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# NF01-473 Stewart's Wilt of Corn

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# Stewart's Wilt of Corn

*By Jim Stack, Jennifer Chaky, and Loren Giesler, Extension Plant Pathologists and Robert Wright, Extension Entomologist*

## Introduction

An outbreak of Stewart's Wilt occurred in Nebraska in each of the last two years. In 1999, Stewart's Wilt was confirmed in 41 fields in at least 14 counties. It was more widespread in 2000, occurring in at least 149 fields in at least 27 counties *(Figure 1).* Using a commercially available antibody-based detection kit, it was confirmed in seed production fields, germplasm improvement plots, and in commercial field corn. Actual yield loss estimates are not available; however, disease severity was high enough in many seed production and hybrid production fields to cause both direct and indirect yield losses. The most serious impact may be the effect on export of seed from fields with a confirmed diagnosis of Stewart's Wilt. Several countries include the Stewart's Wilt bacterium among their quarantined pests and pathogens. In those countries, quarantine regulations require that seed from fields with confirmed Stewart's Wilt disease must be tested prior to export by a certified lab and certified as pathogen-free.

## Pathogen

Stewart's Wilt of corn is caused by the gram negative bacterium *Pantoea stewartii;* formerly known as *Erwinia stewartii.* It is found throughout the Corn Belt in the United States as well as other countries in South and Central America, Europe, and Asia. Some countries (e.g., South Africa) are believed free of the pathogen and have imposed quarantine restrictions to exclude the pathogen. Molecular detection techniques have been developed to aid in the certification of seed as being free of the Stewart's Wilt pathogen. *Pantoea stewartii* has a narrow host range infecting field corn, sweet corn, and popcorn as well as gamma grass. Sorghum, millet, sudan grass, and several weed species (e.g., yellow foxtail) can be infected by artificial inoculation. Whether these species contribute to the development of Stewart's Wilt in corn production systems is not known. They may serve as reservoirs of the bacterium and harbor the flea beetle vector.

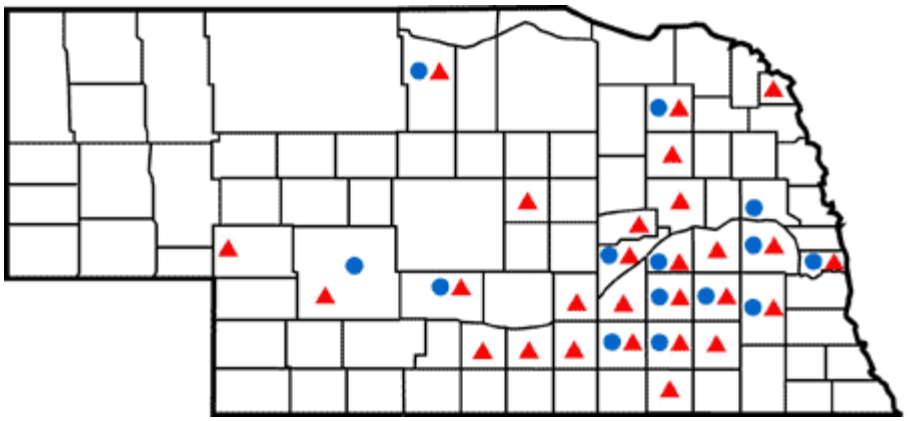

**Figure 1. Distribution of confirmed Stewart's Wilt cases in Nebraska in 1999(•) and 2000.**

## Vector

Corn flea beetles *(Chaetocnema pulicaria)* are the primary vector of the bacterium which causes Stewart's Wilt. These small (1/16 inch long), shiny, black beetles feed by scraping the epidermis of the leaf, leaving streaks or window panes of white tissue. When abundant, they may kill leaves, and in severe cases, seedlings. Their common name refers to their ability to jump like a flea when disturbed. Corn flea beetles overwinter as adults in protected areas near corn fields. They become active in April and feed on a variety of grasses before corn emerges. Overwintered beetles begin to feed on corn at seedling emergence. Flea beetles lay eggs in the soil, and larvae develop in the soil and feed on corn roots. A new generation of flea beetles emerges in July, lays eggs and produces a second generation of beetles which overwinter.

## Disease Development

There are two phases of Stewart's Wilt disease: the first occurs in young seedlings and the second occurs in mature plants, usually after tasseling. In general, the first phase is more severe and plants may be killed outright. The bacterium enters the plant through wounds, usually those caused by feeding of the flea beetle. Long water-soaked lesions may extend the length of the leaf on seedlings of susceptible plants. This leaf stripe symptom can be confused with nutrient deficiencies or *Aspergillus* leaf blight. As the disease progresses, seedlings wilt and eventually die. When the stalks of diseased seedlings are cut, a yellow ooze may flow from the vascular bundles. In severely affected plants, a rotted cavity may develop at the base of the stalk.

The second phase of Stewart's Wilt normally occurs after tasseling. As with the first phase, the flea beetle vector is the primary variable in epidemic development. The number of disease cycles during the season and the subsequent disease severity are determined by the proportion of the beetle population carrying the bacteria and the feeding activity of the flea beetle. If several cycles occur, then disease severity may be high and lead to yield loss. Sweet corn and popcorn hybrids are most susceptible; most dent hybrids have some resistance to the early phase of disease. Unlike the first phase, systemic symptoms (e.g., wilting) usually do not develop during the second phase. The most common symptoms are leaf lesions; long water-soaked lesions may extend the length of the leaf of susceptible plants and turn necrotic. Stewart's Wilt lesions on plants after tassling can be confused with lesions caused by Goss's Wilt. These two diseases are easily distinguished by laboratory tests. This can be done in the Plant and Pest Diagnostic Clinic at the University of Nebraska in Lincoln. Stewart's Wilt epidemics depend on the corn flea beetle whereas Goss's Wilt outbreaks in Nebraska usually follow hail storms or

sand-blasting from high speed winds.

Although direct yield losses from Stewart's Wilt are usually low in field corn hybrids, high levels of leaf damage from Stewart's Wilt can predispose the plants to stalk rot disease (see *Common Stalk Rot Diseases of Corn,* NebGuide G99-1385). As the season ends, the flea beetle seeks refuge in grassy areas near production fields. If they have fed on infected plant tissues, they may contain the Stewart's Wilt bacteria in their gut, facilitating survival of the pathogen through the winter. In the spring, the beetles carrying the bacteria feed on emerging corn seedlings and complete the cycle.

## Pathogen Survival and Disease Forecasting

The Stewart's Wilt pathogen has a complex survival strategy that facilitates winter survival and dissemination to susceptible hosts in the spring; it also makes possible the prediction of the incidence and severity of Stewart's Wilt prior to each season. The Stewart's Wilt bacterium does not survive free in nature. Its survival depends upon its insect vector, the corn flea beetle. The bacteria survive winter in the gut of the beetle. It overwinters as an adult in grass near production fields. Consequently, survival of the beetle vector predicts survival of the pathogen. Research has determined that if the sum of the mean monthly temperatures for December, January, and February is greater than 37o - 38o C (98o - 100o F), survival of corn flea beetles will be high. If the sum of mean monthly temperatures for December, January, and February is less than 270 C (810 F), survival of the corn flea beetles will be low. If a significant proportion of the flea beetle population harbors the bacteria, disease incidence and severity will be high in those years where survival of the beetle is high *(Table I).* The absolute temperature value may vary between 90o and 98o F, depending on other environmental factors including the amount of snowfall in a given year. The Stewart's Wilt pathogen survives poorly within infected seed. Disease transmission from infected seed is very low and not believed to be important under field conditions.

**Table I. Model for predicting risk of Stewart's Wilt disease.**

| *Predicting Risk of Stewart's Wilt* |
|---|
| IF: (mean Temp Dec) + (mean Temp Jan) + (mean Temp Feb) $\geq$ **98 degree F** |
| THEN: beetle survival will be high and Stewart's Wilt **risk is high.** |
| IF: (mean Temp Dec) + (mean Temp Jan) + (mean Temp Feb) $\leq$ **81 degree F** |
| THEN: beetle survival will be low and Stewart's Wilt **risk is low.** |

## Disease Management

- **Cultural:** Careful fertility management is required to minimize the impact of Stewart's Wilt. Excess nitrogen and phosphorus in corn increases the Stewart's Wilt severity. High temperatures and high soil moisture also increase severity.
- **Plant resistance:** The most effective management strategy for Stewart's Wilt disease is planting resistant hybrids. Most dent corn hybrids have some resistance to the early seedling phase of the disease and rarely experience yield loss to Stewart's Wilt. Seed corn production involving susceptible inbreds can suffer severe loss from Stewart's Wilt.
- **Insect Management:** Seed-applied insecticides containing imidacloprid can significantly reduce incidence of Stewart's Wilt. Insecticide sprays and in-furrow applied insecticides somewhat reduce Stewart's Wilt. The high cost of such treatments precludes their widespread use in field

corn production systems.

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