

Flag smut is a fungal disease of wheat that occurs in many wheat-producing regions of the world. Historically, flag smut was known to occur in the northwestern United States, but it had not been detected in the Great Plains since the 1930s. In May of 2015, flag smut was detected in multiple counties within central and western Kansas. Preliminary survey results indicated the disease was present in many areas of the state, but was more common in the arid, wheat-producing counties of western Kansas. The disease is a concern because some countries have import restrictions on grain produced in areas where flag smut is known to occur.

## Symptoms

Flag smut symptoms become apparent during the stem elongation and heading stages of growth. Infected plants become increasingly obvious during the early stages of grain development. Infected plants are deformed (figures 1 and 2) and often noticeably shorter than healthy plants. The stunted plants are often restricted to the lower third of the crop canopy. The leaves of diseased plants are often twisted and have long gray or black lesions that run parallel to the leaf veins. As the plants mature, the lesions rupture and release large numbers of black, powdery spores of the fungus. Flag smut may infect all the tillers of a plant,

## Quick Facts

Symptoms of flag smut include stunted plants with deformed tillers. The leaves of infected plants are twisted and have long gray lesions that break open to release black, powdery spores.

The spores of the fungus that causes flag smut can survive in the soil for at least 4 years and can be moved to adjacent fields by wind, plant debris, or equipment. The fungus also can be moved on seed contaminated with the fungal spores.

Flag smut can be effectively managed with seed-treatment fungicides. Crop rotation with nonhost crops such as soybeans, sorghum, and corn also may reduce the risk of severe disease.

but in some cases, only a few tillers become diseased. The heads of diseased tillers are poorly developed and often will not emerge from the twisted flag leaves. Heads that do emerge may have black-striped stems and glumes. The infected tillers often produce no grain.

## Life Cycle

The fungus *Urocystis tritici* causes flag smut in wheat. Plants with the disease produce large amounts



Figure 1. Wheat infected with flag smut has long gray and black lesions on the leaves and leaf sheaths (A). As flag smut lesions break open, they release large amounts of black, powdery spores of the fungus (B).

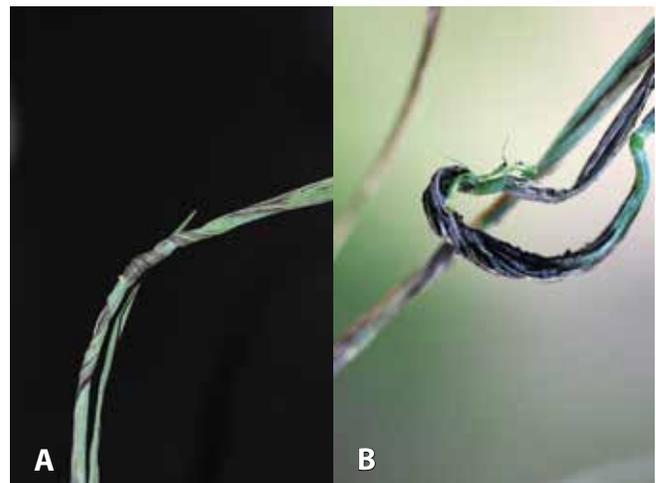


Figure 2. Tillers infected with the flag smut are often stunted and have twisted leaves (A). They also have poorly developed heads (B).

of spores that contaminate the soil and can be moved within a field or to adjacent fields by wind, plant debris, and farm equipment. Spores incorporated into the soil are a major source of infections where the disease is common. The fungus can survive in the soil for at least 4 years, but viability of the spore decreases rapidly during this time. Spores may survive longer in arid regions where the dry soil conditions prolong viability of the fungus. The fungal spores also can survive on the seed surface. Seed contaminated with the fungus can introduce the disease to new fields.

Infection of flag smut takes place shortly after planting when the spores germinate and invade the young seedlings before emergence. In general, the risk of infection is greatest when winter wheat is planted into warm, moist soils. Although the spores of the fungus can germinate when soil temperatures are between 40 and 86 degrees Fahrenheit, soil temperatures between 50 to 68 degrees Fahrenheit are most favorable for infection. Once inside the plant, the

fungus invades the growing point and remains dormant during the winter months. The fungus resumes activity in the spring and grows systemically within the plant, eventually producing characteristic leaf lesions and more black, powdery spores.

## Management

Fungicide seed treatments are the most effective way to manage flag smut. There are many seed treatment fungicides labeled for control of flag smut and many of the widely marketed fungicides should provide excellent control of the disease. The genetic resistance of wheat varieties grown in Kansas is unknown.

Crop rotations with nonhost crops such as soybeans, sorghum, or corn provide time for the fungal population to decline between wheat crops and lower the risk of infection in subsequent years. It also may be possible to reduce the risk of severe disease by avoiding early planting conditions that place seed into warm moist soils, which are known to favor infection by the flag smut fungus.

**Erick De Wolf**

Plant Pathologist  
Department of Plant Pathology

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