

Corn Foliar Diseases

Identification and Management

Field Guide



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Foliar Fungicides

Fungicide applications can be a component of an integrated approach to manage foliar diseases of corn. However, it is important to consider several factors before deciding on a fungicide application.

- 1 Scouting is essential. Just before tassel emergence, examine plants for disease symptoms from several locations in each field. Management decisions should be based on symptoms present and on a field-by-field basis.
- 2 Know your field history of disease.
- 3 Know your hybrid's susceptibility to diseases. Fungicide sprays generally are not recommended for resistant hybrids. For susceptible hybrids, fungicides should be considered if symptoms are present on the third leaf below the ear or higher on at least 50% of the plants. For hybrids with intermediate levels of disease resistance, fungicides should be considered if symptoms are present on the third leaf below the ear or higher on at least 50% of the plants, at least 35% of the soil surface is covered with corn residue, the previous crop was corn, and weather is favorable for foliar fungal diseases.
- 4 Proper diagnosis is important. Fungicides do not control bacterial diseases such as Goss's and Stewart's wilt.
- 5 The use of fungicides may result in higher grain moisture. This can lead to increased costs associated with drying.

Stewart's Wilt

(Pantoea stewartii)



Stewart's Wilt

(*Pantoea stewartii*)

SYMPTOMS: Two phases of Stewart's wilt occur depending upon time of infection. Seedling wilt occurs when seedlings of susceptible hybrids are infected systemically, and leaf blight occurs after tassel emergence. Systemic infections may result in a range of symptoms: bleached tassels, cavities in the stalks near the soil line, and tillering. Leaf blight symptoms include pale-green to yellow, linear, elongated lesions (streaks) with irregular or wavy margins that run parallel to the veins and taper off to a point and can result in dead tissue with age. Leaf blight is often associated with feeding scars caused by flea beetles.

RISK FACTORS: *Pantoea stewartii*, a bacterium, is vectored by and overwinters in the corn flea beetle. The greatest risk factor for Stewart's wilt is the presence of this beetle vector of *P. stewartii*. Beetles emerge from hibernation in spring and can transmit the bacterium throughout the growing season. Forecasting tools are based on air temperatures from December to February. If the average daily temperature for December through February is above 32°F there is an increased likelihood of corn flea beetle survival and a greater risk for severe Stewart's wilt, while if the average daily temperature is less than 27°F, the risk of severe Stewart's wilt is much lower. Seed-borne *P. stewartii* can pose a moderate risk.

MANAGEMENT: Plant resistant hybrids. Control flea beetles when planting susceptible hybrids: insecticides applied as a seed treatment have been shown to provide more consistent control than in-furrow or foliar applications. Fungicides WILL NOT control Stewart's wilt.

Goss's Wilt and Blight

(*Clavibacter michiganensis*
subsp. *nebraskensis*)



Goss's Wilt and Blight

(*Clavibacter michiganensis*
subsp. *nebraskensis*)

SYMPTOMS: Symptoms can include leaf lesions and wilt. Distinguishing characteristic symptoms of Goss's wilt include: distinct light tan/yellow to gray lesions, with wavy or irregular margins that follow the leaf veins. Dark green to black specks or flecks (freckles) are common within lesions. Lesions often appear shiny due to bacteria oozing onto the leaf surface. Lesions may coalesce to cause blighted leaves at the top of the plant. Wilt, stalk degradation and even plant death may occur when the bacterium infects the water-conducting tissues of the plant. Splitting the corn stem reveals orange to brown, water-soaked and slimy tissue.

RISK FACTORS: *Clavibacter michiganensis* subsp. *nebraskensis* is a residue borne bacterium, so continuous corn and no-tillage production can increase the risk of disease. Once the pathogen is present in a field, injury caused by violent weather or sandblasting can increase the probability of disease. Bacterial growth is favored by moderate temperatures throughout the growing season (80°F optimum). The bacterium is both seed borne and seed transmitted.

MANAGEMENT: Tillage and crop rotation (non-hosts: soybean, small grains, alfalfa) can be used to increase the rate of degradation of corn residue. Do not replant into stubble of previously infected corn. Controlling weed hosts, such as foxtail, barnyard grass and shattercane, can reduce inoculum. Plant partially resistant hybrids. Fungicides WILL NOT control Goss's wilt.

Diplodia Leaf Streak

(Stenocarpella macrospora)



Diplodia Leaf Streak

(*Stenocarpella macrospora*)

SYMPTOMS: Symptoms of Diplodia leaf streak can occur on all leaves including the ear leaves. Lesions are large (up to 10 cm long), gray-green and elliptical with a water-soaked appearance. Older lesions produce black spots called pycnidia, which are spore-producing fungal structures. Diplodia leaf streak lesions can look similar to lesions of northern corn leaf blight (NCLB), Stewart's wilt, and Goss's wilt, but only Diplodia leaf streak lesions contain pycnidia. These pycnidia are much more easily observed than any fungal sporulation that may occur in NCLB lesions. *S. macrospora* can attack all corn tissues at all stages of growth and has caused significant yield losses in Africa and Latin America. *S. macrospora* also may cause ear rot, but this has not yet been observed in the North Central U.S.

RISK FACTORS: The pathogen is thought to overwinter in corn residue. Therefore, continuous corn and no-till management increase the risk of disease. Disease is favored by moderately humid conditions (mean relative humidity = 50% day, 95% night) and average temperatures. This disease is relatively new to the North Central U.S.

MANAGEMENT: Because Diplodia leaf streak occurs infrequently, no known management practices are available. Corn residue management is thought to reduce inoculum survival. Avoid planting into corn stubble from previously diseased plants.

Physoderma Brown Spot

(Physoderma maydis)



Physoderma Brown Spot

(Physoderma maydis)

SYMPTOMS: Lesions initially appear small, round to oblong, and yellow and occur primarily on leaves and leaf sheaths. Because infection usually occurs during daylight hours in standing water in the whorl, lesions may appear in bands across the leaf blade. Lesions develop and coalesce into larger reddish-brown blotches that have an angular appearance. Chocolate or purple oval blotches also occur on the midrib of infected leaves. Physoderma brown spot is often misdiagnosed as eye spot or southern rust. Eye spot lesions have a light, almost translucent center while lesions of Physoderma brown spot do not. Pustules of southern rust produce thousands of orange spores that can be wiped off the upper leaf surface with your finger.

RISK FACTORS: The pathogen survives in residue and is soil borne, so continuous corn and no-tillage production can increase risk in fields with a history of disease. Plants are most susceptible 50–60 days after germination with susceptibility decreasing with age. Abundant rainfall with free water resting in whorls and high mean temperatures (73–86°F) favor disease.

MANAGEMENT: Because Physoderma brown spot has historically been a problem only in the Southern U.S. and Central America, resistance has not been incorporated into hybrids adapted to the North Central U.S. Some fungicides are labeled for control of Physoderma brown spot, but because this disease historically has not caused substantial yield losses in the North Central region, application may not be economical. Manage residue through both crop rotation and tillage. In high humidity areas such as river bottoms, avoid planting highly-susceptible hybrids, if possible.

Common Rust

(Puccinia sorghi)



Common Rust

(Puccinia sorghi)

SYMPTOMS: Rusts produce quite distinctive reproductive structures called pustules that erupt through the surface of leaves, stalks, or husks and produce spores called urediniospores. Urediniospores serve as secondary inoculum throughout the growing season. Three main characteristics distinguish common from southern rust: common rust pustules are 1) more round and red-brick in color 2) have a more scattered distribution and 3) occur on both leaf surfaces. Pustules become dark in color later in the season as teliospores are produced instead of urediniospores. Severe infections can lead to defoliation and premature senescence.

RISK FACTORS: Urediniospores do not overwinter in the North Central region and are blown northward during the growing season, arriving typically between mid-June to mid-July. Susceptible and long season hybrids and later planting increase the risk of yield loss. Disease is favored by high relative humidity (>95%) and cool temperatures (60° to 75°F). If environmental conditions are favorable, new urediniospores can be produced every 7 to 8 days after initial infection.

MANAGEMENT: Plant early to avoid high spore levels of the fungus later in the season. Plant resistant hybrids. Fungicides can be economical in high value corn such as seed corn if considerable rust is present on the lower leaves prior to silking and the weather forecast is for unseasonably cool, wet weather.

Southern Rust

(Puccinia polysora)



Southern Rust

(Puccinia polysora)

SYMPTOMS: Southern rust generally occurs late in the season in the North Central region, and may not be observed every year. Rusts produce distinctive structures called pustules (diameter: 0.2 to 2 mm) that erupt through the surface of leaves, stalks, or husks and produce spores called urediniospores. Three main characteristics distinguish southern rust from common rust: 1) southern rust pustules are smaller and orange-brown (common rust pustules are larger and brick-red); 2) southern rust pustules are more densely clustered 3) southern rust pustules occur primarily on the upper leaf surface. Pustules become dark in color later in the season as teliospores are produced instead of urediniospores. Severe infections can impact yield and cause defoliation and premature senescence.

RISK FACTORS: The risk of yield loss is greater in late-planted or long-season corn, because spore inoculum levels may be greater later in the season. Resistant hybrids may be unavailable in the North Central region. Infection requires more than 6 hours of high relative humidity ($\geq 95\%$) and moderate temperatures (77–82°F). The IPM-PIPE resource can help in determining your risk of southern rust (www.ipmpipe.org/). In a favorable environment, new urediniospores can be produced every 7 to 8 days.

MANAGEMENT: Earlier planting date and/or shorter-season hybrids may reduce risk of yield loss. Plant resistant hybrids if available. Fungicides are labeled for control of Southern rust and are most useful if disease is at a high enough level early in the growing season. Use the IPM-PIPE to determine the risk of spread of southern rust.

Northern Corn Leaf Blight

(*Exserohilum turcicum*)



Northern Corn Leaf Blight

(Exserohilum turcicum)

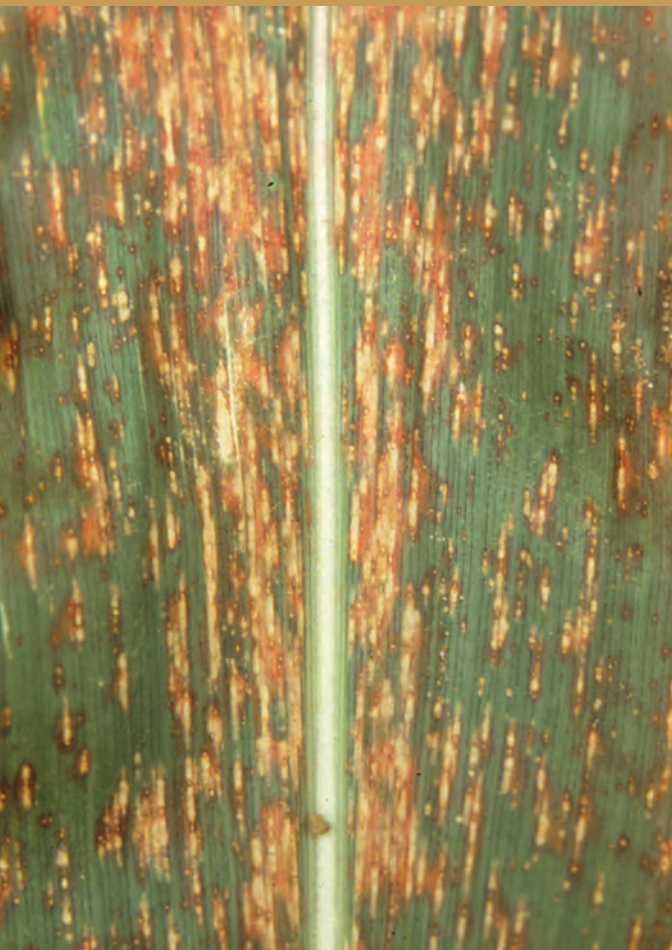
SYMPTOMS: Northern corn leaf blight (NCLB) is typified by long (length: 1–6 in.) lesions with tapered ends that are gray-green to tan lesions in color. Disease usually begins on lower leaves but can spread to all leaves and husks with secondary infections. When lesions coalesce, the entire leaf can become blighted and symptoms resemble frost-killed leaf tissues. Lesions can appear similar to Stewart's wilt on hybrids carrying resistance genes.

RISK FACTORS: The pathogen over-winters in corn residue. Residue that resides on or near the soil surface can increase the risk of NCLB. In fields with a history of NCLB, the use of continuous and no-till corn production will increase the risk of disease. Infection occurs when conidia are exposed to 6-18 hours of leaf wetness and moderate (66-80 °F) temperatures. Susceptible hybrids and high nitrogen soils also increase disease risk.

MANAGEMENT: Resistant hybrids are the most effective means of controlling NCLB. Residue management through tillage and crop rotation can help to destroy primary inoculum. Several fungicides are labeled for NCLB control. Foliar fungicides may be effective when applied early (when the first lesions appear on lower leaves) and when weather conditions are favorable for disease.

Northern Corn Leaf Spot

(Bipolaris zeicola)



Northern Corn Leaf Spot

(Bipolaris zeicola)

SYMPTOMS: *Bipolaris zeicola* has five distinct races that can cause different disease symptoms, but only race 3 is important in the North Central region. Symptoms caused by race 3 of the fungus include narrow, linear, gray or tan lesions with a pigmented border on leaves, leaf sheaths and husks. Multiple lesions may develop along leaf veins, creating the appearance that individual lesions are longer. Symptoms usually occur on lower leaves at the time of silking or at full maturity. Symptoms caused by race 1 include tan, oval lesions, with concentric zones of sporulation (bulls-eye appearance). Lesions caused by race 2 are oblong ($\leq 0.5 \times 2.5$ cm) and chocolate colored. Symptoms caused by race 4 are similar to race 2, but often have concentric zones of sporulation.

RISK FACTORS: The risk of northern corn leaf spot (NCLS) increases in fields with a history of the disease as the pathogen overwinters in corn residue. Thus continuous corn and no-till management increase disease risk. NCLS is favored by moderate temperatures (65–80°F) and high relative humidity or heavy dew. During prolonged damp weather, spores are produced abundantly on diseased leaves and can cause secondary infections.

MANAGEMENT: Residue management, such as crop rotation or tillage, decreases inoculum and therefore the risk of disease. Plant resistant hybrids when possible. Although fungicides are labeled for control of NCLS, application is only recommended for high value corn.

Eyespot

(Kabatiella zeae)



Eyespot

(Kabatiella zeae)

SYMPTOMS: Eyespot develops as small ($\frac{1}{16}$ in.), water-soaked, circular lesions that first appear on lower leaves of the plant. Mature lesions are larger in diameter (up to $\frac{1}{4}$ in.) and are tan in appearance with a darker brown or purple margin, surrounded by a larger yellow “halo.” To observe the “halo,” hold the leaf up to the light and the “eye” appearance can be more easily seen. In severe epidemics, lesions may grow together and can lead to death of large areas of tissue. Spores are produced within the eyespot lesions and if conditions are favorable can result in additional infection and disease. Severe early season infections can lead to barrenness.

RISK FACTORS: Because the fungus survives in corn residue, management tactics such as no-till and continuous corn that increase corn residue also increase primary inoculum in fields with a history of eyespot. The fungus is rain splash disseminated and disease is favored by cool, wet weather and dew. Planting susceptible hybrids increases risk of disease.

MANAGEMENT: Reducing the amount of residue through crop rotation and tillage can decrease the risk of disease. Plant resistant varieties, particularly if you have had a history of disease in your field. Fungicide applications can effectively reduce disease and protect yield. However, fungicides are cost prohibitive unless used on high value corn. Fungicides are only recommended if you sustained disease in the previous year and practice reduced tillage.

Gray Leaf Spot

(Cercospora zeae-maydis)



Gray Leaf Spot

(Cercospora zeae-maydis)

SYMPTOMS: Mature lesions are rectangular (length: 3-4 in), are bordered by leaf veins, and appear tan to brown in color turning silvery-gray when sporulating. On some hybrids, lesions may be orange to yellow and may be evident on the leaf sheath and stalk.

RISK FACTORS: The fungus overwinters on corn debris and practices such as conservation tillage and continuous corn increase disease risk. Spores begin to develop on corn residue in response to warm, humid weather. High relative humidity ($\geq 95\%$) is required for infection. Plants growing in river bottoms or in weedy fields have an increased risk for disease. Spores are blown onto young leaves and secondary infections can occur throughout the growing season.

MANAGEMENT: Moderately resistant hybrids are available. Practices such as crop rotation and tillage that help to reduce corn residue are key to decreasing your risk for disease. Fungicides applied before significant damage has occurred (scout a couple of weeks before tassel emergence) may be economical in fields with history of significant yield loss due to gray leaf spot or in high-value corn. If high levels of disease develop during grain fill, early harvest may be warranted.

Anthracnose Leaf Blight

(Colletotrichum graminicola)



Anthracnose Leaf Blight

(Colletotrichum graminicola)

SYMPTOMS: Leaf lesions are oval to spindle-shaped, brown in color, and surrounded by a yellow or orange area. The pathogen produces characteristic small black spines (setae) within older lesions that protrude from the leaf surface.

RISK FACTORS: *C. graminicola* overwinters in corn residue and management practices such as continuous or no-till corn increase your risk of disease. Severe leaf damage can result after long periods of heavily overcast, rainy weather as disease is favored by warm, moist weather and periods of low light intensity and high humidity. Yield reductions can be expected when significant leaf death occurs within the first six weeks after tasseling. Poor soil fertility can increase risk due to plant stress.

MANAGEMENT: Select hybrids that are resistant to both leaf blight and stalk rot. Management practices that reduce corn residue, such as crop rotation and tillage, reduce the source of primary inoculum and your risk for disease. Test soil to maintain good fertility.

Credits

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Further Information

www.extension.iastate.edu/CropNews

www.uwex.edu/ces/croppathology

www.oardc.ohio-state.edu/ohiofieldcropdisease

bulletin.ipm.illinois.edu

Photo Credits

Alison Robertson: Cover photo, Goss's wilt, Physoderma brown spot, Gray leaf spot (inset), Northern corn leaf blight

Charles Block: Stewart's wilt

Carl A. Bradley: Diplodia leaf streak, Southern rust, Gray leaf spot (main photo)

Craig R. Grau: Common rust, Eyespot, Northern corn leaf spot, Anthracnose leaf blight

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