



OAT SMUTS

There are two smuts of oats, loose smut and covered smut. They look very much alike and occur worldwide wherever the crop is grown. Diseased plants cannot be recognized in the field before the oats head out. Before wide acceptance of fungicide seed treatment and release of highly resistant oat varieties, both loose and covered smuts were found wherever this crop was grown in Illinois. When disease outbreaks are heavy, both yield and quality of grain may be highly reduced.

Loose smut (or black loose smut), caused by the fungus *Ustilago avenae*, is quite conspicuous (Figure 1). In individual fields planted to susceptible varieties in Illinois, smut has been reported on as many as 25 percent, or more, of the plants. Data collected for a 15-year period in the state indicate an average annual loose smut infection of 2 percent of the heads or panicles.

Covered smut, caused by the closely related fungus *Ustilago kollerii* (synonyms *U. hordei* and *U. levis*), was found in a trace to 3 percent of the heads. The 15-year data show an average annual covered smut infection of slightly more than 1 percent in the state.



Figure 1. Oat smut. (1) healthy plant; 2, 3, 4) smutted panicles; in 4 some of the spores have already dispersed.

Covered smut may be as abundant as loose smut in Illinois oat fields. Because of the difficulty in distinguishing the two smuts, some of the loss attributed to loose smut is undoubtedly caused by covered smut. The problem is further complicated by the ability of the two smut fungi to hybridize and produce a range of symptoms through numerous intermediate types. One hybrid may produce loose smut on one oat variety and covered smut on another, while another combination may produce the same type of smut on both varieties. This variation shows that the type of smutted panicle is determined by both the fungus and the variety of oats. Interspecific hybridization apparently produces new races of these smuts in nature and thus greatly complicates the problem of developing highly resistant varieties.

SYMPTOMS

When a smutted oat panicle emerges from its enclosing sheath, an olive-brown to brownish black powdery mass (sorus) of smut spores has completely replaced the oat grains, and sometimes even the awns and glumes. This smut mass is composed of many millions of spores (teliospores), contained within a delicate, whitish gray membrane. Smutted panicles do not spread as widely as normal ones (Figure 1).

For further information contact your nearest Extension office or an Extension Specialist, Department of Crop Sciences, University of Illinois at Urbana-Champaign.

Usually all of the spikelets and heads on an infected plant are smutted. Occasionally the panicle on the main tiller may escape or perhaps some upper spikelets in a head may appear healthy. Smutted plants are generally shorter than healthy plants and are often overlooked at harvest because by that time they may have lost their sooty spore masses.

In **loose smut**, the thin membrane usually breaks and disintegrates soon after the oat panicles emerge. The naked mass of smut spores is quickly scattered by wind and rain, leaving a denuded panicle.

In **covered smut**, the grayish white membrane is more persistent and remains intact until the chaff dries or the grain is harvested. The persistence of the membrane and the extent of damage to the panicle vary with the variety of oats.

DISEASE CYCLE

The fungi causing loose and covered smuts have similar cycles. The smut spores (teliospores) are scattered by threshing operations, wind, and rain. The microscopic spores are easily transported by air currents. Many of them lodge on healthy heads, either on the chaff (glumes) or between the open glumes and the young kernels. Some of the spores germinate immediately, producing hyphae producing a promycelium or hypha that grows into the hulls or into the seed coats of the kernels and remaining dormant there as a mat of mycelium until the seed is sown. Other spores do not germinate immediately but remain on the seed, in the grooves, or between the kernel and the hull until the seed is sown. Infection of the young oat seedling occurs at sprouting time, via direct penetration of the young oat shoot (coleoptile) by the sporidia (basidiospores) of germinating teliospores (Figure 2) that are either on the seed or in the soil close to the germinating embryo. The coleoptile is invaded before it reaches the soil surface. Oat plants cease to be susceptible to infection when the first leaves have emerged more than 3/8 inch (1 centimeter) beyond the sheaths.

Once inside the seedlings, the smut fungi grow systemically, keeping pace with the growing tip of a susceptible plant and finally entering the young, developing kernels. By heading time the fungi have replaced the oat kernels with masses of smut spores. The cycle is repeated when the spores are shed, lodge on the grain of healthy oat panicles, germinate, and infect the young seedling after the grain is sown.

Soil temperature and soil moisture at the time oat seeds are sprouting have a marked influence on infection. Depending on the soil moisture, infection may occur at soil temperatures of 41° to 86°F (5° to 30°C), with an optimum of 59° to 77°F (15° to 25°C). It may occur when soils have a moisture content between 5 and 60 percent (optimum 35 to 40 percent). A distinct interaction occurs between soil moisture and soil temperature. At 15 percent moisture, a temperature of 59° F (15°C) is optimum for infection; at 20 and 25 percent moisture, 68° F (20°C) is best; and at still higher moisture levels, the optimum is close to 77° F (25°C). A soil reaction (pH) near the neutral point of 7.0 or slightly acid seems to favor infection.

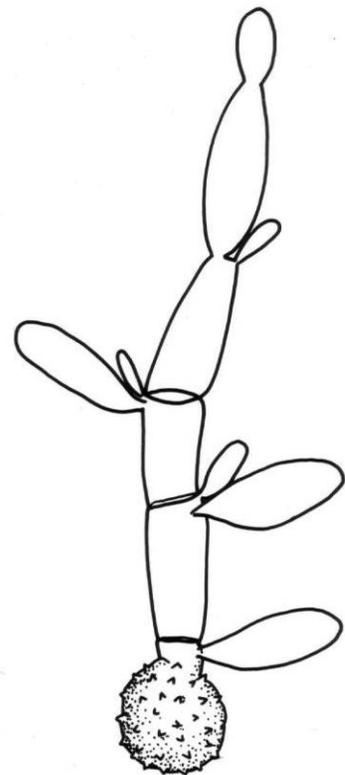


Figure 2. Teliospore of the loose smut fungus, *Ustilago avenae*, which has germinated to form a promycelium on which four primary sporidia (basidiospores) are borne and four secondary sporidia (drawing by L. Gray).

CONTROL

1. Grow smut-resistant oat varieties currently recommended for your area by Illinois Extension Agronomists and your nearest Extension Adviser. Refer to the Agronomy Handbook and Illinois Extension Agricultural Pest Management Handbook. Both of these publications are revised annually and are available at your nearest Extension office. Since new races of smut fungi arise periodically, an oat variety resistant one year may be quite susceptible the next.
2. Proper seed treatment with an approved systemic fungicide will give complete control. Seed of oat varieties listed as being moderately susceptible (MS) or moderately resistant (MR) to smuts should be treated with a suggested fungicide every year or two.