

With the recent rainfall we have had throughout our territory mixed with mid 80 degree temperatures in the forecast, we are setting up for almost ideal conditions for Gray Leaf Spot.

What is Gray Leaf?

This foliar disease in corn overwinters in crop residue and will begin to infect the lower leaves in the canopy before moving up the plant towards the ear leaf. Leaf lesions are identified as rectangular spots of dead tissue that will be confined within the veins of the leaf. These lesions may also be surrounded by a yellow or bronze colored "halo". Fields that are corn on corn, or reduced tillage, can be the most susceptible due to the increased amount of residue for the pathogen to overwinter on.

How does it cost us yield?

As the disease moves up the plant and lesions continue to grow in size, the primary loss of yield results from the plant losing leaf area that limits photosynthesis. This is especially true once the plant begins to pollinate and the disease infects the ear leaf and above. This area of the plant is mainly responsible for producing the carbohydrates that help produce and fill the ear. Loss of this leaf tissue can result in smaller kernels and reduced test weight. In severe infections, stalk lodging and rots can occur as the plant sacrifices carbohydrates stored in the stalk to try and help fill the ear at all costs.

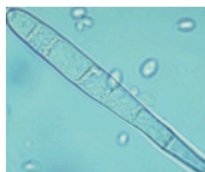
What can we do about it?

Knowing your hybrids is a key part of prioritizing the most vulnerable fields. Hybrids with high resistance scores can help limit the extent of damage in corn fields, while lower scored products can show a larger benefit from a fungicide application. A fungicide application will make sense for the majority of acres in our area due to our current conditions. The biggest thing to consider when looking at different fungicide products is to make sure to use a product with multiple modes of action such as Aproach Prima or Headline AMP. These products mix strobilurin and triazole chemistries together to help stop the fungus in its tracks, and help prevent further advancement through the canopy. Spraying early on before the plant is overtaken with disease is the best way to see an economic response, because once the tissue has been killed by the disease, there is no way to bring it back.

Gray Leaf Spot of Corn

Pathogen Facts

- Gray leaf spot (GLS) is a common fungal disease in the United States caused by the pathogen *Cercospora zea-maydis* in corn.
- Disease development is favored by warm temperatures, 80°F or 27 °C; and high humidity, relative humidity of 90% or higher for 12 hours or more.
- *Cercospora zea-maydis* overwinters in corn residue, allowing inoculum to build up from year to year in fields.
- Cropping systems with reduced- or no-till and/or continuous corn are at higher risk for gray leaf spot outbreaks.
- Conducive weather conditions encourage the rapid spread of disease near the end of summer and early fall, when corn plants allocate more resources to grainfill.

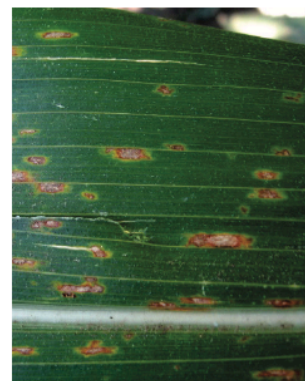


Cercospora zea-maydis spore

Identification

Early Symptoms

- Gray leaf spot lesions begin as small necrotic pinpoints with chlorotic halos, these are more visible when leaves are backlit.
- Coloration of initial lesions can range from tan to brown before sporulation begins.
- Because early lesions are ambiguous, they are easily confused with other foliar diseases such as anthracnose leaf blight, eyespot, or common rust.



GLS lesions begin as small necrotic spots with chlorotic halos.

Later Symptoms

- As infection progresses, lesions begin to take on a more distinct shape.
- Lesion expansion is limited by parallel leaf veins, resulting in the blocky shaped "spots".
- As sporulation commences, the lesions take on a more gray coloration.
- Entire leaves can be killed when weather conditions are favorable, and rapid disease progression causes lesions to merge.



As GLS develops, lesions become blockier in appearance and more gray in coloration.

Gray Leaf Spot Life Cycle

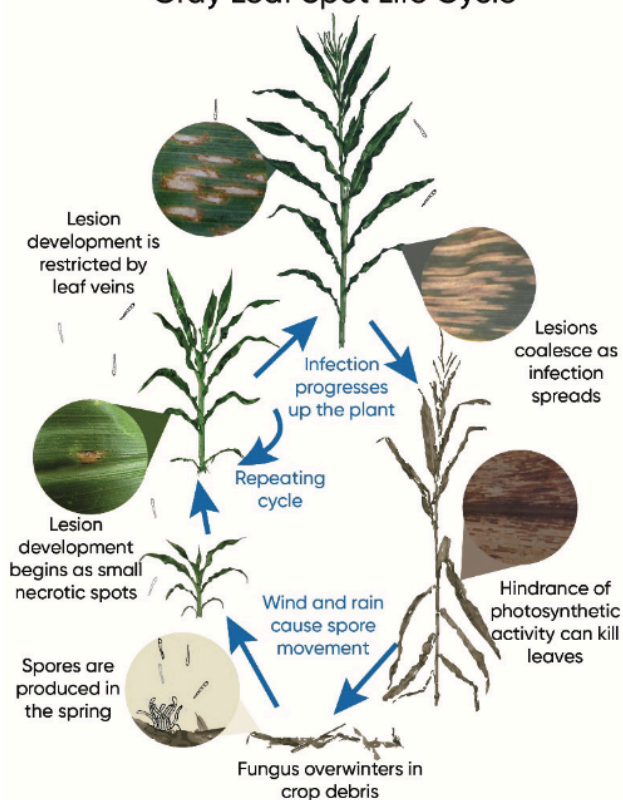


Figure 1. Life cycle of gray leaf spot *Cercospora zea-maydis* in corn. Spores and lesions are enlarged to show detail.



As GLS progresses, lesions will coalesce and form larger necrotic areas.

Crop Damage

- Gray leaf spot lesions on corn leaves hinder photosynthetic activity, reducing carbohydrates allocated towards grain fill.
- The extent to which gray leaf spot damages crop yields can be estimated based on the extent to which leaves are infected relative to grainfill (Table 1).
- Damage can be more severe when developing lesions progress past the ear leaf around pollination time.
- Because a decrease in functioning leaf area limits photosynthates dedicated towards grainfill, the plant might mobilize more carbohydrates from the stalk to fill kernels.
- This can result in a higher risk of stalk lodging and stalk rots due to a loss of structural integrity.



Table 1. Estimated yield loss based off of percent of tissue infected by gray leaf spot (Lipps, 1998).

Percent Leaf Area Affected at R5 (Early Dent Stage)	Approximate Yield Loss
5% or less	0 – 2%
6 – 25%	2 – 10%
25 – 75%	5 – 20%
75 – 100 %	15 – 50%

Management Considerations

Cultural Practices

- *Cercospora zea-maydis* overwinters in corn debris, so production practices such as tillage and crop rotation that reduce the amount corn residue on the surface will decrease the amount of primary inoculum.
- Crop rotation away from corn can reduce disease pressure, but multiple years may be necessary in no-till scenarios.

Hybrid Resistance

- Planting hybrids with a high level of genetic resistance can help reduce the risk of yield loss due to gray leaf spot infection.
- Pioneer® brand hybrids and parent lines are improved through a screening process in areas with a high incidence of GLS and specialized “disease nurseries”.
- Customers can see the effectiveness of hybrid resistance based off of a score (ranging from 1 to 9) that is assigned to Pioneer brand products.
- Susceptible hybrids are more likely to benefit from a foliar fungicide application, but resistant varieties may benefit as well under high gray leaf spot pressure (Figure 2).

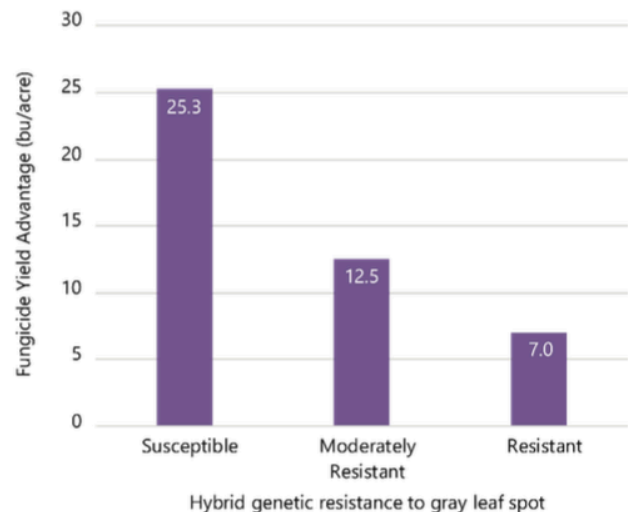


Figure 2. Average yield increase of hybrids, with varying levels of resistance to GLS, due to a foliar fungicide application in a three-year University of Tennessee/DuPont Pioneer research study with very high GLS pressure.

Fungicides

- During the growing season, foliar fungicides can be used to manage gray leaf spot outbreaks.
- Farmers must consider the cost of the application and market value of their corn before determining if fungicides will be an economical solution to GLS.
- When selecting a fungicide, it is important to keep in mind the efficacy of the available products (Table 2).

Table 2. Fungicide efficacy for control of gray leaf spot. (Wise, 2019).

Fungicide	Active Ingredients	GLS Efficacy
DuPont™ Approach® Prima	picoxystrobin + cyproconazole	Excellent
Headline®	pyraclostrobin	Excellent
Headline® AMP	pyraclostrobin + metconazole	Excellent
Priaxor®	pyraclostrobin + fluxapyroxad	Very Good
Quilt® Xcel	propiconazole + azoxystrobin	Excellent
Stratego® YLD	prothioconazole + trifloxystrobin	Excellent

References

- Patrick Lipps, 1998. Gray leaf spot and yield losses in corn. Crop Observation and Recommendation network. Issue 98-23.
- Wise, K. 2010. Gray Leaf Spot. Purdue Extension.
- Wise, K. 2019. *Fungicide Efficacy for Control of Corn Diseases*. Crop Protection Network.



FOLIAR FUNGICIDE CONSIDERATIONS FOR CORN



ILLINOIS

Gray Leaf Spot



Extended periods of leaf wetness (13 hours) allow infection of leaves. Typical lesions are rectangular with straight edges. The lesions can grow together and kill entire leaves. High relative humidity (>90 percent) can lead to increased disease.

Northern Leaf Blight



Infection occurs when there is free water on the leaf surface for 6-18 hours and temperatures are 65-80° F. Lesions are 1 to 6 inches long and cigar shaped. Yield losses are most severe when the disease infects plants early and progresses to the upper plant leaves by pollination or early ear fill.

Scout for foliar diseases in corn just before tassel emergence and answer the following questions when considering an application of foliar fungicide:

What was the previous crop? Many foliar pathogens survive in corn residue, so the risk of foliar disease (such as gray leaf spot and northern corn leaf blight) increases when corn is planted back into a field that was corn the previous year.

What has the weather been? Rainy and/or humid weather generally is most favorable to foliar diseases. In growing seasons when these conditions prevail, the risk for disease development increases.

Does the field have a history of disease? Some field locations may have a history of high foliar disease severity. Fields in river bottoms or low areas or surrounded by trees may be more prone to having foliar corn diseases.

What is the susceptibility level of the hybrid? If the disease resistance rating is a 6 or greater, a fungicide may not provide a benefit. For hybrids with a rating less than 4, spray if disease symptoms are present on the third leaf below the ear or higher on 50 percent of the plants examined.

For hybrids with ratings of 5, spray:

- If disease symptoms are present on the third leaf below the ear or higher on 50 percent of the plants examined.
- If the field is in an area with a history of foliar disease problems.
- If the previous crop was corn.
- If there is 35 percent or more surface residue.
- If the weather is warm and humid.

What products should you push fungicide for yield?

This question is never an easy one to answer, however through Pioneer's vast network of research testing we have identified a few key products that in the absence of disease pressure still typically benefit from a shot of fungicide. As always consult your local Pioneer Sales Rep and Pioneer agronomist when trying to decide if its time to push the gas or the breaks on products.

Products to Consider Pushing:	P0720	P1099	P1197	P1359
	P0924	P1108	P1222	P1366
	P0953	P1185	P1298	P1563

Pioneer® brand Family ¹	CRM ²	GLS ³	Foliar Fungicide Response -GLS ⁴	NCLB ⁵	Foliar Fungicide Response - NCLB ⁶
P9998	99	4	HP	5	MP
P0075	100	5	MP	6	LP
P0157	101	4	HP	5	MP
P0306	103	4	HP	5	MP
P0404	104	5	MP	5	MP
P0487	104	5	MP	6	LP
P0574	105	4	HP	5	MP
P0720	107	4	HP	6	LP
P0732	107	5	MP	5	MP
P0924	109	5	MP	6	LP
P0950	109	5	MP	6	LP
P0953	109	5	MP	5	MP
P0977	109	5	MP	5	MP
P1077	110	5	MP	5	MP
P1093	110	4	HP	6	LP
P1099	110	6	LP	5	MP
P1108	111	5	MP	5	MP
P1136	111	5	MP	5	MP
P1181	111	5	MP	7	LP
P1185	111	4	HP	6	LP
P1197	111	5	MP	6	LP
P1222	112	5	MP	5	MP
P1244	112	4	HP	5	MP
P1257	112	6	LP	5	MP
P1278	112	6	LP	4	HP
P1289	112	5	MP	6	LP
P1298	112	5	MP	5	MP
P1306W	113	6	LP	6	LP
P1309W	113	5	MP	5	MP
P1353	113	4	HP	5	MP
P1359	113	5	MP	5	MP
P1366	113	4	HP	6	LP
P1380	113	5	MP	6	LP
P1422	114	5	MP	6	LP
P1442	114	5	MP	5	MP
P1464	114	5	MP	4	HP
P1477W	114	6	LP	5	MP
P1563	115	4	HP	6	LP
P1618W	116	5	MP	6	LP
P1656W	116	6	LP	7	LP
P1718	117	5	MP	4	HP
P1870	118	5	MP	5	MP
P1903	119	6	LP	4	HP
P2089	120	6	LP	6	LP



IMPORTANT: Trait rating scores provide key information useful in selection and management of Pioneer® brand products in your area. Information and ratings are based on comparisons with other Pioneer brand products, not competitive products. Information and scores are assigned by Pioneer Research Managers. Scores are based on period-of-years testing through 2017 harvest and were the latest available at time of printing. Some scores may change after 2018 harvest. Scores represent an average of performance data across areas of adaptation, multiple growing conditions, and a wide range of both climate and soil types, and may not predict future results. All products within a hybrid family receive the same score unless observations indicate a significant difference. Individual product responses are variable and subject to a variety of environmental, disease and pest pressures. Please use this information as only one component of your product positioning decision. Refer to www.pioneer.com/products or contact a Pioneer sales professional for the latest and most complete listing of traits and scores for each Pioneer brand product and for product placement and management suggestions specific to your operation and local conditions.

WHITE AND WAXY CORN RATINGS: Based on comparisons with other Pioneer brand products, not competitive products. Trait ratings for white and waxy products reflect comparison with non-modified yellow products of a similar maturity.

DISEASE PRECAUTION: Grower should balance product yield potential, product maturity and cultural practice selection against their anticipated risk of a specific disease and need for resistance. In high disease-risk conditions, consider planting products with at least moderate resistance ratings of 4 or higher to help reduce risk. When susceptible products with disease ratings of 1 to 3 are planted in conditions of high disease pressure, the grower assumes a higher level of risk. If conditions are severe, even products rated as resistant can be adversely affected. Independent of yield reduction, diseases can predispose plants to secondary diseases such as stalk rots. This requires individual field and product monitoring for stalk stability and timely harvest when warranted.

DISEASE & PEST RATINGS: 8-9 = Highly Resistant; 6-7 = Resistant; 4-5 = Moderately Resistant; 1-3 = Susceptible; Blank = Insufficient Data.

¹ **HYBRID FAMILY:** Hybrid family identifies products that have the same base genetics. Manage products within the same family similarly.

² **CRM (Comparative Relative Maturity):** There is not an industry standard for maturity ratings so comparing product maturity and harvest moisture ratings between companies is usually difficult. Use the CRM rating to compare Pioneer® brand products with competitive products of a similar maturity and harvest moisture. CRM ratings, and harvest moieties, for products within a family may vary slightly, depending upon the level of insect (ECB and CRW) infestation. Conventional and straight products with the RR2 gene within a family will usually be 1-2 CRMs earlier than indicated, when insect infestations are moderate to heavy. One CRM difference is about 1/3 point of moisture difference at harvest.

³ **GRAY LEAF SPOT PRECAUTION:** Avoid planting products with a lower gray leaf spot (GLS) rating in continuous corn fields that have a history of GLS infection, unless tillage operations that bury significant amounts of corn residue and inoculum are practiced.

⁴ **FOLIAR FUNGICIDE RESPONSE - GLS:** Probability of positive yield response to foliar fungicide applications when significant levels of Gray Leaf Spot (GLS) leaf disease is present. **HP** - High Probability; **MP** - Moderate Probability; **LP** - Low Probability. Probabilities based upon product disease scores. Because of the unlimited number of growing environments, cropping practices, and foliar fungicide active ingredients combinations possible, Pioneer makes no warranty regarding this foliar fungicide crop response information.

⁵ **NORTHERN LEAF BLIGHT CAUTION:** In conditions where northern leaf blight (NLB) risk is high, growers should consider planting only products with at least moderate NLB resistance ratings of 4 or higher.

⁶ **FOLIAR FUNGICIDE RESPONSE - NLB:** Probability of positive yield response to foliar fungicide applications when significant levels of Northern Leaf Blight (NLB) leaf disease is present. **HP** - High Probability; **MP** - Moderate Probability; **LP** - Low Probability. Probabilities based upon product disease scores. Because of the unlimited number of growing environments, cropping practices, and foliar fungicide active ingredients combinations possible, Pioneer makes no warranty regarding this foliar fungicide crop response information.

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