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Corn Diseases

Purdue University
Cooperative Extension Service

Gray Leaf Spot

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Gray leaf spot of corn is caused by the fungus *Cercospora zeae-maydis*. The fungus is now widespread in Indiana and the Eastern Corn Belt (Midwest). Weather strongly influences development of gray leaf spot. The disease develops rapidly during prolonged periods of hot, humid weather. Tillage and crop rotation are also important predisposing factors. Gray leaf spot is potentially more severe in fields where corn follows corn and reduced tillage practices are used.

Prior to 1992, gray leaf spot was observed only in an occasional field in southern Indiana, and relatively few fields suffered significant yield losses. In 1993, the disease occurred widely in Indiana south of Interstate 70. Highly susceptible hybrids were damaged in many fields. In 1994, the disease was found throughout the state, but, due to weather conditions, it did not develop until mid-August or later. Although yield losses were minor because of the delayed development of the disease, the fungus was established throughout the state. In 1995, prolonged periods of high humidity, night temperatures above 70°F, heavy dews, fogs, and occasional rains in July and August were favorable for the development of gray leaf spot. The disease occurred in most areas of the state and developed to severe proportions, especially in highly susceptible hybrids. During 1996 and 1997, gray leaf spot was commonly found, but weather was not conducive to severe disease development. Now that the fungus occurs throughout the state, we can expect major outbreaks of gray leaf spot whenever favorable weather conditions occur.

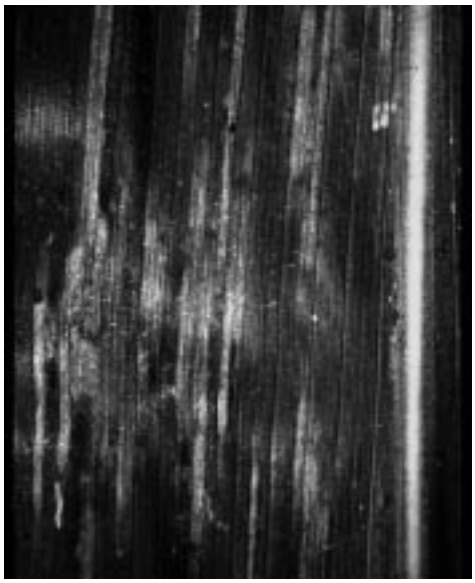

FIG. 1. Mature gray leaf spot lesions with parallel sides.

Symptoms

The characteristic symptoms of gray leaf spot appear on mature leaves as tan to brown, long (1/2 to 2 inches), narrow (1/8 to 1/4 inch), rectangular lesions (Fig. 1). Lesion width is limited by secondary and tertiary leaf veins, thus lesions have parallel sides. Individual lesions may coalesce, and under severe disease conditions, blight entire leaves. The first symptom of gray leaf spot appears as a tiny, dark, water-soaked spot that is often surrounded by a narrow, yellow halo (Fig. 2). The spot rapidly increases in size and tissue in the center of the lesion dies (Fig. 3). With time, usually two to three weeks,

FIG. 2. Initial symptoms of gray leaf spot, often surrounded by a yellow halo.

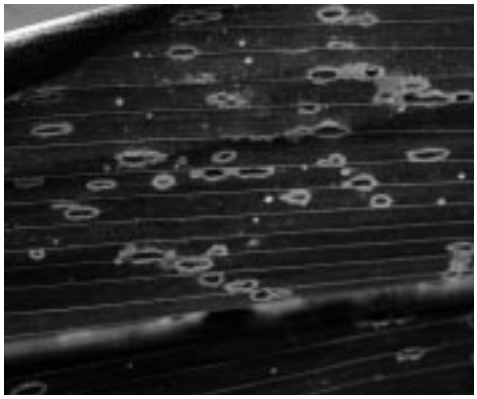

FIG. 3. Intermediate stage of lesion development.

FIG. 4. Gray leaf spot lesions on leaf sheaths.

these spots elongate and develop into characteristic, long, narrow leaf lesions. Lesions are at first tan, but may become grayish when the fungus produces numerous spores on the lesion surface.

Gray leaf spot symptoms may also occur on leaf sheaths and husks. Husk lesions are similar in appearance to leaf lesions. Leaf sheath symptoms appear as relatively large, circular to oblong, tan to dark brown lesions surrounded by a dark brown to dark purple border (Fig. 4). These lesions are difficult to distinguish from those produced by other pathogenic fungi, such as the northern corn leaf blight, southern corn leaf blight, or northern corn leaf spot fungi.

Disease Cycle

Infected corn residues on the soil surface are the source of primary inoculum (fungal spores) for the next corn crop. *Cercospora zeae-maydis* is a poor competitor with other microorganisms in the soil and survives only as long as infected crop residues are present. Thus, gray leaf spot is potentially more severe in fields where corn follows corn and crop residues are left on the soil surface. As little as 10% residue cover from a previous corn crop can provide enough inoculum to cause an epidemic in a highly susceptible hybrid under favorable weather conditions. The disease can spread, via air-borne spores, from one spot in a field to another or to a neighboring corn field during periods of optimal weather. The spread of gray leaf spot throughout corn-producing areas of the U.S. suggests that the air-borne spores may be carried for great distances (miles). Currently, there are no research data to demonstrate how far this fungus may be transported by air currents.

Spores produced by the fungus in corn residues are blown by wind or splashed by rain onto young corn leaves where primary infections occur. The disease usually appears first on lower leaves. New spores are produced on the surface of mature lesions. These spores cause secondary infections and serve to spread the disease up the plant, further within a field, and to surrounding fields. Many secondary cycles of infection may occur during the growing season if weather conditions are favorable. Corn inbreds and hybrids appear to become more susceptible to gray leaf spot after tasseling, thus the disease sometimes seems to explode later in the season.

The optimum weather conditions for gray leaf spot development are prolonged periods (2, 3, or more days continuous) of high relative humidity (90% or more for a minimum of 12 hours), free moisture on leaves from dew, fog, or light rain (for a minimum of 12 hours), overcast days, and high temperatures (75˚ to 95˚F). Temperatures below 75˚F during periods of leaf wetness or lack of more than 12 hours continuous leaf wetness will greatly reduce the spread of gray leaf spot. Heavy rains tend to aid in dissemination of the pathogen. When spores of the fungus land on leaf or husk tissue, they germinate if humidity is high and temperatures are in the optimum range. After growing over the leaf or husk tissue for a time, the fungus penetrates living tissue and initiates a new infection that results in another lesion. The longer the optimum conditions persist, the more rapidly new infections develop, and the more severe the disease. Disease development can appear to stop during dry conditions, but the fungus has the ability to “sit and wait” for favorable conditions. Once spores of most leaf-infecting fungi germinate, they must penetrate the leaf within a few hours or they die. *Cercospora*

zeae-maydis is unusual in that it can grow and survive on leaf tissue for several days before penetration.

Disease Loss

Like other pathogens that kill leaf tissue, *Cercospora zeae-maydis* reduces yield by destroying green tissue. Damage, in terms of reduced grain yield, depends on how much leaf area is destroyed and how early in plant development the destruction occurs. As a general rule, if lesions appear on the upper half of the plant within 2 weeks before or after tasseling, yield reductions can be substantial. If lesions do not appear on the upper leaves until 6 weeks after tasseling, damage will be minimal.

Stalk lodging can be a problem in fields heavily damaged by gray leaf spot. While the gray leaf spot pathogen can penetrate stalks from leaf sheaths, it is unclear whether it is the primary or secondary cause of stalk decay. Leaf damage from gray leaf spot may be sufficient to result in increased stalk rot from various other stalk rot organisms. Regardless of whether *Cercospora zeae-maydis* is a primary or secondary stalk rot organism, fields with gray leaf spot should be checked for stalk rot incidence in several locations as the crop reaches maturity. If more than 10% stalk rot is present at black layer, harvesting the field as soon as possible will usually more than pay the drier costs.

Disease Management

Management of gray leaf spot is achieved by hybrid selection, crop rotation, tillage system, or more commonly, a combination of these. Growers should manage this disease on an individual field basis. It is important to know which fields have the disease in order to make sound management decisions for the following years. Following is a summary of disease risk starting with the highest risk fields and going to fields with a lesser risk. Keep in mind that this disease organism can be spread by wind currents over long distances (several miles), but disease development in lower risk fields usually occurs 2 to several weeks later than in high risk fields, and disease losses are usually not as great.

1. (Highest risk) Field in continuous corn, the disease occurred in the previous crop, and infected crop residues are on the soil surface.

2. Field in continuous corn, the disease occurred within the past 2 years and infected corn residues are on the soil surface.

3. Field rotated from a non-host crop, but adjacent to a field(s) that is listed in #1 or #2 above.

4. Field in continuous corn, the disease occurred in the previous crop, but infected residues have been completely buried by moldboard plowing.

5. (Lowest risk) Field rotated from a non-host crop for at least 2 years, and **not** adjacent to a field(s) that is listed in #1 or #2 above.

Crop Rotation. Rotation to a non-host crop for 1 to 2 years reduces the inoculum potential within that field. Two years is preferable for no-till fields. The pathogen survives from season to season only in infected plant residues; e.g. leaves, husks, and leaf sheaths. When the infected residues decompose, the source of primary inoculum is gone. Buried crop residues break down more quickly than residues left on the soil surface. On the soil surface, leaf tissue usually decomposes within 6 to 9 months; husk and leaf sheath tissues may remain partially intact into the second year. Studies have shown that the fungus survives abundantly on surface residue over the first winter and through the second winter.

Crop rotation by itself may not always be sufficient to prevent yield losses in fields that are surrounded by heavily infested fields. Under these conditions, selection of hybrids with moderate gray leaf spot resistance may be advisable.

Barnyardgrass, Johnsongrass, and sorghum may be hosts of the gray leaf spot fungus. Non-host crops include soybeans, wheat, oats, barley, alfalfa, clover, and most forage grasses.

Tillage. Complete burial of infected crop residues by moldboard plowing will reduce the source of primary inoculum within a field. Where clean plowing is not desired because of soil erosion potential, government programs, or other factors, a combination of rotation and/or hybrid selection is advisable.

Resistant Hybrids. Some hybrids have resistance (sometimes called tolerance) to the disease. Some hybrids with a high degree of resistance to gray leaf spot have lower potential yields (in the absence of gray leaf spot) than susceptible hybrids or hybrids with lower degrees of resistance. No hybrids are immune to the disease. Resistance in corn is quantitative, thus the variability between hybrids. Many dent corn hybrids currently on the market are susceptible to gray leaf spot, a few are highly susceptible, and some have moderate resistance. Consult your seed company representatives about the level of resistance or tolerance to gray leaf spot in their hybrids and your specific needs. Well adapted hybrids with good yield potential and better gray leaf spot resistance are beginning to become available.

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