AGRONOMIC ALERT

Technology Development by MONSANTO ®

IDENTIFYING AND MANAGING GOSS'S WILT

Goss's wilt commonly occurs in areas of the Western Corn Belt such as Colorado, Kansas, and Nebraska. Over the past few years, the incidence of Goss's wilt has been on the rise in the Eastern Corn Belt. This year, the disease is more evident in some areas due to heavy storms during the growing season. Because this is a fairly new disease to the region, proper identification is critical to determining management practices and planning for the future.

Goss's Wilt in 2011

The "disease triangle" (Figure 1) can be used to help explain why Goss's wilt is showing up in the Eastern Corn Belt this year.

- The pathogen that causes Goss's wilt is the bacterium *Clavibacter michiganense* subsp. *nebraskensis*. It is likely that the disease has been present at low levels in Illinois fields for several years, but gone unnoticed or undiagnosed. Bacteria overwinter in diseased residue on or near the soil surface. Inoculum levels have probably been on a gradual increase each year, particularly in heavy residue and corn-on-corn fields.
- This year, environmental conditions in the region have been particularly conducive to Goss's wilt infection and spread. Because bacteria require wounding in order to infect, the occurrence of high winds and heavy rains this summer, along with warm temperatures, created an ideal environment for Goss's wilt.
- In Western Corn Belt states, like Nebraska, where the disease is present every year, hybrids with resistance to Goss's wilt are commonly grown. These same hybrids are often available in eastern markets as well, along with others that offer a range of choices for farmers dealing with this disease.

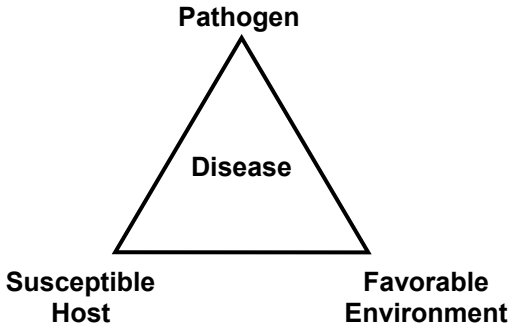

Figure 1. The disease triangle illustrates that disease only occurs when a pathogen, susceptible host, and favorable environment exist at the same time.

Symptoms and Identification

Goss's wilt can occur as either a vascular wilt or leaf blight. Leaf blight symptoms usually appear mid-season. Lesions extend along leaf veins and first appear as long, gray-green water-soaked streaks with wavy margins. Smaller, darker water-soaked flecks, often referred to as freckles, are apparent inside the larger lesion (Figure 2). The lesions may ooze bacteria-laden droplets in the morning. As the droplets dry, a crystalline sheen develops on the leaves. Eventually, the lesions will fade to a tan or gray color and may blight large areas of leaves.

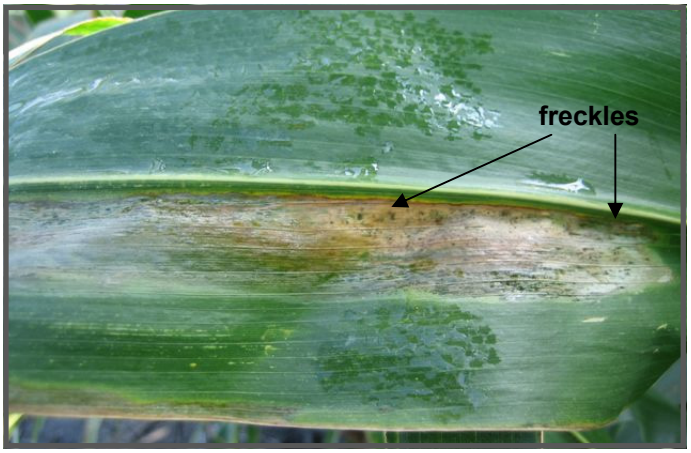

Figure 2. Goss's wilt lesion with gray-green wavy margins and dark flecks (freckles) formed within a lesion (bottom).

In the field, symptoms of Goss's wilt can be easily confused with symptoms of other diseases, nitrogen deficiency, and abiotic disorders such as heat stress or sun scalding[1] (Figure 3). Stewart's wilt is another bacterial disease of corn and symptoms of this disease can look very similar to symptoms of both the vascular wilt and leaf blight phases of Goss's wilt. Early stage leaf symptoms of Goss's wilt may also be confused with foliar lesions caused by the fungal disease northern corn leaf blight (NCLB). With both diseases, lesions run parallel to leaf veins and individual lesions can be elliptical-shaped and tan with gray-green margins.

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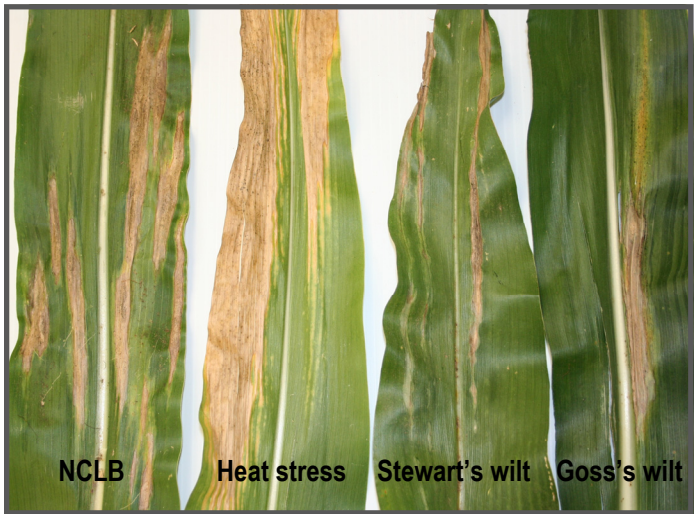

Figure 3. Various foliar symptoms that may look similar and can be easily confused.

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To determine whether Goss's wilt is present, plant tissue samples should be sent to a diagnostic lab. Once the sample is received, it will first be examined under a microscope for the presence of bacteria oozing from the tissue. If bacteria is present, then likely the sample will be tested using an ELISA test to determine whether the bacteria present is the pathogen that causes Goss's wilt or Stewart's wilt. Even if the pathogen that causes Goss's wilt is identified in a sample, it does not necessarily mean that Goss's wilt is the primary culprit responsible for the observed symptoms. It is possible for similar looking samples to be taken from a single field and have one be positive for Goss's wilt and the other negative. Further field observation and testing may be required to fully explain symptoms in the field.

Monsanto Efforts

Beginning in the early 2000s, Monsanto set up a large-scale phenotypic screening program using increasingly effective automated inoculation systems to screen their vast array of germplasm (Figure 4). This program has expanded to the point where today the breeding group screens tens of thousands of inbred parents and hybrids yearly for tolerance to Goss's wilt. From this screening effort, the breeding group has identified key sources of Goss's wilt resistance in Monsanto's germplasm pool. These sources are being used in ongoing breeding programs to generate new, high performing products tolerant to Goss's wilt—a few of which have already been deployed commercially. In addition, this screening effort has enabled identification of specific genes that confer tolerance to Goss's wilt. These genes are also in the process of being deployed throughout Monsanto's corn germplasm pool through molecular breeding techniques, which are very similar to those used to successfully incorporate traits like herbicide and insect resistance. This effort will further enhance Monsanto's ability to provide improved inbred parents and resulting hybrids. Finally, Monsanto is also working on more basic research projects to help understand the underlying genetics of the Goss's Wilt pathogen and the interaction of that pathogen with corn germplasm.

Figure 4. Equipment used to infect corn plants with Goss's wilt during the germplasm screening process.

Management Considerations

The primary tools to manage Goss's wilt include tillage, crop rotation, product selection, and weed control. Tillage operations that bury infected crop residue, encouraging decomposition, can be effective in reducing bacterial populations and the rate of new infection. Rotations for two or more years out of corn can provide good control of Goss's wilt by allowing infected residue to degrade and bacterial populations to decrease before corn is planted again. Non-host crops include alfalfa, oats, wheat, and soybeans. Growers should evaluate product selection and placement on a field by field basis, matching yield, agronomic traits, and disease tolerance to their farming operation. If Goss's wilt is suspected this year, scout fields carefully and note the location and severity of the disease to prepare for the next season. Consider sending multiple samples to diagnostic labs to confirm the presence of Goss's wilt. The best time for scouting fields is between VE and R6. Because injury from hail or high winds usually plays a direct role in initial infection of Goss's wilt, scouting after strong wind or hail may be particularly helpful. Weeds such as green foxtail, barnyardgrass, and shattercane are alternative hosts for this disease. Controlling weeds can help limit sources of inoculum.

Sources: [1]Wise, K. et al. 2010. Goss's bacterial wilt and leaf blight. Purdue University Extension. BP-81-W; Additional sources: Jackson, T.A. et al. 2007. Goss's bacterial wilt and leaf blight of corn. University of Nebraska-Lincoln. G1675; Goss's bacterial wilt and leaf blight. 2010. University of Minnesota Extension. [Online] http://www.extension.umn.edu (Verified 06/13/11); Compendium of corn diseases. APS Press; Corn disease management. 2002. Illinois Agronomy Handbook. University of Illinois Extension.