

Goss's Bacterial Wilt and Leaf Blight of Corn

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This publication describes a threat to various types of corn in Nebraska, and how to identify and manage it.

Introduction

Goss's bacterial wilt and blight of corn, caused by the Gram positive bacterium, *Clavibacter michiganensis* subsp. *nebraskensis*, is a persistent and economically serious disease of susceptible dent, food-grade, sweet and popcorn hybrids. It was first observed in three central Nebraska corn fields in Dawson County near Lexington in 1969. Over the next 10 years, it also was identified in other states adjacent to Nebraska, including Kansas, Colorado, Wyoming, South Dakota and Iowa. The disease also has been confirmed in Illinois and Wisconsin. Until recently, the disease had not been observed in Nebraska production fields at severe levels for many years. During the 2006 season, the pathogen was confirmed from more than 25 fields in western Nebraska, southeastern Wyoming and eastern Colorado, with many more suspected but unsubstantiated reports.

Many different common names for the disease that reflect the descriptive and characteristic disease symptoms have been

used in various scientific publications. These names include leaf freckles and wilt, Nebraska leaf freckles and wilt, bacterial freckles and wilt, bacterial leaf blight and wilt, and Nebraska wilt and leaf freckles. The name now associated with the disease is Goss's bacterial wilt and blight, or sometimes shortened to simply Goss's wilt. It was named after R. W. Goss, a former chair of the Department of Plant Pathology and first full-time dean of the Graduate College at the University of Nebraska, who is credited with pioneering the early development of modern plant pathology in Nebraska.

Symptoms and Signs

The pathogen can cause two major types of symptoms, a systemic wilt and leaf blight. The most commonly encountered symptom is leaf blight that appears as gray to light yellow lesions with wavy margins that follow the leaf veins. Prior to lesion development, characteristic streaks of water soaking can appear on the leaf. Dark green to black discontinuous, water-soaked spots resembling and often referred to as 'freckles' on the surface occur within the infected area and are diagnostic of the disease (*Figure 1*). A bacterial exudate on diseased tissue that glistens and appears shiny in sunlight after drying (*Figure 2*) is a sign of the foliar blight phase of the disease. Foliar lesions may progress to blight



Figure 1. Small, dark discontinuous water-soaked spots or 'freckles' are one of the diagnostic symptoms and frequently develop near the edges of lesions associated with Goss's wilt and blight.



Figure 2. Bacterial exudate on the surface of leaves infected with Goss's wilt will often appear shiny.



Figure 3. Goss's wilt and blight can progress to blight entire leaves over large areas of the canopy.



Figure 4. Water-soaked and wavy lesions following the veins are associated with the bacterial disease Stewart's wilt shown in both leaves above. Stewart's wilt can easily be confused with Goss's wilt, but lacks the green 'freckles' and shiny exudate on the surface.

and kill large portions of the canopy (Figure 3). Severe necrosis and dying tissue may be confused with leaf scorch symptoms, associated with drought stress or hot, drying winds. The water-soaked symptoms and lesions of Goss's wilt may be confused with those of another bacterial disease



Figure 5. Systemic infection and movement of the pathogen within the plant can discolor vascular bundles orange following recent infections that may later appear dark brown to black as Goss's wilt progresses.

of corn, Stewart's wilt, which is similar in appearance and often occurs in Nebraska (Figure 4).

The disease also is characterized by the less common wilt phase in which the pathogen infects the vascular system and moves systemically within the water-conducting elements. The infection may cause discoloration of xylem tissues (Figure 5), and a water-soaked, slimy stalk rot, followed by wilting and death of plants (Figure 6). Systemic infection can kill plants at any time during the season, including young seedlings, and can cause losses approaching 50 percent during severe epidemics in fields planted with susceptible cultivars.

Disease Cycle

The pathogen over-winters on the soil surface in infested residue, which serves as the primary inoculum source for future corn crops. Research results indicated that all infested parts of the corn plant (roots, stems, leaves) allowed survival of the pathogen on the soil surface for 10 months, but pure cultures of the bacterium did not survive after the same



Figure 6 Premature death of plants can occur when seedlings are systemically infected. Loss of plants prevents canopy closure, allowing excessive sunlight to penetrate the canopy, thus weeds flourish. Some monocot weeds may provide a reservoir for inoculum spread and survival, making weed control important in managing Goss's wilt and blight.

period of time. Burial of infested residue inhibited recovery of the bacterium from all plant parts except for infested stems, which yielded low levels of the pathogen. Pathogen spread throughout fields is enhanced by continuous corn production and injury to leaves caused by factors such as sand blasting, heavy winds or especially hail (*Figure 7*). Insects are not known to be involved with disease spread or development. Disease has been observed from both dryland and irrigated production fields. Once infection occurs, optimal temperature for disease development is 80°F, and all plant parts may serve as sites for infection. Hot, dry weather can impede disease development, except in overhead irrigated corn.

The pathogen is capable of being both seedborne and seed transmitted. Studies have shown that up to 32 percent of corn ears carried the bacterium after harvest and natural seed infection levels (seedborne) in Nebraska were additionally found to be almost 21 percent in some situations. Transmission to seedlings (seed transmission) has been demonstrated at low rates (2 percent) from naturally infected seed planted into sterilized soil. However, seed transmission still may play an important role in introduction of the disease into other corn-growing regions, or in serving as inoculum point sources for spread within fields after severe storms during the growing season.

Management

Yield losses in susceptible corn cultivars have been documented, from both the wilt and leaf blight phases of the disease. Thus, use of partially resistant hybrids is the best management strategy for Goss's wilt (*Figure 8*). Several disease resistant hybrids are available, but less than 25 percent of seed corn companies in Nebraska currently publicize their hybrids' disease reactions to Goss's wilt and leaf blight. Furthermore, even in the event that resistance becomes widely available,



Figure 7. Wounds created by mechanical injury, especially stalk bruising (left) and leaf shredding (right) caused by hail, provide pathogen entry into the plant.

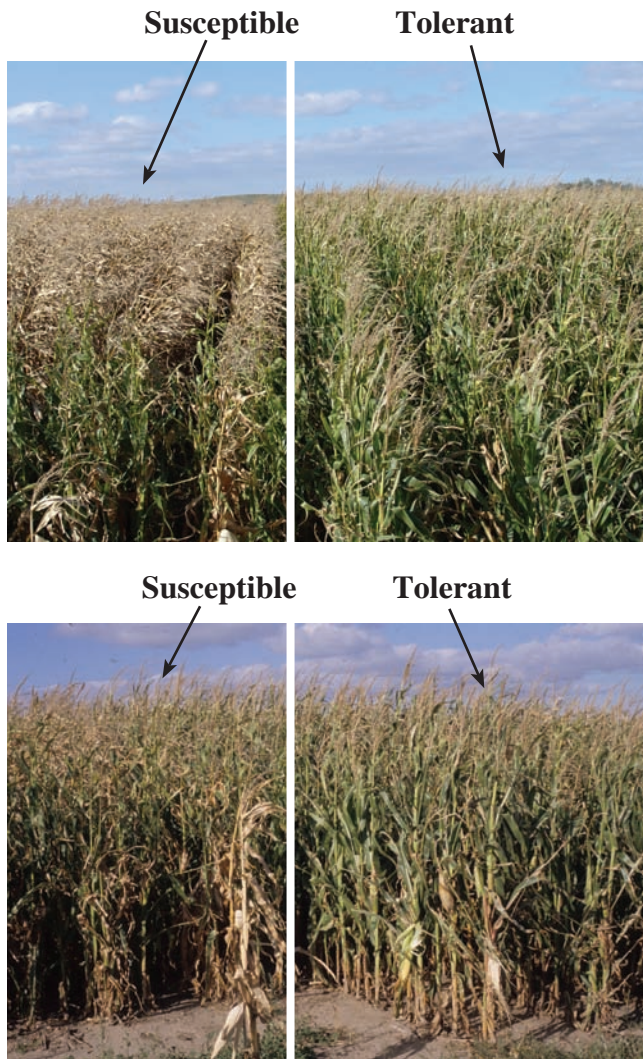


Figure 8. A field planted with susceptible (left rows) and tolerant (right rows) hybrids with obvious differences in height (top) and blighted leaf area (bottom).

it likely won't provide immunity (i.e. complete absence of symptoms) to the disease. Other factors may enable the pathogen to infect resistant cultivars, but yield losses should be reduced compared to susceptible cultivars.

Since the bacterium survives in infested residue, and poorly in or on soil, any type of tillage that buries residue to encourage decomposition may be effective in reducing the rate of new infections. Rotating out of corn into other crops such as soybean, dry bean, small grains or alfalfa will help reduce primary inoculum sources in corn residue. Additional hosts for the pathogen include green foxtail, shattercane and barnyard grass; therefore weed control also may provide an effective method for reducing inoculum.

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