

Goss's Bacterial Wilt and Blight

Goss's bacterial wilt and blight of corn is an economically serious disease of susceptible dent and specialty corn hybrids and varieties. This disease (most commonly called Goss's wilt) is caused by the bacterium *Clavibacter nebraskensis*. Grain yield loss from severe Goss's wilt infections can exceed 50 percent.

Goss's wilt was first observed in south-central Nebraska in 1969, and was reported in neighboring states soon after that. The disease's prevalence was low throughout the region from the 1980s through the early 2000s. However, between 2006 and 2017, Goss's wilt re-emerged in these states and was reported in many other U.S. states and two Canadian provinces.

Currently, the known distribution of Goss's wilt reaches as far east as Indiana, west to Colorado, south to Texas, and as far north as Manitoba and Alberta. To date, the disease has not been confirmed outside the continental United States and Canada.

This publication describes Goss's bacterial wilt and blight symptoms, describes disorders commonly confused with the disease, and recommends management strategies.

Symptoms

Goss's wilt can cause leaf blight and systemic wilt symptoms. Leaf blight is the most common symptom and may occur at any growth stage. Leaf symptoms include elongated tan to grayish-brown lesions that have irregular or wavy margins that extend parallel to the veins (Figure 1). Before the tan lesions form, young lesions appear as streaks of light green tissue with water soaking on the leaf (Figure 2). The tan lesions can affect large sections of leaf area — more than 60 percent of the leaf area on infected plants may be killed (Figure 3).



Figure 1. This photo shows typical Goss's wilt lesions on a corn leaf.



Figure 2. This early Goss's wilt lesion shows a light green lesion developing with water soaking, gray/green margins, and dark, water-soaked freckles.



Figure 3. Goss's wilt can kill large areas of leaves.

Dark green to black, scattered, water-soaked spots (“freckles”) develop in the lesions (Figure 4). When the lesions are exposed to sunlight, small, glossy droplets of dried bacterial ooze may appear. When dried, this ooze may look similar to dried varnish (Figure 5).



Figure 4. Dark, water-soaked spots (“freckles”) appear in Goss's wilt lesions. The water-soaked spots appear translucent when backlit.



Figure 5. Dried bacterial ooze on the surface of lesions appears shiny.

The systemic wilt phase is less common than the leaf blight phase and is often first observed in the early vegetative stages of growth (corn growth stages V2-V6). When the wilt phase develops, the infection may discolor xylem tissues or cause a slimy stalk rot, which is followed by wilting and plant death (Figures 6-8). Systemically infected plants may wilt and appear drought stressed. Corn plants may have weak stalks and an increased susceptibility to lodging.



Figure 6. Discolored stalk pith is indicative of the wilt phase of Goss's wilt.



Figure 7. Severe stalk decomposition from the wilt phase of Goss's wilt.



Figure 8. Plant wilting is symptomatic of Goss's wilt.

Disease Cycle

Figure 9 shows the disease cycle for Goss's wilt. Infested corn residue is the primary source of inoculum for Goss's wilt. The pathogen overwinters in infested corn residue on or near the soil surface. Infested residue may allow the pathogen to survive on the soil surface for at least 10 to 15 months. Burying infested residue reduces the pathogen's survival.

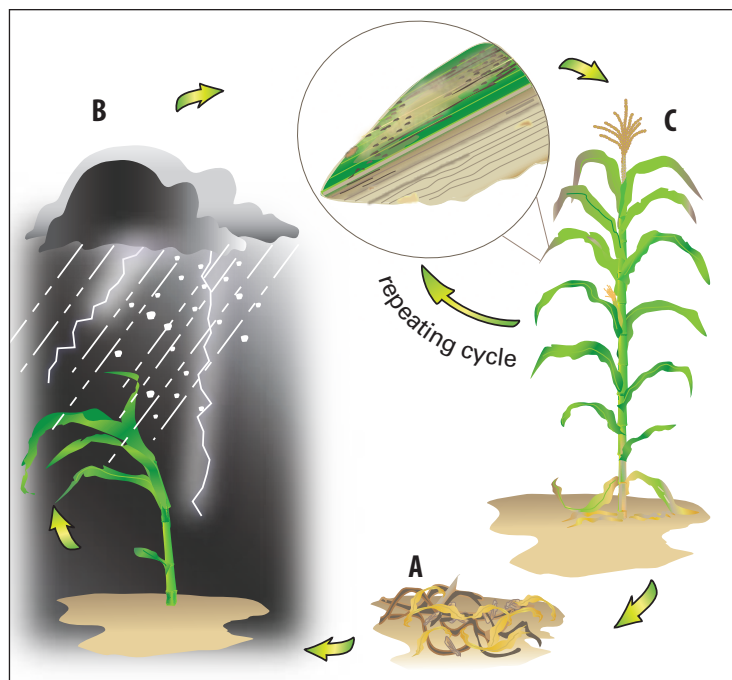


Figure 9. The Goss's bacterial wilt and blight disease cycle. A. The pathogen overwinters in infested corn residue. B. Wind and rain splash the pathogen on corn leaves — plants with wounds from hail or other factors may be more susceptible. C. Pathogen can spread to adjacent plants.

The Goss's wilt pathogen can also survive in other plant species. Confirmed hosts include grain sorghum, annual ryegrass, sudangrass, several foxtail species, johnsongrass, large crabgrass, shattercane, big bluestem, little bluestem, and woolly cupgrass. These and other grasses may also be sources of inoculum to infect corn.

The bacterium is likely splashed from infested residue or grasses onto the surface of corn leaves. The disease typically develops after the bacterium enters wounds in leaves caused by hail, blown soil, or wind. However, wounds may not be required for infection.

The pathogen can spread systemically in plants after leaves are infected. Although infection that leads to significant yield losses typically occurs during the vegetative growth stages, symptoms often become most visible and severe after silking (R1 growth stage). The bacterium can spread short distances within a field by contacting leaves on adjacent plants and between fields across country roads during the growing season.

In addition, wind and equipment can spread infested leaves or other plant material from field to field. Seed can be infected at very low levels but is not known to be an important means of dissemination; however, it may play a role in introducing the disease into new areas or specific sites within fields.

Conditions that Favor Disease

Planting hybrids susceptible to Goss's wilt, practicing reduced tillage, and planting continuous corn in fields with a history of the disease can favor outbreaks in subsequent growing seasons. Strong storms, wind, sandblasting, and hail that injure corn leaves allow the pathogen to enter and infect the plant.

Disease development is favored by warm (80°F) weather. Very hot (greater than 95°F) or cool (less than 70°F) temperatures may impede disease development. The disease may occur in fields regardless of irrigation practices, although irrigation may enhance disease progression.

Yield Loss and Impact

Many states have documented yield losses in susceptible corn hybrids during the leaf blight phases of the disease. Fields infected during vegetative growth stages can experience yield losses of more than 50 percent. No hybrids are completely resistant (immune) to Goss's wilt, but yield losses for resistant hybrids are greatly reduced compared to susceptible cultivars (Figure 10).



Figure 10. This photo shows different levels of Goss's wilt severity in two corn hybrids. The plants with the most brown tissue are the more susceptible hybrids. Most seed companies rate the resistance of their hybrids on a scale of 1 to 10 (very susceptible to highly resistant).

Diagnosis

Goss's wilt can be confused with several other diseases. Therefore, we recommend that you have a diagnostic laboratory confirm suspected samples. Diagnosing this disease is based on noting the presence of the characteristic symptoms and signs (as noted above), confirming the presence of the pathogen, and observing bacterial streaming from the lesions (Figure 11).

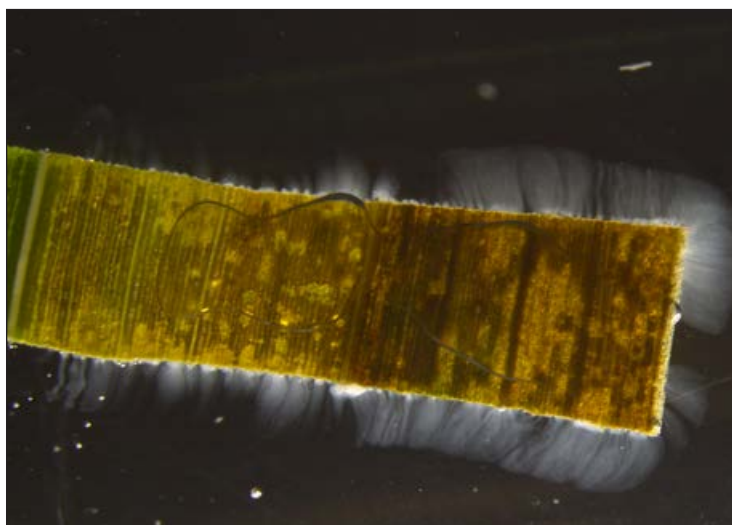


Figure 11. Streaming of the Goss's wilt bacterial pathogen from a lesion as seen under a microscope.

Diseases and Other Conditions with Similar Symptoms

Diseases

Northern Corn Leaf Blight (*Exserohilum turcicum*)

Corn infected with northern corn leaf blight (NCLB) typically have symptomatic canoe- or cigar-shaped lesions that are 1 to 4 inches long and ½- to 1-inch wide (Figure 12). The lesions initially have grayish-green margins. Eventually, typical NCLB lesions turn tan and contain dark areas of fungal sporulation when mature.

How to distinguish northern corn leaf blight from Goss's wilt:

NCLB can be distinguished from Goss's wilt by the lesion's canoe shape and even lesion margins. NCLB lesions lack the freckles in the lesions and bacterial streaming observed in Goss's wilt.

Figure 12. Typical brown lesions on a corn leaf caused by northern corn leaf blight.



Stewart's Bacterial Wilt (*Pantoea stewartii*)

Both Goss's wilt and Stewart's wilt may cause seedling blights that kill young plants (Figure 13). Leaf lesions are also similar in that they can both develop into long lesions with wavy margins that extend between veins.

How to distinguish Stewart's bacterial wilt from Goss's wilt:

A key distinguishing characteristic of Goss's wilt is the dark green-to-black freckles that develop within the lesions. Stewart's wilt has been seen less frequently in the Midwest than Goss's wilt over the past 10 years and is not as widely distributed.

Figure 13. Typical long lesions on leaf caused by Stewart's wilt.



Diplodia Leaf Streak (*Stenocarpella macrospora*)

Mature Diplodia leaf streak lesions are long and slender, parallel to the veins, and taper at the ends (Figure 14).

How to distinguish Diplodia leaf streak from Goss's wilt:

Diplodia leaf streak lesions are distinct based on the bright yellow hallow around lesions. Diplodia lesions also have dark fungal structures (pycnidia) that appear as pepper-like specks. Diplodia lesions do not have bacterial streaming or dark, water-soaked freckles.

Figure 14. Typical lesions on leaf caused by Diplodia leaf streak.



Other Conditions

Nutrient Deficiencies

Nitrogen, potassium, or phosphorus deficiencies can sometimes be confused with Goss's wilt. However, the presence of nutrient deficiency symptoms may differ based on the plant's general growth stage.

How to distinguish nutrient deficiencies from Goss's wilt:

The general symptoms associated with nutrient deficiencies do not include the water-soaked freckles, shiny bacterial ooze, or the bacterial streaming characteristic of Goss's wilt lesions.

Figure 15. Nitrogen deficiency in corn



Drought Stress/Leaf Scorch

High temperatures and drought stress can cause brown discoloration and kill leaf tissues, often from the margins inward.

How to distinguish drought stress/leaf scorch from Goss's wilt:

The brown discoloration from leaf scorch tends to be more uniform in color, and the necrotic leaf tissues do not have the water-soaked freckles, shiny bacterial ooze, or the bacterial streaming in the lesions associated with Goss's wilt.

Figure 16. Symptoms of drought stress/leaf scorch on corn leaf/leaves.



Disease Management

The best way to manage Goss's wilt is to plant highly resistant corn hybrids. Additional control can be achieved by rotating crops with nonhosts (such as soybean, dry bean, small grains, or alfalfa) to help reduce the primary inoculum for the subsequent corn crop.

Because the bacterial pathogen survives in infested residue, tillage that buries residue may reduce the disease. It may also be beneficial (where feasible) to

control grassy weed hosts and practice tillage that buries infected residue after harvest. Fungicides are ineffective and other chemical sprays have not been consistently effective at reducing symptoms or preserving yield.

Find Out More

Other publications in the *Corn Disease Management* series are available on the Crop Protection Network website (cropprotectionnetwork.org).

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