Corn Diseases in 1998 - Management and Research Update

Gary P. Munkvold  
_Iowa State University, munkvold@iastate.edu_

Charlie A. Martinson  
_Iowa State University_

John M. Shriver  
_Iowa State University_

Follow this and additional works at: [https://lib.dr.iastate.edu/icm](https://lib.dr.iastate.edu/icm)

Part of the [Agriculture Commons](https://lib.dr.iastate.edu/icm/), and the [Plant Pathology Commons](https://lib.dr.iastate.edu/icm/)

---

[https://lib.dr.iastate.edu/icm/1998/proceedings/7](https://lib.dr.iastate.edu/icm/1998/proceedings/7)

This Event is brought to you for free and open access by the Conferences and Symposia at Iowa State University Digital Repository. It has been accepted for inclusion in Proceedings of the Integrated Crop Management Conference by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Each growing season has unique weather conditions that exert a strong influence on diseases. The prominent weather conditions that contributed to disease problems in Iowa corn in 1998 were: an unusually mild winter, very wet weather in June, and drier-than-normal conditions late in the season. The early spring was also very wet, which affected planting dates and caused some seedling disease problems, but not on a widespread basis.

**Leaf Diseases**

**Stewart’s disease** or Stewart’s wilt, caused by the bacterium *Pantoea stewartii* (previously called *Erwinia stewartii*), was predicted to be a widespread problem in 1998 because of the mild winter. The disease is carried by the corn flea beetle and the bacterium overwinters in the gut of the insect. When there is a mild winter, the flea beetles survive in greater numbers and the threat of disease is greater. A traditional system has been used to predict the risk of Stewart’s disease; the mean temperatures for December, January, and February are added, and the sum is related to disease risk. A sum of 90 or more corresponds to a high risk of disease, 80-90 corresponds to a moderate risk, and less than 80 corresponds to a low risk. This system does not take into account several factors that could influence beetle survival, and revisions of the system have been proposed. In 1998, the sum was greater than 90 for most of Central, East Central, and Southern Iowa (Munkvold and Rice, 1998).

Stewart’s disease can be divided into two phases: early-season wilting and late-season leaf blighting. The early-season phase is mainly a problem for sweet corn and certain susceptible inbred of dent corn. Plant can be killed or they may survive and be infected systemically. This type of infection can be a serious problem for seed corn producers because it can sometimes lead to seed infection. Many nations will not import corn seed if Stewart’s disease has been seen in the production field. This is still true in spite of the fact that seed transmission is nearly nonexistent (Block et al., 1998). The leaf blight phase can cause extensive damage to the leaves after silking. Very little information is available on yield losses to the leaf blight phase in modern hybrids, but it is likely that significant losses occurred in some fields in 1998. We received scattered reports of very severe flea beetle infestations during May and Stewart’s wilt was visible on the leaves of some plants early in the season. In late August and September, severe leaf blighting could be seen in some fields in Southern Iowa. It is still uncertain how much yield loss occurred in these fields. We established an experiment at the McNay Research Farm in Lucas Co. to quantify yield loss to Stewart’s disease. Stewart’s wilt was moderately severe, but we were not able to control the disease sufficiently with insecticide treatments. Therefore, we ultimately did not have an effective comparison to make.

Currently this disease is controlled by partial resistance that exists in most hybrids, and control of the flea beetle with a foliar insecticide. In 1998, an exemption was granted for the use of Gaucho, a systemic insecticidal seed treatment, for Stewart’s wilt control on inbred corn seed. This product and others may be used in the future on inbred seed, but it is unlikely they will be economical on hybrid corn seed.
Anthracnose leaf blight, caused by the fungus *Colletotrichum graminicola*, was prevalent in June due to the high levels of rainfall. This disease occurs commonly in late spring in Iowa and usually is not associated with yield loss when it occurs at this stage. However, in some fields where rainfall was excessive, early plant growth was generally inhibited and anthracnose was a component of the overall poor plant health. Therefore some portion of the yield reduction is attributable to anthracnose. When the weather became warmer and drier in July, anthracnose leaf blight did not progress further.

Eyespot, caused by the fungus *Aureobasidium zeae*, also was very prevalent in June. It also faded as the season progressed, but in some fields in northern Iowa it continued to develop to economic levels during the grain fill period. Eyespot is potentially one of the most damaging leaf diseases in Iowa because resistance to it is not at high levels in most hybrids. However, economic damage from this disease probably was limited to a low percentage of fields in the state.

Both of these diseases are controlled by partial resistance and crop rotation. Tillage also will reduce the risk of either disease. Fungicides would rarely be warranted for anthracnose control, but eyespot can be controlled with Tilt fungicide in seed corn and occasionally in hybrid field corn.

Bacterial leaf blight, caused by *Acidovorax avenae*, is a little-known disease (Pataky et al., 1997) that became prevalent for a short time in field scattered across Iowa this year. Symptoms are elongated, water-soaked lesions from about 1/2 to several inches long that later turn yellow, then brown and dry out. Individual lesions often are clustered together in a band on the leaf where infection took place in the whorl. It can somewhat resemble gray leaf spot because it has elongated lesions, but they are not as straight as gray leaf spot lesions. In the laboratory, the two can easily be distinguished because of the bacterial streaming from bacterial leaf blight lesions. The bacterium survives in plant residue and splashes onto leaves where infection takes place after a heavy rainfall. The disease does not spread from leaf to leaf very much and most plants grow out of it. Bacterial leaf blight is usually not considered to cause economic losses, but recently there have been outbreaks in Illinois sweet corn that have caused considerable yield loss. Once again, severe bacterial leaf blight is usually associated with excessively wet growing conditions, and if reduced yields occur under these conditions, they are a product of multiple stresses on the plants, including the leaf disease.

Holcus leaf spot, caused by *Pseudomonas syringae*, is another “minor” bacterial leaf disease. Symptoms are roughly circular, light tan spots of various sizes up to about 1/2 inch in diameter. This disease also tends to appear following heavy rains and then usually fails to spread from leaf to leaf. It can resemble eyespot because of the small, round spots, but holcus spot is usually much lighter in color and lacks the distinct border that eyespot lesions have.

There are no management practices recommended for these two bacterial leaf diseases. They occur early in the season and plants almost always recover from the symptoms when the weather turns dry and the plants grow rapidly.

Gray leaf spot, caused by the fungus *Cercospora zeae-maydis*, was more severe in Iowa in 1998 than in the previous two years. In plots of susceptible hybrids planted in early May at the ISU SE Research Farm at Crawfordsville, about 30% leaf area was diseased on the ear leaves at the dough stage, which is similar to the disease levels we saw there in 1995. At this level of disease, yield loss would be estimated at about 20-30%. Fortunately, most hybrids planted in 1998 have some partial resistance and did not reach disease levels as high as this. Although gray leaf spot resistance is improving in hybrids, the disease continues to be observed further north and west in Iowa each year. In another 5-10 years, gray leaf spot resistance will likely be an issue for hybrids grown anywhere in Iowa.
Gray leaf spot management includes the use of partially resistant hybrids, crop rotation, and tillage if necessary. Gray leaf spot ratings are available for hybrids in the Iowa Crop Performance Test (Pm-660-GLS-98). Fungicides can be used profitably in seed corn production and on susceptible hybrids. Current recommendations for hybrid corn are for a single application of Tilt at tasseling if several conditions are met.

On susceptible hybrids - if the disease is present on the third leaf below the ear (or higher) on 50% of the plants before tasseling.

On intermediate hybrids - only if conditions are very favorable for disease. This is likely if:
1) the field is south of Highway 30 or in an area with a history of gray leaf spot problems,
2) the previous crop was corn and there is 35% or more surface residue,
3) the field itself has a history of gray leaf spot problems,
4) the disease is present on the third leaf below the ear (or higher) on 50% of the plants before tasseling, and
5) the weather is warm and humid through July and August.

On moderately resistant or resistant hybrids, we do not recommend using a fungicide. Potential profitability of a fungicide application depends greatly on hybrid susceptibility. Because different seed companies use different rating scales, it can be difficult to decide what is “susceptible” or “intermediate.” The following table can be used as a general guide for classifying hybrids in these three broad categories.

Table 1. Gray leaf spot ratings for grouping corn hybrids using four different rating scales.

<table>
<thead>
<tr>
<th>Group</th>
<th>Rating Scale</th>
<th>Rating Scale</th>
<th>Rating Scale</th>
<th>Rating Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 (good) - 9 (poor)</td>
<td>1 (poor) - 9 (good)</td>
<td>1 (good) - 5 (poor)</td>
<td>1 (poor) - 5 (good)</td>
</tr>
<tr>
<td>Susceptible</td>
<td>7 or greater</td>
<td>3 or less</td>
<td>4 or greater</td>
<td>2 or less</td>
</tr>
<tr>
<td>Intermediate</td>
<td>5 - 6</td>
<td>4 - 5</td>
<td>3 - 3.5</td>
<td>2.5 - 3</td>
</tr>
<tr>
<td>Moderately resistant/Resistant</td>
<td>4 or less</td>
<td>6 or greater</td>
<td>2.5 or less</td>
<td>3.5 or greater</td>
</tr>
</tbody>
</table>

Several new fungicides are being investigated for gray leaf spot control. So far, we have concentrated on seed corn with these new products. Data are somewhat preliminary (Fig. 1), but the fungicide Quadris (Zeneca), as well as new experimental fungicides being developed by Novartis Crop Protection, seem to be at least as effective as Tilt, possibly more effective. Registration of these products is probably several years away. These new products may have the advantage of later applications than what is allowed by the Tilt label. Meanwhile, there is a possibility that the recent revision of federal pesticide laws will facilitate a change in the Tilt label to allow post-silking applications.

Root, crown, and stalk rots are caused by a variety of fungi, especially species of Fusarium (including Gibberella zeae, another name for Fusarium graminearum) and Colletotrichum graminicola (anthracnose). There are connections among the occurrence of decay of the roots, crown, and stalk. Root rot can lead to crown rot or stalk rot. “Crown rot” is a term that refers to decay at the base of the plant during the early vegetative stages, when the plant does not have a distinguishable stalk. “Stalk rot” refers to decay at the base of the plant or anywhere else in the stalk later in the season. Crown rot and stalk rot are caused by some of the same fungi, and the main distinction between these two terms is timing. Plants with crown rot may either die, recover, or develop stalk rot. In 1998, root and crown rot developed in areas of fields that were saturated by the June rains. Hail-damaged fields also developed a lot of crown rot due to injuries near the soil line. Crown rot results in poor growth and color, as well as wilting and leaf death.
Development of stalk rot is more complicated, and differs greatly from field to field. Stalk rot was prevalent in 1998, and continues to be the biggest economic problem among corn diseases. Weather conditions in 1998 were very favorable for stalk rot in many parts of the state. Wet weather early in the season promoted shallow root development and infection of roots by fungi in the soil that can cause stalk rot. Subsequent growing conditions were good, with adequate moisture in the soil and favorable temperatures and sunlight. But as the season progressed, the soil moisture continued to decrease to the point that some plants were experiencing drought stress, enhanced by root systems that were inadequate and warmer-than-normal temperatures. This type of stress makes plants very susceptible to stalk rot development. Stalk rot fungi are present in every corn field to some extent, so stress-related susceptibility will almost always lead to stalk rot development. Table 2 indicates the weather pattern that was so favorable for stalk rot.

Table 2. Iowa weather in 1998 - precipitation and GDD departures from normal

<table>
<thead>
<tr>
<th>District</th>
<th>Precipitation Departure from Normal</th>
<th>GDD Departure from Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4/1 to 7/9</td>
<td>7/10 to 9/21</td>
</tr>
<tr>
<td>NW</td>
<td>+0.9</td>
<td>-2.5</td>
</tr>
<tr>
<td>NC</td>
<td>+3.4</td>
<td>-3.0</td>
</tr>
<tr>
<td>NE</td>
<td>+5.6</td>
<td>-1.1</td>
</tr>
<tr>
<td>WC</td>
<td>+8.4</td>
<td>-1.9</td>
</tr>
<tr>
<td>C</td>
<td>+6.0</td>
<td>-2.8</td>
</tr>
<tr>
<td>EC</td>
<td>+3.4</td>
<td>-0.3</td>
</tr>
<tr>
<td>SW</td>
<td>+6.6</td>
<td>-3.4</td>
</tr>
<tr>
<td>SC</td>
<td>+3.4</td>
<td>-2.4</td>
</tr>
<tr>
<td>SE</td>
<td>+5.2</td>
<td>-0.2</td>
</tr>
</tbody>
</table>
Stalk rot resulted in premature death of plants in many fields and contributed to the overall rapid rate of plant maturity this year. Anthracnose stalk rot also showed up in the tops of plants, causing a top dieback. When the upper leaves of these plants were stripped off, the characteristic black lesions of anthracnose were visible. There were other factors that caused top dieback and/or premature death, including moisture stress, nitrogen deficiency, and wind damage.

Last year, there was also a high incidence of stalk rot and some discussion related to the relationship between Bt corn, stalk rot, and lodging. In our 1998 experiment in Ames, we found a significantly lower incidence of stalk rot in Bt hybrids compared to their non-Bt isolines. This is consistent with our results from previous years in Ames. Differences in stalk rot between Bt and non-Bt hybrids do not tend to be universal, however. In ISU Bt corn trials across the state, most showed no difference in stalk rot between Bt and non-Bt hybrids. Figure 2 shows one example from Cedar Co. Conditions in each field and the background susceptibility of the hybrids will influence stalk rot as much or more than the effect of European corn borers. Where corn borer populations are low, there is little or no difference between Bt and non-Bt hybrids, as one would expect.

**Figure 2.** Stalk rot (in cm) in Bt and non-Bt hybrids in a field plot in Cedar Co., IA. Differences between Bt and non-Bt hybrids were not significant. Data courtesy Virgil Schmitt, ISU Extension Field Specialist.

**Fusarium ear rot,** caused by the fungi *Fusarium moniliforme, Fusarium proliferatum,* and *Fusarium subglutinans,* is commonly associated with ear damage by European corn borers or corn earworms. Over the past four years, we have found that Bt hybrids with kernels expression of Cry proteins (primarily YieldGard hybrids) suffer significantly less Fusarium ear rot than non-Bt isolines (Munkvold et al., 1997). A major implication of that result is the potential differences in mycotoxin concentrations between Bt and non-Bt hybrids. The species that cause Fusarium ear rot can produce several different harmful mycotoxins. Fumonisins in particular are a group of toxic compounds produced by these *Fusarium* species. Fumonisins B₁, B₂, and B₃ are probable carcinogens and cause fatal diseases in horses and pigs (Munkvold et al., 1997b). Our results over the last three years have shown that high populations of European corn borer can result in increases in fumonisin concentrations in non-Bt hybrids (Fig. 3). These increases do not occur in Bt hybrids, so under these conditions, Bt hybrids have lower concentrations of fumonisins and potentially enhanced safety for consumption.
Literature Cited


Figure 3. Fumonisin concentrations in Bt and non-Bt hybrids in 1997, Ames, IA.