Managing Early Onset of Foliar Diseases in Corn

As with all plant diseases, all three points of the disease triangle need to occur for disease to ensue, a susceptible host plant, the pathogen, and favorable environmental conditions. Many of the Bayer seed products have genetic resistance incorporated into the plant with traditional breeding techniques for many of the common plant diseases. Your seed provider can provide information on the hybrid's susceptibility levels to many of the common corn foliar diseases. Depending on the pathogen, some can survive the winter on previous crop residue (e.g., northern corn leaf blight) and some are moved into northern growing areas on winds from southern locations (e.g., southern corn rust). Many foliar diseases need warm, humid, and wet conditions to propagate. Fungal diseases (e.g., grey leaf spot) can infect and penetrate plant tissue without a wound; however, bacterial diseases (e.g., Goss's wilt) can only infect and penetrate plant tissue via a wound to the plant.

When to Scout

Depending on the disease, field history, and susceptibility of the corn product, scouting should start at the whorl or tasseling stage (Table 1). If a susceptible corn product is used in a field with a history of a foliar disease or planted in an area with a history of foliar disease, it should be scouted prior to tasseling to determine disease severity.

Disease development in corn around the tasseling stage of growth can result in yield loss, particularly if favorable environmental conditions support continued infection of leaves around and above the ear. Foliar diseases of corn are a concern when they develop early and progress up the plant before grain fill is complete. While fungicides can help reduce the incidence of fungal diseases, they will have no effect on bacterial diseases that infect corn.

Table 1. Suggested sampling window, favorable environmental conditions, and management options for common foliar diseases of corn.

Disease	Sampling Window	Favorable Environment	Management Options	In-season Management
Fungal Pathogens				
Leaf anthracnose[1]	Knee-high to whorl stage	Warm temperatures and prolonged wet weather	Resistant corn products, tillage to bury residue, crop rotation	None
Northern corn leaf blight[2]	Whorl through dent stage	Warm temperatures (65 - 80° F) and extended leaf wetness	Resistant corn products, fungicides, tillage to bury residue, crop rotation	If disease is present on 50% or more of the plants in a susceptible hybrid, and warm, wet weather is forecasted, a foliar fungicide application should be considered
Grey leaf spot[3]	Tasseling to maturity	Warm temperatures (75-85° F) and relative humidity greater than 90%	Resistant corn products, fungicides, tillage to bury residue, crop rotation	Fungicide applications made in the very early stages of disease development (few lesions in the lower canopy) are more effective at slowing disease development and protecting yield
Physoderma brown spot[3]	V12 through R1 stages	Warm (75-85° F) and excessively wet conditions result in water pooling in the whorl during the V3-V9 stages	Resistant corn products	None
Eyespot[4]	Whorl through R1 stages	Cool and wet conditions	Resistant corn products, fungicides, tillage to bury residue, crop rotation	If infection occurs early in development a fungicide should be considered if the corn product is very susceptible and the forecast is for prolonged cool and wet conditions
Common rust and southern rust[5]	Whorl through dent stage	Common rust: temperature range of 61-77° F and at least 6 hours of concurrent dew; Southern rust: temperature range of 77-88° F	Both: resistant corn products, fungicides	Common rust: scout corn regularly to detect it early. If disease progresses and weather is conducive to spread a fungicide application may be considered; Southern rust: early and frequent scouting of fields is beneficial if corn rust is found nearby because the disease can spread rapidly, and a fungicide application should be considered if weather is conducive to spread
Tar spot[6]	VT through maturity	Cool (59-70° F), humid conditions, 85% relative humidity with greater than 7 hours of leaf wetness	Plant less susceptible corn products, tillage, crop rotation. Fungicides have shown to reduce the impact of disease	Fungicides, but data are limited on application timing; consult your local Extension office for recommendations
Bacterial Pathogens				
Stewart's wilt[7]	Knee-high through whorl stage	Only transmitted by corn flea beetle under field conditions	Plant less susceptible corn products, insecticide seed treatments	None
Goss's wilt[8]	Late vegetative stages through maturity	Enters through wounds on plant surfaces, wind-blown rain can spread disease	Plant less susceptible corn products, tillage, crop rotation	None
Bacterial leaf streak[9]	Late vegetative stages through maturity	The disease is spread through irrigation and rain, and wounds are necessary for infection	Consult seed producer for susceptibility ratings of corn products	None

Managing Early Onset of Foliar Diseases in Corn

Impact on Yield and Standability

Yield loss can occur when photosynthetic capacity is reduced in the upper canopy, particularly when the top 8 to 9 leaves above the ear are infected as these leaves contribute at least 75% of the carbohydrate needs to complete ear fill.[10] Studies conducted at Iowa State University demonstrated that when grey leaf spot and common rust were controlled using a fungicide, the incidence of stalk lodging was reduced.[11]

Common Corn Foliar Diseases

Anthracnose leaf blight. Can be very common in fields that are in a continuous corn cropping system. Spores are spread primarily by splashing water on the crop residue onto the corn leaf. Disease develops soon after planting and continues to develop until canopy closure. Oval- or spindle-shaped lesions develop that are brown with very-dark-brown or purple margins. Lesions can coalesce and create larger areas of dead tissue and leaves may die. Under magnification, spores formed on the dead tissue will look spiny, much like a sea urchin.

Northern corn leaf blight (NCLB). Typical symptoms of NCLB are large (1 to 6 inches long), cigar-shaped lesions (Figure 2). Lesions are initially grey-green with a water-soaked appearance and turn tan-brown as infected tissues die. A distinct margin between the infected and healthy tissue is often apparent. Distinct dark areas of fungal sporulation develop within necrotic lesions when weather is humid. Mature NCLB symptoms can look similar to the leaf blight phase of Goss's wilt or drought/heat stress.

Grey leaf spot. Grey to tan, rectangular lesions on leaf, sheath, or husk tissue (Figure 3). Spots are opaque and long (up to 2 inches). Lower leaves are affected first, usually not until after silking. Lesions may have a grey, downy appearance on the underside of leaves where the fungus sporulates. Grey leaf spot has become more prevalent with increased use of reduced tillage and continuous corn.

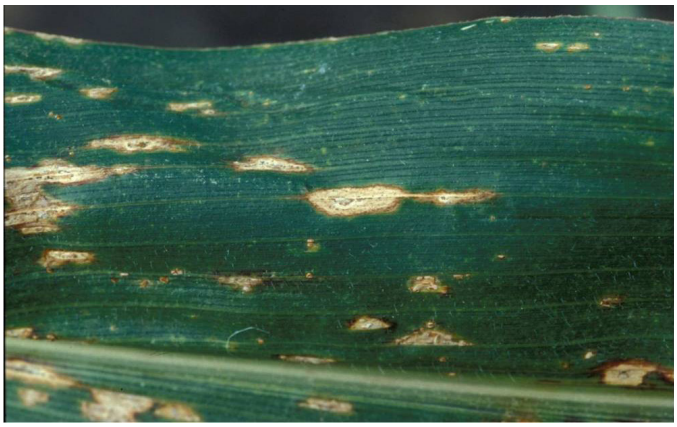

Figure 1. Anthracnose leaf blight.

Figure 2. Northern corn leaf blight.

Figure 3. Grey leaf spot.

Managing Early Onset of Foliar Diseases in Corn

Physoderma brown spot. Symptoms include very small (approximately ¼ inch in diameter), round to oval-shaped lesions that are yellowish-brown in color and occur in high numbers and in broad bands across the leaves. In addition, dark-purple to black spots occur on the midrib. The midrib lesions help to distinguish this disease from other diseases such as eyespot and southern rust. Because infection requires a combination of light, free water, and warm temperatures, alternating bands of infected and non-infected tissues commonly develop on the plant. Symptoms may also appear on the stalk, leaf sheath, and husk.

Eyespot. Small (about 1/16 of an inch), circular, translucent lesions surrounded by yellow to purple margins that gives them a halo effect (Figure 5). Lesions occur on leaves (most commonly as plants approach maturity), sheaths, and husks. The disease is favored by cool, moist weather.

Common rust. Infections begin as light-green to yellow spots on leaves and develop into circular or elongated, small (2-10 mm long), reddish-brown, raised pustules.[6] Pustules rupture the leaf epidermis and contain small, cinnamon-brown, powdery spores that can become darker brown to black later in the season. Pustules are often found in bands or patches indicating that infection occurred while the leaf was in the whorl. Pustules can form on the upper and lower leaf surfaces. Severely infected plants may have issues with water balance and show symptoms of moisture stress during hot, dry weather, even when soil moisture is adequate.

Southern rust. Early symptoms of southern corn rust are small, circular to oval-shaped lesions, which are oftentimes accompanied by a light-green to yellow halo. Unlike common rust, the lesions are almost exclusively located on the upper leaf surface. Within the lesions are light-orange to cinnamon-red pustules, which are key to identification. Southern rust pustules tend to be smaller, have a more circular shape, and are more densely packed than common rust pustules. Also, unlike common rust, the lesions can develop on tissues other than the leaves, including the stalk, husk, and leaf sheath.

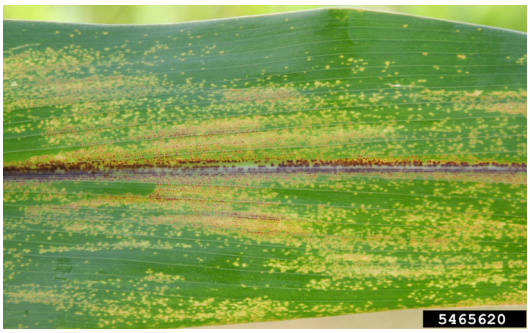

Figure 4. Physoderma brown spot. Daren Mueller, Iowa State University, Bugwood.org.

Figure 5. Corn eyespot.

Figure 6. Common rust pustules on underside of corn leaf.

Figure 7. Southern rust on corn.

Managing Early Onset of Foliar Diseases in Corn

Tar spot. A preliminary identification of tar spot can be done in the field, but a laboratory diagnosis is required to distinguish it correctly from other pathogens. Leaves with tar spot have small, raised, black and circular spots, which are called stromata. Stromata can be present on healthy or dead tissue of leaf sheaths, stalks, and husks and can be surrounded by a narrow, tan halo. The stromata are raised and bumpy and vary in shape from small, pinhead structures to more elongated structures. This disease can be easily confused with structures associated with other fungal diseases, such as the black pustules that the corn rust pathogen produces as it ages. Tar spot can also be easily confused with the black saprophytic organisms that grow on dead leaf tissue. However, saprophytes can be rubbed off, whereas stromata cannot.

Stewart's wilt. Stewart's wilt can occur as two different phases. The seedling wilt phase occurs when young plants are infected systemically. At the VT stage, the leaf blight phase may occur. With seedling wilt, rapid wilting occurs in highly susceptible corn products. Long, pale-green to yellow lesions with wavy margins will develop parallel to the leaf veins, which will turn brown as leaves die. With the leaf blight phase, foliar symptoms similar to the seedling wilt phase can occur, most often after VT.

Goss's wilt. The leaf blight symptoms of Goss's wilt usually appear as long, grey-green to black, water-soaked streaks extending along leaf veins. Small, dark, water-soaked flecks, referred to as "freckles", often occur inside larger lesions and at the edges of lesions where symptoms are advancing. Leaf freckles are luminous when lighted from behind, such as when the sun is used as backlighting. Bacterial cells may ooze from infected leaves and dry on leaf surfaces forming a shellac-like sheen. As lesions mature, large areas of tan to brown, dead leaf tissues are visible (Figure 10).

Figure 8. Tar spot of corn.

Figure 9. Stewart's wilt of corn.

Figure 10. Goss's wilt of corn.

Managing Early Onset of Foliar Diseases in Corn

Bacterial leaf streak. Disease symptoms have been observed in corn as early as the V7 growth stage, in which lesions first appear on lower leaves. Incidences are more common under continuous corn production, overhead irrigation, or rainfall during hot weather. Symptoms in the upper canopy are more common when the disease occurs after tasseling. It can be confused with grey leaf spot and common rust; therefore, a laboratory test is often needed to confirm bacterial leaf streak.

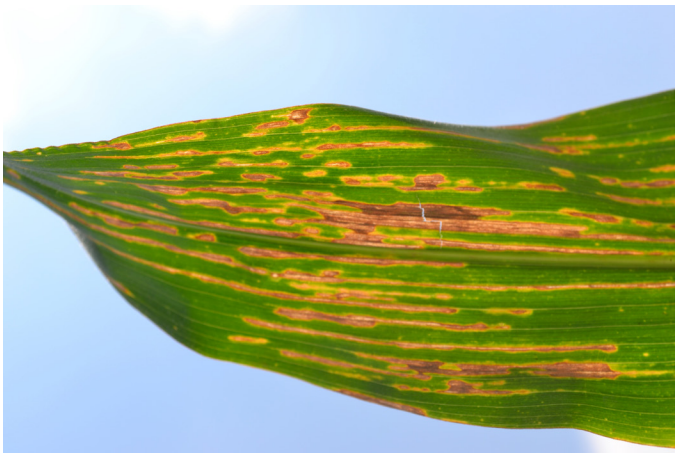

Figure 11. Bacterial leaf streak on corn. Vinicius Garnica, Bugwood.org.

Fungicide Considerations[12]

Triazole and strobilurin fungicides are labeled for corn to help manage foliar fungal diseases. Triazole fungicides interfere with fungal membrane structure and function and must be applied preventatively or in the early stages of infection. Following application, active ingredients move locally into leaves but are not necessarily transported to other leaves. Strobilurin fungicides inhibit fungal respiration and should be applied preventively or as early as possible in the disease cycle. They are absorbed into the leaf and have some upward movement in the xylem. Most triazoles and strobilurins have some residual activity based on the rate of application, coverage, and environmental conditions. Consult individual product labels for harvest interval and other restrictions for use.

In most cases, fungicides should be applied at or after tasseling. For example, a fungicide has been shown to be most effective for northern corn leaf blight and grey leaf spot when applied two weeks prior to tasseling to two weeks after tasseling.[13] Follow all individual product label instructions for proper application timing, application volume, application equipment, and environmental and harvest interval precautions.

Making an Application Decision

There are many factors to consider when determining if a fungicide application is warranted. Prior to making an application, evaluate each field for the susceptibility of the corn products to the diseases, the current yield potential of each field, disease severity, and corn stage of development. Then consider the cost of treatment and corn price to determine if the application has a probability of providing an economical return in each field. Finally, check the weather forecast to evaluate if upcoming conditions will continue to promote disease development.

Managing Early Onset of Foliar Diseases in Corn

Sources:

[1]Stoetzer, E. and Robertson, A. 2019. Signs of anthracnose leaf blight on your seedlings? No need to fret! Iowa State University Extension. https://crops.extension.iastate.edu/blog/alison-robertson-ethan-stoetzer/signs-anthracnose-leaf-blight-your-seedlings-no-need-fret

[2]Vittetoe, R. and Roberstson, A. 2016. Seeing northern corn leaf blight? Iowa State University Extension. https://crops.extension.iastate.edu/blog/alison-robertson-rebecca-vittetoe/seeing-northern-corn-leaf-blight

[3]Stoetzer, E. and Robertson, A. 2018. Weather conditions ripe for Physoderma brown spot and node rot and gray leaf. Iowa State University Extension. https://crops.extension.iastate.edu/cropnews/2018/06/weather-conditions-ripe-physoderma-brown-spot-and-node-rot-and-gray-leaf-spot

[4]Smith, D. 2015. Corn diseases of 2015 and should I spray fungicide? University of Wisconsin Extension. https://fyi.extension.wisc.edu/fieldcroppathology/2015/07/13/corn-diseases-of-2015-and-should-i-spray/

[5]Thiessen, L., Rivera, Y., and Kinczyk, J. 2018. Corn rusts: common and southern rust. North Carolina State University Extension. https://content.ces.ncsu.edu/corn-rusts-common-and-southern-rust

[6]Telenko, D. and Creswell, T. 2019. Tar spot. Purdue University Extension. https://www.extension.purdue.edu/extmedia/BP/BP-90-W.pdf

[7]Bradley, C., Mehl, K., and Pfeufer, E. 2017. Stewart's wilt of corn. University of Kentucky Extension. https://plantpathology.ca.uky.edu/files/ppfs-ag-c-04.pdf

[8]Wise, K., Ruhl. G., and Creswell, T. 2005. Goss's bacterial wilt and leaf blight. Purdue University Extension. https://www.extension.purdue.edu/extmedia/bp/BP-81-W.pdf

[9]Stoetzer, E. and Zaworski, E. 2018. Identifying, scouting and management of bacterial leaf streak. Iowa State University Extension. https://crops.extension.iastate.edu/cropnews/2018/07/identifying-scouting-and-management-bacterial-leaf-streak

[10]Rees, J.M. and Jackson, T. 2008. Gray leaf spot of corn. University of Nebraska Extension. http://extensionpublications.unl.edu/assets/pdf/g1902.pdf

[11]Robertson, A., Abendroth, L., and Elmore, R. 2007. Yield responsiveness of corn to foliar fungicide application in Iowa. Iowa State University Extension. https://crops.extension.iastate.edu/encyclopedia/yield-responsiveness-corn-foliar-fungicide-application-iowa

[12]Smith, D. Field crops fungicide information. University of Wisconsin Extension. https://fyi.extension.wisc.edu/fieldcroppathology/field-crops-fungicide-information/

[13]Smith, D. 2018. Late season corn foliar disease update and hail damaged corn. University of Wisconsin Extension. https://ipcm.wisc.edu/blog/2018/08/late-season-corn-foliar-disease-update-and-hail-damaged-corn/