CROP INSIGHTS

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Goss's Wilt Management in Corn

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Summary

- Goss's wilt, a bacterial disease of corn historically confined to the Great Plains, has now spread to several states in the Midwest. The disease survives primarily in corn residue.
- The Goss's wilt pathogen enters the corn plant through wounds from rain, wind and hail. It has a systemic wilt phase and a more common and damaging leaf blight phase.
- Goss's wilt impact on the crop generally depends on the amount of leaf area lost during the grain fill period. Leaf loss may lead to reduced stalk quality and yield, with grain losses ranging from minimal to near 50%.
- No rescue measures are available to control Goss's wilt, as fungicides are ineffective against this bacterial disease. Growers can minimize damage by reducing corn residue (by crop rotation and tillage) and using resistant hybrids.
- Pioneer offers hybrids with good to excellent resistance in a wide range of maturities suitable to at-risk areas. Pioneer scientists are continuing to make improvements in hybrid resistance using accelerated breeding methods.

Introduction

Goss's wilt (*Clavibacter michiganensis* subsp. *nebraskensis)* is a bacterial disease that may cause systemic infection and wilting of corn plants, as well as severe leaf blighting. The leaf blight phase is generally more prevalent and more damaging to the corn crop (Figure 1).

Figure 1. The leaf blight phase of Goss's wilt can cause significant loss of functional leaf area in corn fields.

Until recently, significant Goss's wilt damage was largely confined to corn fields in Nebraska and parts of Colorado, Kansas and South Dakota. In the last two years, however, significant damage has been reported in Iowa, Illinois, Indiana, Minnesota, and Wisconsin (Figure 2). Higher levels of corn residue from corn-after-corn production and reduced tillage are likely contributing factors in the spread of this disease. In addition, the prevalence of summer storms (hail, wind and rainstorms) that damage corn leaves has a large impact on the severity of infection and yield loss in a given growing season.

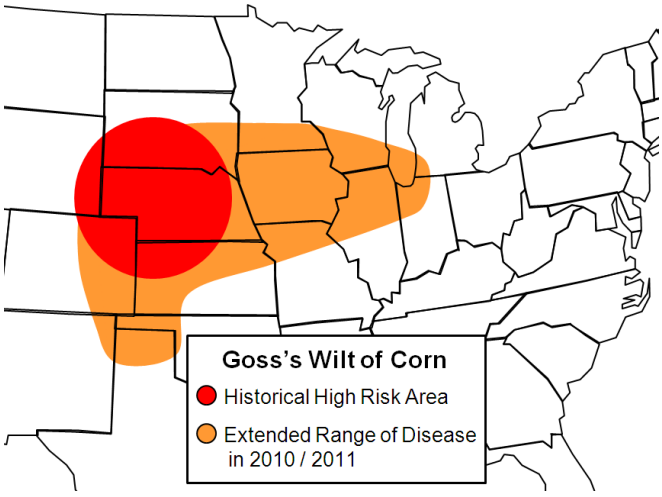


Figure 2. Historical and current range of Goss's wilt in the US.

The sudden spread of Goss's wilt across primary corn-growing states places it among the major corn diseases capable of causing leaf loss, lower stalk quality and reduced yields in corn. Consequently, growers should learn to recognize and manage this disease to help protect future corn yields and profits. This *Crop Insights* will discuss development, symptoms and management of Goss's wilt of corn.

Disease Development

Goss's wilt overwinters in infected corn residue, and that of other host plants, including green foxtail, barnyardgrass and shattercane. From this infected residue, bacteria are transferred to growing plants primarily by rain splash, although Goss's wilt can also survive in irrigation water during the growing season. Once on the plant, bacteria invade plant tissue through wounds caused by hail, heavy rain, wind or mechanical damage (Figure 3). Plants may be infected at any

stage of development. Wet weather and high relative humidity favor development of Goss's wilt. This is because leaf wetness is required for infection to occur, and the bacteria spread most readily in humid weather. However, disease spread under generally hot, dry conditions has also been documented.

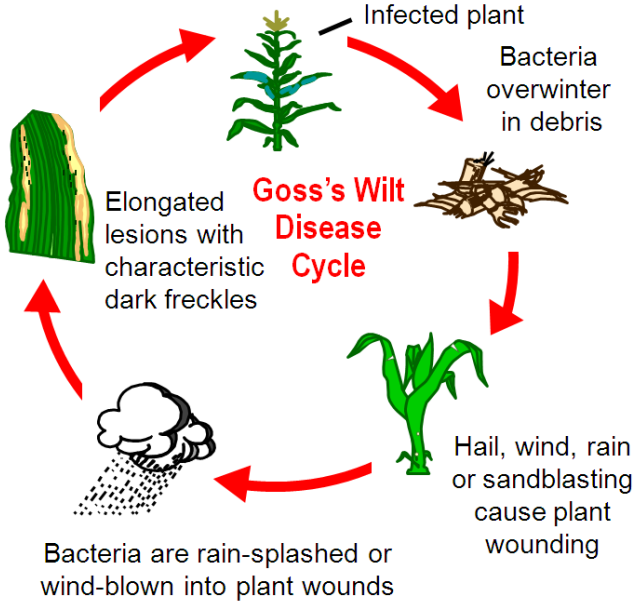


Figure 3. Disease cycle of Goss's wilt in corn.

Disease Symptoms

Early leaf symptoms are oblong or elongated lesions of water-soaked, grayish-green tissue that progress to long dead streaks with wavy, irregular margins (Figure 4). These streaks extend along the leaf veins, which suggests a bacterial infection (Figure 5a). One of the most characteristic symptoms of Goss's wilt is leaf "freckles" that develop within the streaks (Figure 5a). In addition, a sticky exudate forms in the streaks, which dries to form a glistening residue, or varnish, within the lesion (Figure 5b).

Figure 4. Early Goss's wilt symptoms progressing to long, dead streaks on corn leaf.

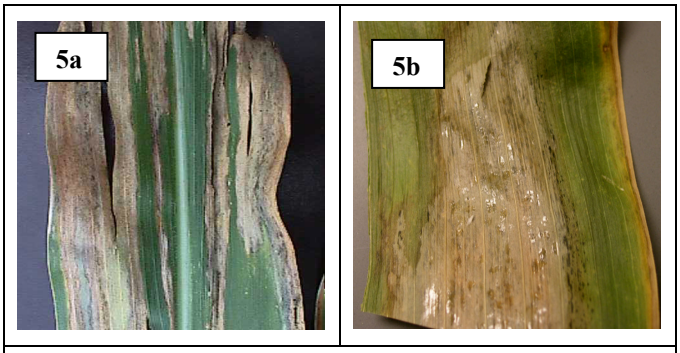


Figure 5. Characteristic symptoms of Goss's wilt: a) lesions extend along leaf veins; b) exudate dries to a varnish on leaf.

As lesions enlarge and coalesce, they form large areas of necrotic tissue on the leaves and eventually, entire leaves may wilt and dry up (Figure 6).

Figure 6. Goss's wilt lesions may expand to eventually encompass the entire corn leaf.

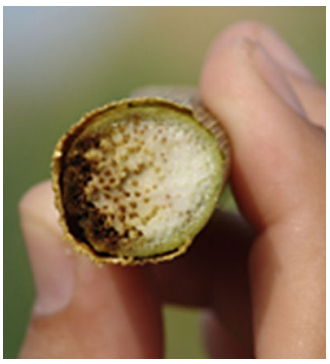
Goss's wilt symptoms can be confused with those of another bacterial disease, Stewart's wilt. Table 1 lists important distinctions between these two diseases.

Table 1. Comparison of Goss's wilt and Stewart's wilt.

Symptoms	Goss's Wilt	Stewart's Wilt
Infection of corn	Plant injury (often due to hail or rain storm)	Flea beetle feeding
Long irregular lesions	Yes	Yes
Leaf freckle symptoms	Yes	No
Varnish-like exudate	Yes	No
Crown cavity symptoms	No	Yes
Vascular discoloration	Orange	Yellow

*Adapted from University of Nebraska

Laboratory tests can easily distinguish the two diseases, but careful field examination can separate the diseases as well. One of the primary clues lies in the cause of plant infection. Development of Goss's wilt is most common after a hailstorm or sandblasting, whereas Stewart's wilt epidemics occur when populations of flea beetles are high. Therefore, Stewart's wilt is accompanied by obvious flea beetle feeding scars on leaves.



Plants may also be infected systemically by Goss's wilt, especially in the seedling stage. These plants have discolored vascular tissue (left), with a slimy bacterial exudate in the stalk. Plants are commonly stunted and wilt and die as if drought stressed.

(Photo courtesy of T. Jackson, Univ. of Nebraska, Lincoln.)

Bacterial soft rot is a different disease common in the Great Plains states. It often occurs in the same field with Goss's wilt, and can sometimes be confused with systemic Goss's infection. Bacterial rot can affect the plant at any node and can spread to additional nodes after infection. The initial symptoms of bacterial stalk rot are leaf sheath and stalk discoloration at a single node. Stalk splitting will reveal soft, slimy rot and internal discoloration. A foul odor is associated with advanced stages of soft rot. Soft rot infection usually results in the collapse of the top portion of the plant and the loss of any yield potential for individually infected plants. Rain splash due to strong thunderstorms and sprinkler irrigation are associated with severe levels of bacterial soft rot infection.

Crop Impacts of Goss's Wilt

Goss's wilt may reduce corn plant stands and vigor, stalk and grain quality and yield. During the systemic infection phase, Goss's may reduce plant stands and weaken surviving plants, both of which are associated with reduced yield. However, in most cases, yield loss is mainly due to the leaf blight phase of the disease, when reduction in green leaf area and premature death of plants may occur (Figure 1).

Timing of leaf blight infection has a critical role in Goss's wilt yield reductions. Early infections lead to the greatest yield loss, whereas late infections often have little yield influence. Yield reductions of 50% have been documented when susceptible hybrids were infected early in the growing season. Other agronomic issues such as stalk lodging may result from fields that have leaf area loss from Goss's wilt. This can result in further reductions in yield if harvest losses occur, and reductions in grain quality if ears contact the ground.

Disease Management

No rescue measures are available to control Goss's wilt, so preventing or avoiding infection is crucial. Where the disease is already present in a field, growers can minimize damage by reducing corn residue and using resistant hybrids.

Prevention/Avoidance

Goss's wilt may be transmitted from field to field by equipment and weather that move infected residue. Harvest and tillage equipment, balers, and wind can all transfer infected residue and soil to previously uninfested fields. To help avoid spreading the pathogen in this way, harvest and till infected fields last and clean equipment of crop residue.

Reducing Corn Residue and Alternate Hosts

Crop rotation and tillage, when practical, can be used to reduce the amount of corn residue remaining on the soil surface to infect the new crop. Crop rotation to a non-host crop such as soybeans, dry beans or alfalfa allows for an additional year of corn residue decomposition between corn crops. Deep tillage is especially effective at incorporating and burying infected residue. These practices reduce but do not prevent disease occurrence, however. Goss's wilt has occurred on fields that are first-year corn and in fields that were plowed.

Grassy weeds that are alternate hosts for the bacteria should also be controlled to help minimize disease inoculum. Susceptible grasses include green foxtail, barnyardgrass, and shattercane.

Resistant Hybrids

Because useful levels of resistance to Goss's wilt have been identified in certain parent lines and hybrids, hybrid resistance is becoming the primary method for management of this disease. Pioneer rates its hybrids for resistance relative to known susceptible and resistant hybrids using Pioneer's 1 to 9 rating system (1 = susceptible, 9 = resistant). These scores are made available to customers to aid in selection of hybrids with appropriate levels of resistance for each field. Your local Pioneer sales professional can assist in identifying hybrids with Goss's wilt resistance and other traits needed for optimum production potential on your fields.

Pioneer researchers screen commercial and potential new hybrids for resistance to Goss's wilt at sites with reliable annual disease pressure. In addition to screening under natural infestations, researchers also inoculate parent lines and hybrids with Goss's wilt bacteria and evaluate for disease symptoms. With the recent outbreaks of Goss's wilt, new samples of Goss's wilt bacterium have been collected and incorporated into the screening program to address potential strain shifts.

On-farm strip trials provide an additional resource for data collection if the disease occurs. The primary maturity range for Goss's screening is from 90 CRM to 110 CRM. However, due to the recent increase in Goss's incidence in Manitoba, Kansas and the Texas Panhandle, Goss's screenings have been expanded. Pioneer now offers a wide genetic range of hybrids with very good to excellent resistance within a hybrid maturity range of 75 to 118 days.

Pioneer will continue using all available plant breeding technologies to improve hybrids for Goss's wilt resistance. This includes screening parent lines and hybrids in areas with severe natural infection, as well as use of molecular markers to identify more resistant types prior to field screening. These steps are designed to accelerate hybrid improvement for resistance to for Goss's wilt bacterial disease.

Fungicides NOT Effective

Goss's wilt is caused by a bacterium, not a fungus. That is why foliar fungicides commonly used to control corn leaf diseases resulting from fungal pathogens are NOT effective against the Goss's wilt pathogen. In fact, no chemical control measures are currently available with proven efficacy against this disease.