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CORN SMUTS

S. Krishna Mohan, Robert L. Forster, and Dale O. Wilson Jr.

Smut diseases are widely distributed in many corn-growing regions of the world. Their incidence in Idaho is usually low, but occasionally they may cause significant economic losses in susceptible varieties under conditions favorable for disease development. Smuts derive their name from the powdery, dark brown-to-black, soot-like mass of spores produced by the fungus in galls formed on various plant parts. Smut diseases of corn are, in general, more destructive to sweet corn than to field corn. Corn is subject to infection by two types of smuts — common smut and head smut.

Common Smut

Common smut, also known as boil smut or blister smut, occurs in many of the corn-growing regions of the world. In Idaho, it occurs wherever corn is grown, but yield losses from the disease rarely exceed 2 percent. In sweet corn, in addition to reducing yield, common smut can cause significant processing losses to the processing industry by adversely affecting product quality.

Symptoms

Common smut symptoms may appear on any above-ground part of the plant but are more common on ears (Figs. 1, 2) and tassels (Fig. 3). Any



Fig. 1. Common smut galls on dent corn ear. Note the silvery-white membrane covering the individual galls.



Fig. 3. Common smut galls on some of the spikelets in a tassel.



Fig. 2. Common smut galls on a sweet corn (shrunken-2) ear.



Fig. 4. Ruptured mature galls of common smut, releasing powdery, black, sooty spores of the fungus.



Fig. 5. Common smut galls on a stalk of sweet corn.

young, actively growing or dividing (meristematic) tissue is susceptible to infection. Infected tissues are transformed into galls, sometimes as large as 5 inches in diameter. Common smut galls are initially firm to spongy and covered with a glistening, greenish-white to silvery-white membrane (Fig. 1). With age, these galls turn dark, and the membrane usually ruptures to expose masses of powdery, black, sooty spores of the fungus (Fig. 4). Galls on the leaves and stalks are usually smaller, hard, and dry, and frequently remain without rupturing (Fig. 5).

Casual Organism and Disease Cycle

Common smut of corn is caused by the fungus *Ustilago maydis* (= *U. zeae*). The black, resting spores (known as chlamydo-spores or telio-spores) fall from the smut galls to the soil where they overwinter. The spores may be spread by surface drainage water, farm machinery, insects, and wind. Under favorable conditions, the resting spores germinate and produce another type of spores (sporidia), which are spread by wind or splashing water to young, actively dividing tissues. Localized infection occurs through stomata or wounds or directly through the cell walls. Infected cells and the adjacent cells are stimulated to enlarge and multiply rapidly, transforming the tissue into a visible gall within a few days.

Moisture is needed for the spores to germinate and penetrate the host, so rainfall or humid conditions are assumed to be critical during this phase. However, common smut development is favored by dry, warm weather (temperature optimum between 80° and 95°F), and by soils high in nitrogen. Injuries caused by hail, blowing sand, cultivation, spraying, or detasseling increase the potential for smut incidence. Several races of the fungus are known. They differ in cultural characteristics or pathogenic ability or both.

Immature corn ears with galls of common smut, harvested about a week before the time of ear harvest for fresh market, are considered an edible delicacy known as "Huitlacoche" in Mexico. Recently, there has been some demand in the U.S. for culinary use of sweet corn ears with large smut galls, popularly referred to as "maize mushrooms."

Control

1. Where possible, grow corn in fields or areas where smut has not previously occurred.
2. Plant resistant varieties. Avoid planting susceptible varieties such as Candy Bar.
3. Avoid mechanical injury to the plants during cultivation, etc.
4. Provide balanced fertilization. Excessive nitrogen tends to increase disease incidence and severity.
5. In home gardens, remove and dispose of smut galls before they mature and disperse the spores. This will prevent soil contamination.
6. Seed treatment with fungicides is not effective due to the mode of infection and localized growth of the fungus in the infected plant.

Head Smut

Head smut is a destructive disease of corn in several regions of the world. It has occurred sporadically in the U.S., mainly in the intermountain and southwestern regions. During the 1960s, it was severe in the Treasure Valley region of Idaho, but its incidence has since been reduced as growers planted resistant varieties, grew corn in non-infested fields, and used fungicide seed treatment. In recent years, however, the disease appears to be on the increase in some corn-growing areas of the U.S., principally on sweet corn and popcorn. Incidence of head smut has been associated with nitrogen deficiency, and it may be more severe in patches in the field where nitrogen application was missed.

Symptoms

Symptoms of head smut are commonly seen in ears and tassels and only rarely on leaves. Smutted ears are rounded or pear-shaped and do not have silks. The galls are initially covered with a thin membrane that ruptures to expose dry, powdery, dark brown-to-black masses of spores. A characteristic symptom of head smut that separates it from common smut is the presence of fine, thread-like strands within the head smut galls (Fig. 6). These thread-like strands are remnants of the vascular tissue of the corn plant. Tassel infection may be confined to individual spikelets, resulting in shoot-like growth, or the entire tassel may be transformed into a leafy structure interspersed with smutted spikelets (Fig. 7). If the tassel is infected, all the ears on that plant will be smutted or aborted with small, leaf-like structures



Fig. 6. Head smut on sweet corn ear. Note the fine, thread-like strands inside the gall.

replacing the ears. Infected plants are usually severely stunted and barren and may show excessive tillering.

Causal Organism and Disease Cycle

Head smut is caused by the fungus *Sphacelotheca reiliana* (= *Sporisorium holci-sorghii*). There are two races of this fungus: One attacks only corn, and the other is limited to sorghum and Sudangrass.

Spores of the fungus from smutted corn ears and tassels are dispersed by wind and rain. They overwinter in the soil and serve as the main source of inoculum. The spores may also be seed-borne, but this is not considered an important source of inoculum. These resting spores germinate and produce the infecting spores (sporidia) under favorable conditions of moderate to low soil moisture and temperature (optimum: 70° to 80°F). Acid soils appear to favor germination of the resting spores. The fungus infects seedlings usually before they reach the 4- to 6-leaf stage. Thereafter, it grows systemically (internally) in the plant and invades the floral parts, eventually transforming part or all of these tissues into smut galls.

Control

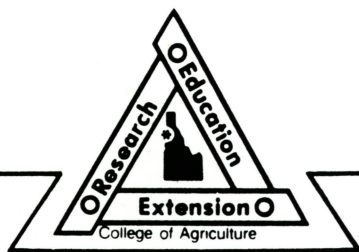
1. Plant resistant varieties, where available. The varieties Jubilee, Sugar Daddy, and Platinum Lady are known to be susceptible to head smut.
2. Practicing a 2- to 3-year rotation to non-host crops will reduce disease



Fig. 7. Tassel infection by head smut. Note the leafy structures interspersed with smutted spikelets.

incidence but will not eliminate the fungus from the contaminated soil.

3. The systemic fungicide carboxin is registered for use as seed treatment for control of head smut. Consult the Extension agricultural agent in your county for current information. Always read and follow the label directions.



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