ADVISORY NOTE: GOSS'S WILT ON MAIZE IN SOUTH AFRICA

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ADVISORY NOTE: GOSS'S WILT ON MAIZE IN SOUTH AFRICA

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GOOD AGRICULTURAL PRACTICES AND RISK MANAGEMENT PROCEDURES IN AREAS WHERE MAIZE- *Zea mays*- IS CULTIVATED

Background

Goss's Wilt is caused by the Gram-positive bacterial species Clavibacter michiganensis subspecies nebraskensis. It was first found on two farms in south central Nebraska (Dawson County) near Lexington in 1969 (Wysong et al. 1973). Initially, epidemics were restricted to Nebraska and parts of Colorado, Kansas and South Dakota. Between 2009 and 2011 it was reported in the following states of the United Sates of America: Iowa, Illinois, Indiana, Minnesota, and Wisconsin. Major epidemics led to leaf loss, lower stalk quality and reduced yields (up to 50% losses). The first symptomatic plants received also showed symptoms of Northern Corn Leaf Blight. Goss's Wilt was not known to occur locally and initial testing (PCR and sequencing) was done and found to be positive for the bacterium. Additional sampling from various localities stretching from north of Parys, across Fochville, Carletonville to Lichtenberg was done. The Department of Agriculture, Land Reform and Rural Development (DALRRD) was then informed, and subsequently, samples were collected by DALRRD officials from farms in the Potchefstroom area (Figure 1). The samples were sent for identification at the Agricultural Research Council (ARC) in Pretoria. Clavibacter michagenesis subsp. nebraskensis was also confirmed by molecular methods (PCR and Sequencing).

Figure1: Sampling by DALRRD officials (Mthembu, 2024)

Goss's Wilt symptoms

Goss's Wilt of maize can cause leaf blight and systemic wilt symptoms. The most common symptom, which can appear at any growth stage is leaf blight. Leaf symptoms include elongated tan to greyish-brown lesions with irregular or wavy margins that extend parallel to the veins (**Figure 2**). Young lesions appear as streaks of light green tissue with water soaking on the leaf (**Figure 3**) before the tan lesions develop. The tan lesions can affect large sections of leaf area and more than 60% of the leaf area on infected plants may be killed (**Figure 4**). Dark green to black, scattered, water-soaked spots ("freckles") develop in the lesions (**Figure 5**). The lesions may develop small, glossy droplets of dried bacteria ooze when exposed to sunlight. When dried, this ooze may look similar to dried varnish (**Figure 6**).

On the other hand, the systemic wilt phase is less common 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 discolour xylem tissues or cause a slimy stalk rot, which is followed by wilting and plant death (**Figures 7–9**). Systemically infected plants may wilt and appear drought stressed. Maize plants may have weak stalks and an increased susceptibility to lodging.

Figure 2: Typical Goss's Wilt lesions on a maize leaf (Malvick et al., 2018)

Figure 3: Early Goss's Wilt lesion showing light green lesion developing with water soaking, grey/green margins, and dark, water-soaked freckles (Malvick et al., 2018)

Figure 4: Goss's Wilt can kill large areas of leaves, thereby reducing chlorophyll activity and subsequent grain fill (Flett, 2024)

Figure 5: Dark, water-soaked spots ("freckles") Goss's Wilt lesions. The water-soaked spots appear translucent (Mthembu, 2024)

Figure 6: Dried bacterial ooze on the surface of lesions appears shiny (Njom, 2024)

Figure 7: Discolored stalk pith indicative of the wilt phase of Goss's Wilt (Malvick et al., 2018)

Figure 8: Severe stalk decomposition from the wilt phase of Goss's Wilt (Malvick et al., 2018)

Figure 9: Plant wilting and dying is characteristic of Goss's Wilt (Flett, 2024)

Distinguishing Goss's Wilt symptoms from other symptoms

Drought (heat) stressed maize, maize infected with Northern Corn Leaf Blight (NCLB) (*Exserohilum turcicum*) and Stewart's wilt (*Pantoea stewartii*) have similar symptoms to those caused by Goss's Wilt. However, these symptoms can be distinguished. The drought stress causes brown discoloration from leaf scorch that tends to be more uniform in colour, and the necrotic leaf tissues do not have the water-soaked freckles, shiny bacterial or the bacterial streaming associated with Goss's Wilt lesions. NCLB can be distinguished from Goss's Wilt by the lesion's canoe shape, even lesion margins, and the absence of freckles in the lesions and bacterial streaming, which are observed in Goss's Wilt. Goss's Wilt and Stewart's wilt may both cause seedling blights that kill young plants, lesions that develop into long lesions with wavy margins that extend between veins, however, a key distinguishing characteristic is the dark green-to-black freckles that develop with Goss's Wilt lesions (**Figure 9**).

Figure 10: How to distinguish Goss's Wilt symptoms from other leaf necrosis (Jackson, 2007)

Epidemiology (Disease cycle)

Infected maize residue is the primary source of inoculum for Goss's Wilt and the pathogen overwinters on them or near the soil surface. Infected residues allow the pathogen to survive on the soil surface for at least 10–15 months. The Goss's Wilt pathogen can also survive on other plant species and confirmed hosts include sorghum, annual rye grass and these may be a source of inoculum. The pathogen being a bacterium can also survive in irrigation water. The bacterium is splashed from infected residue or grasses onto maize leaves. Once on the plant, the bacterium infects through wounds caused by hail, heavy rain, wind or mechanical damage. The pathogen can spread systematically in plants after leaves are infected. Plants can be infected at any growth stage and wet weather and high relative humidity favour development and spread. Disease is also capable of spreading under hot drought conditions. The pathogen can move from a field to another through infected stubble, wind or farm equipment. Seed-borne

transmission rates have been shown to be low but are known to be an important means of dissemination. Infected seed may play a role in introducing the disease into new areas or specific sites within fields. Although infection that causes significant yield losses typically occurs during the vegetative growth stages, symptoms often become 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.

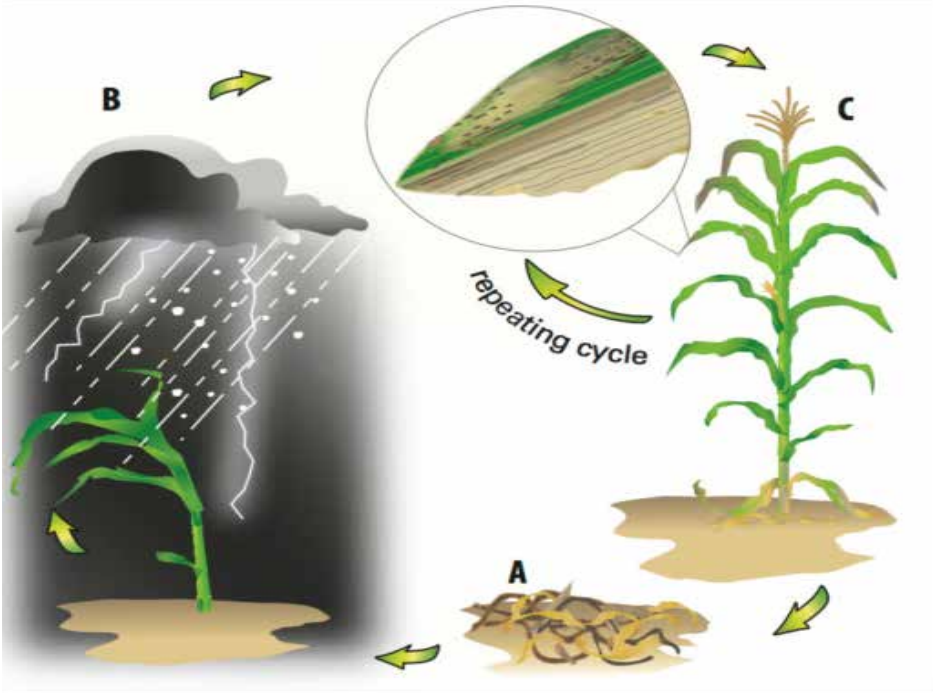

Figure 11: The Goss's bacterial wilt and blight disease cycle. A. The pathogen overwinters in infested corn residue. B. Wind and rain splash the pathogen on maize leaves—plants with wounds from hail or other factors may be more susceptible. C. Pathogen can spread to adjacent plants (Malvick et al., 2018)

Control of Goss's Wilt

Goss's Wilt is a bacterial disease and there are no recorded fungicides **that** work against this disease. Furthermore, no curative measures are available as these bacteria cannot be effectively controlled chemically, therefore the best way to manage Goss's Wilt is to plant highly resistant maize hybrids. This highlights the importance of screening maize hybrids and avoid planting hybrids with a history of high infections. The bacterial pathogen survives in infected stubble, therefore the reduced movement of infected stubble between fields and removal of infected stubble by ploughing can reduce spread and initial inoculum load. Keep in mind that stubble control will reduce inoculum but will not prevent the disease. Additional control can be achieved by rotating crops with nonhosts (for example soybean, dry bean, small grains, or alfalfa), which will help to remove the primary inoculum for the subsequent maize crop. Weed control of alternate hosts and tillage practice that buries infected residue after harvest reduces initial inoculum levels in the USA.

Reporting of disease occurrence

At present we have information regarding Goss's Wilt management practices from abroad, which may not be effective under South African conditions. It is therefore imperative that we conduct local research regarding epidemiology and management options for South African maize producers. Producers are encouraged to report any bacterial disease symptoms observed in the fields, irrespective of the disease, to the Directorate: Plant Health within DALRRD at phytomatters@dalrrd.gov.za. Samples can be collected and submitted to the laboratory at the ARC, Grain-Crops, Potchefstroom or the ARC: Plant Health and Protection, Roodeplaat. This will assist in assessing the situation of bacterial diseases in South Africa and the collection and identification of bacterial isolates that are critical to future research efforts.

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