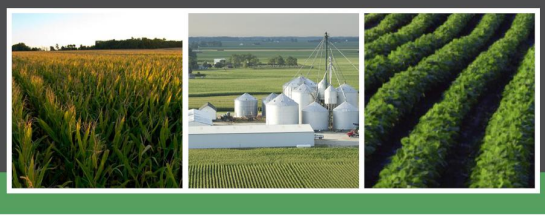

Agronomic Spotlight

Goss's Wilt through the Years

- Since its discovery in 1969, Goss's wilt has been slowly spreading to new areas of the United States and Canada.
- Goss's wilt is more likely to become established in areas where conservation tillage and corn-following-corn are common production practices.
- For over a decade, Monsanto breeding efforts have focused on the development of new corn products with improved resistance to Goss's wilt across all geographies at risk.

Distribution

Goss's wilt was first reported in Dawson County, Nebraska in 1969. The disease was initially named leaf freckles and wilt because of the distinct leaf symptoms (Figure 1). Within ten years, the disease had spread throughout most of Nebraska and into Colorado, Iowa, Kansas, and South Dakota. Throughout the decades, the bacterial pathogen Clavibacter michiganensis ssp. nebraskensis (Cmn) continued to spread throughout corn-growing regions of North America. To date, Goss's wilt has been found in 18 states and in Alberta, Manitoba, and Ontario, Canada (Figure 2).[1,2]

Figure 1. Early symptoms of Goss's wilt with leaf freckles.

A Change in Production Practices

During the 1980s, Goss's wilt was thought to have the potential to become a widespread problem. However, in certain areas of the Corn Belt where the Cmn bacterium had been found, such as Minnesota, Iowa, and Illinois, it did not become established with only sporadic occurrences of the disease noted. By the end of the decade, it was evident that the disease had not become a significant problem outside of the western portion of the Corn Belt.

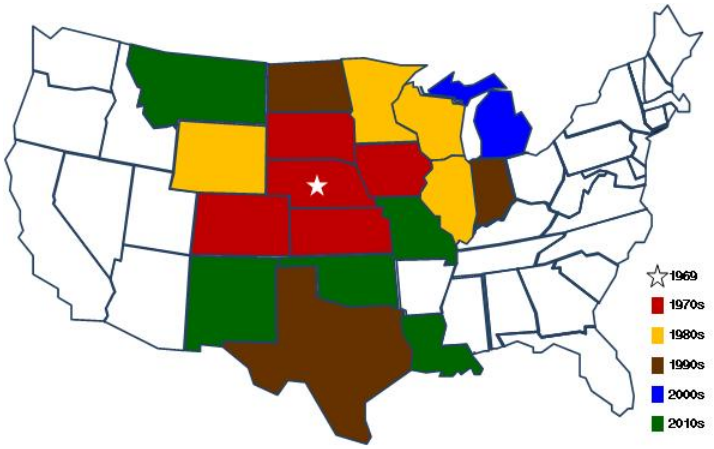

Figure 2. States and timeline of reported incidences of Goss's wilt since first identification in 1969 (white star).

Factors that prevented Goss's wilt from becoming a widespread and significant disease throughout the entire Corn Belt in the 1980s also explain why the disease has made a comeback in recent years. Goss's wilt did not become widely established in parts of the Corn Belt during the 1980s due to the predominant production practices of that period, which included clean fall plowing; whereas conservation tillage had been a common practice for decades in the western Corn Belt where the disease was a significant problem.

The Culprit

Corn stubble is a source of primary inoculum for Cmn under naturally-occurring field conditions. University of Nebraska plant pathologists demonstrated that Cmn could be recovered eight months after harvest from 80% of infected leaf tissue left on the soil surface; however, the bacterium could not be recovered from infected leaf debris buried 4 or 8 inches in the soil.[3] Thus, as the bacterium spread to new areas (via movement with weather fronts, movement of infected corn debris, and/or movement of infected seed) it failed to become established when infected debris decomposed with adequate fall tillage. Increases in the adoption of conservation tillage and continuous corn production throughout the Corn Belt are contributing factors to the resurgence of Goss's wilt. Because corn residue at the soil surface has the potential to harbor a substantial amount of Cmn inoculum, once introduced into a field, the bacteria can survive on

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Goss's Wilt through the Years

surface debris and gradually increase to levels that are likely to cause a significant problem when favorable conditions occur.

Goss's Wilt Now and in the Future

The most effective management approach for Goss's wilt is the use of resistant corn products. Corn products have a range of reactions to Goss's wilt from relatively resistant to very susceptible. This range of reactions is found among commercial products from all seed companies. No corn plant is completely immune to infection. Corn products targeted for the western Corn Belt tend to have better resistance to Goss's wilt than those grown in the central and eastern Corn Belt because the frequency of the disease in the west has eliminated the practical use of the most susceptible products. The group of corn products grown in the central, eastern, and southern areas of the United States have a wider range of reactions to Goss's wilt because the disease has not been a major issue in those regions until recently. Nevertheless, individual products grown anywhere throughout North America may have Goss's wilt resistance equivalent to products grown in the west.

Severe occurrences of Goss's wilt are now observed over a wider geography than in previous decades. In these new cases, it is likely that the pathogen was introduced but remained undetected until conditions were adequate for more severe disease development. Conservation tillage and continuous corn production likely enhanced the build-up of Cmn inoculum, increasing the chances of noticeable levels of disease. The probability of Goss's wilt increases when severe weather conditions conducive to infection occur and a corn product with moderate to susceptible reactions is grown. Severe occurrences of Goss's wilt will likely continue until more commercial products with increased resistance become available in these regions, or agricultural practices, such as crop rotation, that reduce the source of inoculum are practiced.

Monsanto's Breeding Efforts

In response to the increased prevalence of Goss's wilt, Monsanto has committed special efforts to develop new corn products with increased tolerance to the disease in all geographies. Large screening nurseries have been established in many areas to provide corn breeders an opportunity to assess the response of individual corn products under different environments and differing levels of disease severity. Monsanto corn products are assigned a tolerance rating based on their response to the disease across all geographies. Disease tolerance ratings range from 1 to 9, with 1 being excellent resistance and 9 being poor resistance.

Monsanto breeders are using genetic markers to enhance traditional phenotypic selection for increased resistance to Goss's wilt. Marker-assisted breeding is an important tool in the development of corn products and has helped speed up the development process for new products. The result has been an increased number of new corn products with improved resistance to Goss's wilt (Figure 3).

For additional information on symptoms and management of Goss's wilt, visit www.aganytime.com

Figure 3. Differences in the severity of Goss's wilt infection on leaves of a susceptible and a resistant corn product from Monsanto. Resistance restricts the area of leaf tissue colonized by Cmn.

Sources

[1] Jackson, T.A., Harveson, R.M., and Vidaver, A.K. 2007. Goss's bacterial wilt and leaf blight of corn. NebGuide G1675. University of Nebraska-Lincoln Extension.

[2] Distribution map of Clavibacter michiganensis subsp. nebraskensis. April 2000. Map No. 549. CAB International.

[3] Schuster, M.L. 1975. Leaf freckles and wilt of corn incited by Corynebacterium nebraskense. Schuster, Hoff, Mandel, Lazar, 1972. Research Bulletin 270. University of Nebraska-Lincoln.

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