt.org> (verified 8/5/13).

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