EB1434

PLANT DISEASES

CEPHALOSPORIUM STRIPE DISEASE OF CEREALS

Cephalosporium stripe (fungus stripe) is a vascular wilt-type disease of wheat and barley, which also affects other cereals and grasses. It is caused by the soilborne fungus *Cephalosporium gramineum.* In autumn, the fungus produces millions of bacteria-sized spores (*conidia*), which are washed into the soil around the plant. These spores are the structures that will eventually infect the plant.

Infection of the plant occurs through wounds in roots during the winter and early spring. Frozen soil in winter and frost heaving of soil in the spring cause the most serious wounds for infection. Once inside the plant, the fungus colonizes the xylem (water-conducting tissue) and slowly kills the plant.

After the fungus has killed the plant, it survives inside the straw in the soil until the next crop. This fungus survives only in straw which it colonized while the plant was alive; the fungus does not colonize straw while it is decaying in the soil.

Typical symptoms of Cephalosporium stripe include yellow and brown stripes in leaves.

Discolored vascular tissue is present as brown streaks in the yellow stripes.

Symptoms

Symptoms of Cephalosporium stripe become visible in the spring after plant growth begins. The most obvious symptoms are long yellow stripes that extend from the tips of the leaf blade down to the sheath, then down the sheath to the node. Typically, two to three yellow stripes appear in each leaf. Cephalosporium stripe can be diagnosed by the presence of fine, brown, necrotic (dying tissue) streaks within the yellow stripes. These streaks of dying tissue extend down the leaf blade and sheath with the yellow stripes, but may be more apparent on leaf sheaths.

As the stem grows and heads appear, the straw takes on a dull color. Another diagnostic symptom can be found by cutting through one of the upper nodes to reveal a brown discoloration. Stems infected by *C. gramineum* die prematurely, forming dead standing stems (white-heads) among living stems. Prematurely killed stems are shorter than surrounding, noninfected stems, and produce little or no grain in the heads. Grain from infected stems appears shriveled, has low test weight, and does not contribute to yield.

One disease that can be confused with Cephalosporium stripe is stripe rust. Stripes also occur with this disease; however, they do not extend down the entire leaf blade or the leaf sheath, and the yellow-orange stripe rubs off when touched.

Factors Influencing Cephalosporium Stripe Occurrence

Severity of Cephalosporium stripe disease depends on the seeding date, host susceptibility, amount of inoculum in the soil, fall and winter weather, and soil pH. Although the factors individually influence the amount of disease, they also interact with each other, resulting in more or less disease. Consider the entire production operation to understand how these factors influence disease.

Seeding date. Early seeding of winter wheat favors Cephalosporium stripe, especially on summer fallow. Early seeded plants grow larger before winter sets in, and these larger plants are more susceptible to winter root injury and disease. Any factor that promotes rapid growth in the fall will probably increase the occurrence of Cephalosporium stripe.

Cultivars. None of the cultivars available for eastern Washington are highly resistant to *C. gramineum,* but some cultivars are more resistant than others. Nugaines is the least susceptible cultivar adapted to eastern Washington and northern Idaho; Stephens, Hyslop and McDermid are the most susceptible cultivars. Cultivars which have intermediate susceptibility include Daws, Lewjain, Luke and Hill 81. Lewjain, although more susceptible than Nugaines, produces better yields when disease is severe than do other adapted cultivars.

Winter barley, a host for *C. gramineum,* is generally more resistant than winter wheat.

Amount of inoculum in the soil. Inoculum density in the soil depends on the length of rotation, on tillage and residue management practices, and on weather conditions in the fall. The exact relationship between amount of disease and amount of inoculum is not known, but more inoculum in the soil increases the chance of disease.

Rotation. Longer breaks between susceptible hosts reduce disease. Longer rotations, which allow time for straw to decompose, reduce the amount of inoculum in the soil. Because the fungus survives only on straw colonized while the plant is alive, the pathogen dies when the host straw decomposes.

To be effective, the rotation should allow 2 years out of winter wheat or barley. Rotation crops include spring wheat and barley, peas, lentils, or fallow. While spring wheat and barley are susceptible, they are not infected because environmental conditions do not favor infection.

Many grassy weeds are hosts for *C. gramineum* and should be controlled during the rotation.

Tillage. Reducing tillage slows decomposition of infested straw and prolongs survival of the pathogen. Studies show that straw infested with *C. gramineum* survives longer in a no-till system than under a minimum-till or conventional moldboard plow system, respectively.

Cephalosporium gramineum produces spores more profusely when colonized straw remains on the soil surface, resulting in more inoculum in the soil.

The tendency of the seedbed to freeze and heave and the relative seeding dates among the various tillage methods complicate the effect of tillage. Seedbeds in reduced tillage systems freeze less often and to a shallower depth than do seedbeds in conventional tillage systems. Consequently, reduced tillage seedbeds heave less, inflicting fewer root wounds and producing fewer avenues of infection for the pathogen.

Seeding dates are usually later in reduced tillage systems, and plant growth is not as vigorous in the fall. Smaller plants have smaller root systems, which are less susceptible to winter root injury than are roots of larger plants.

Weather. Moderate fall temperatures (40–50°F) and high rainfall favor disease development. Cool and wet weather, which provides optimum growing conditions for plants, also stimulates the fungus to produce millions of spores. Splashed by rain, spores move with running water to all parts of a field or fields, where they are washed into the soil. Optimum winter weather includes mild, open winters with periods of frozen soil. Similar conditions in the early spring lead to frost heaving and root injury.

Soil pH. Soil pH has a pronounced effect on survival of the pathogen and on disease development. Soils having a pH of less than 6.0 favor disease development, fungus survival, and spore production. Experiments have shown that under the same weather, seeding date and inoculum conditions, more Cephalosporium stripe disease develops when soil pH is less than 6.0. *C. gramineum* produces the most spores when the pH ranges from 3.9 to 5.5.

C. gramineum survival increases in straw at low soil pH because the fungus produces a wide-spectrum antibiotic in straw which inhibits other microorganisms in the soil and prevents them from colonizing the same straw. This antibiotic is produced profusely, and is most active under acidic conditions. In addition to living off the decaying straw, spores survive longer in the soil when pH is low. The reason is not known, but may be related to reduced competition from other soil microorganisms.

Control

The best control for Cephalosporium stripe is a 3-year rotation, including winter cereals one year in three. Three-year rotations allow infested straw to decompose and the pathogen to die-out. If a field has a history of Cephalosporium stripe, and a 3-year rotation is not possible, use of a less susceptible cultivar and slightly delayed seedings will reduce the risk of Cephalosporium stripe.

A 3-year rotation allows much more flexibility in choosing a variety, tillage system, and planting date. In addition, a 3-year rotation may help control strawbreaker foot rot (Cercosporella foot rot or eyespot).

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