Corn & Soybean

Disease ID Guide

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Disease ID Guide

Corn

Anthracnose Leaf Blight

***Anthracnose** is a fungal disease that infects corn, grain sorghum and small grains.*

Anthracnose has both a leaf and a stalk phase in corn. The infection can spread from leaves to stalk, or the stalk may be infected through the roots or base of the plant.

Timing

Anthracnose leaf blight is common early in the season in fields where diseased crop residue was left on the soil. Infection develops when disease spores are splashed onto seedling plants by rain.

Conditions For Development

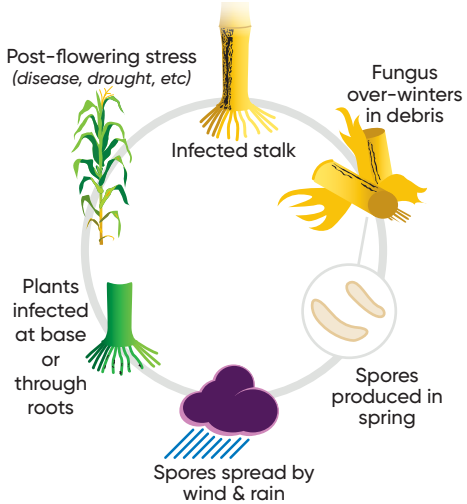
The pathogen overwinters in diseased leaves and stalks and produces spores when the weather warms in the spring. Spores are spread by wind and rain; infection is favored by warm temperatures (70-80°F) and high humidity.

Management Tips

- Plant well-adapted, disease/stress resistant hybrids
- Reduce crop stress through proper plant populations, irrigation, soil management and foliar disease and weed control
- Practice balanced soil fertility
- Control insects
- Manage corn residue
- Scout fields prior to crop maturity and harvest fields based on crop condition

Impact On Yield

Careful scouting and harvesting fields according to crop conditions can help prevent field losses due to stalk rot. Corn loss potential should be weighed just as heavily as grain moisture in deciding which fields to harvest first. Scouting fields approximately two to three weeks prior to the expected harvest date can identify fields with weak stalks predisposed to lodging. Fields with high lodging potential should be slated for early harvest.



Symptoms

Upon infection, small round to irregular water-soaked spots appear and later turn yellow and then brown with reddish-brown borders. The leaf spots may enlarge to one-half inch long and coalesce (join together). In severe cases, the leaf tips or entire leaves may turn yellow.

Though anthracnose is common in seedlings, plants appear to resist the leaf blight phase during vigorous vegetative development. However, during the ear-fill stage, plants often become susceptible to the top dieback and/or stalk phase of the disease.

Note black "specks" in center of lesion on seedling leaf (magnified)

Lesions coalesced on mature leaf.

Common Rust

***Common Rust** is a fungal disease caused by **Puccinia sorghi** pathogen that spreads by windblown spores from southern corn growing areas.*

It is less likely than southern rust to cause significant yield loss to hybrid corn.

Timing

Common rust typically progresses as corn matures in late summer if conditions are persistently wet and cool.

Conditions For Development

Favored by moist, cool conditions (temps in the 60s and 70s). Conversely, hot, dry conditions typically slow or stop development.

Management Tips

Plan to scout corn to detect common rust early. Monitor disease development, crop growth stage and weather forecast. Disease is wind-borne and does not overwinter in U.S.; therefore, rotation and tillage are not effective.

Apply a foliar fungicide if:

- Rust is spreading rapidly or likely to spread and yield may be affected
- Disease exceeds threshold established by your state extension plant pathologist

Impact On Yield

Yield losses may result from poorly filled kernels and lodging-induced harvest losses. Significant damage to upper leaves early in the life of the hybrid results in higher yield losses. If damage is confined to lower leaves or occurs after corn is well-dented, yield losses are lower.

	Common Rust	Southern Rust
Ideal Environment	Cool to warm & moist: 60 - 77° F	Warm to hot & moist: 77°+ F
Appearance of Pustules	Large, circular to elongated	Small circular, pinhead appearance
Pustule (spore) Color	Brown to cinnamon brown	Reddish orange
Location of Pustules	Upper & lower leaf surfaces. Infects leaves only.	Upper leaf surface. May also infect husks.

Symptoms

Lesions begin as flecks on leaves that develop into small tan spots. Spots turn into elongated brick-red to cinnamon-brown pustules with jagged appearance. Symptoms of Common Rust are found on both upper AND lower leaf surfaces (unlike Southern rust). Occurs on leaf only, NOT on sheaths, stalks, ear shanks and husk leaves.

Eyespot

***Eyespot** is a residue- borne, fungal disease that occasionally reaches severity levels that can cause yield loss in susceptible hybrids.*

It is most common across the northern areas of the Midwest.

Timing

The fungus overwinters and survives between corn crops on residue left on the soil surface. In the spring, the fungus produces spores that are carried to the new corn crop. The fungus may also be seed-borne, but this source of fungal inoculum is insignificant when compared to the number of spores produced on infested crop residues.

Conditions For Development

Eyespot is favored by long periods of cool, wet weather during the growing season and is more of a problem in the northern regions of the Corn Belt

Management tips

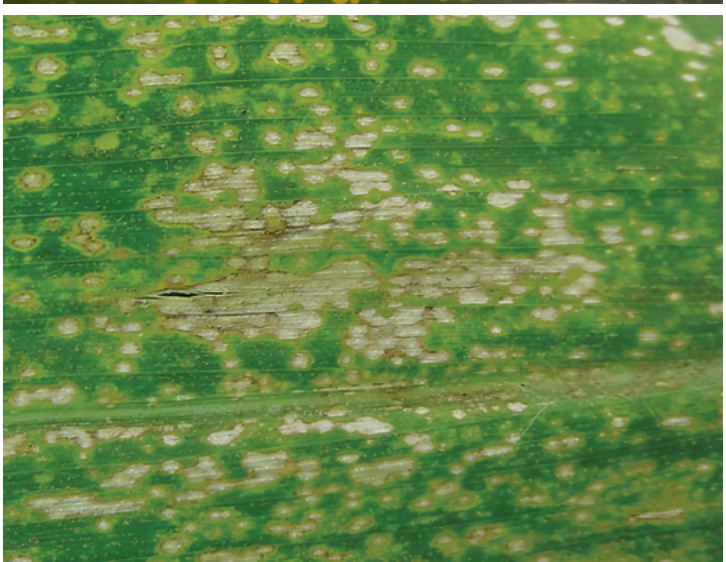
Plant corn hybrids that have some resistance to eyespot. Crop rotation and clean plow down of corn residues will help reduce the amount of surviving fungus and limit early season disease spread.

Impact On Yield

High disease levels that can result in yield loss usually occur in seed production fields, under no-till conditions, and when corn is planted sequentially for two or more years.

Symptoms

Affected leaves are covered with numerous small round spots. Spots are about 1/8 inch in diameter, oval to circular and initially appear water soaked. The central area of the spot soon dies, leaving a tan center surrounded by a distinct brown to purple border. The border is frequently encircled by a yellow halo.



Gray Leaf Spot

***Gray Leaf Spot** is an annual threat in cornfields from the Midwest to the Atlantic Coast that has been developing into new areas in recent years.*

All corn hybrids in this region, regardless of type, have some susceptibility.

In addition to geography, there are many factors that contribute to the risk of gray leaf spot damage in corn. Climate, moisture, cropping system, weed pressure, timing and tillage practices are other considerations to take into account when assessing fields for disease risk.

Timing

Late-planted corn is exposed to disease at vulnerable early growth stages and can suffer higher levels of infection. Significant yield loss can occur if leaf area is destroyed before grain fill is complete. Early infection also allows more time for secondary outbreaks, disease spread and leaf damage — resulting in even greater yield losses.

Conditions For Development

Warm temperatures and high humidity create an optimal environment for gray leaf spot. Periods of fog can trap moisture in the canopy, sparking an outbreak. Heavy wind and rain aid spread of disease from soil to and among developing plants.

Infection requires leaf surfaces to be wet for 11-13 hours and relative humidity in the leaf canopy to be at least 90% for 12-13 consecutive hours.

Gray leaf spot fungus overwinters in corn residues, making the threat of infection greater with continuous corn.

Weeds block air movement through the canopy, holding humidity and preventing leaf surfaces from drying, which increases disease risk.

Management Tips

In its early stages, gray leaf spot symptoms may be confused with other foliar fungal diseases, including anthracnose leaf blight, eyespot and common rust. To verify, hold a leaf up to the light and look for a yellow halo around pinpoint lesions.

Hybrids with partial gray leaf spot resistance may restrict lesion growth, displaying small lesions with round or jagged shapes instead of the long, rectangular lesions on more susceptible hybrids.

Impact On Yield

The disease appears in cornfields most growing seasons without significant effect on yield. If conditions favoring the disease are especially persistent, then yield losses in excess of 50% can occur if left untreated.

Symptoms

Long, thin, rectangular lesions, up to 2 inches in length, appear on leaves. The lesions start out tan and usually turn gray.

Northern Corn Leaf Blight

Northern Corn Leaf Blight *is an annual threat in cornfields from the Midwest to the Atlantic Coast, wherever environmental conditions are met. It spreads quickly from south to north, riding hurricane winds to infect new areas.*

Many factors contribute to the risk of northern corn leaf blight damage. Climate, moisture, cropping system, timing, tillage practices and soil content should be taken into account when assessing fields for disease risk.

Timing

Late-planted corn is exposed to disease at vulnerable early growth stages and can suffer higher levels of infection. Significant yield loss can occur if leaf area is destroyed before grain fill is complete. Early infection allows secondary outbreaks, disease spread and leaf damage to create even greater yield losses.

Conditions For Development

- Moderate temperatures (65 F to 80 F), precipitation and high humidity create the optimal environment for northern corn leaf blight. Long periods of dew and overcast days can trap moisture in the crop canopy, encouraging infection. Strong winds and rain spread disease from soil to and among developing plants.
- Infection requires leaf surfaces to be wet for 6 to 18 hours.
- According to the University of Illinois, high nitrogen levels in the soil increase the risk of northern corn leaf blight.

Management Tips

Hybrids with partial resistance to northern corn leaf blight typically produce fewer, smaller lesions and fewer fungal spores. Hybrids with race-specific resistance display small yellow lesions and produce no spores. Lesions may appear on leaf sheaths and husks of susceptible hybrids.

Choose resistant corn varieties with your retailer, rotate crops, till fields to encourage decomposition of infected residue, and apply a fungicide preventively or, if necessary, curatively.

Impact On Yield

Early season infection can have a serious impact on yield, with losses up to 30%.

Symptoms

Elliptical, gray to tan lesions on leaves. Lesions can be anywhere from 1 to 6 inches long. Symptoms tend to start on lower leaves.

Under high humidity, spores coating the lesions turn olive-green or black, giving leaves a dark or dirty appearance.

Southern Rust

Southern Rust *(Polysora rust) is favored by high relative humidity and high temperatures and therefore tends to be confined to tropical and subtropical regions more than common rust. In seasons with higher than average temperatures, southern rust can spread into temperate regions where it can impact corn yield.*

Timing

In North America, southern rust usually occurs later in the growing season and is more prevalent in the southern states. Southern rust does not occur as often from year to year as common rust, but it is usually more severe when it does occur.

Conditions For Development

The disease can develop very rapidly during warm, humid conditions.

Management Tips

If applied properly and in a timely manner, fungicide treatments can be effective in protecting corn leaves from foliar diseases. Whether the treatment will provide an economic return is often difficult to predict. To help with this decision, the University of Illinois gives the following fungicide treatment guidelines for rust and other foliar diseases *(Bissonnette, 2000)*:

- Scout for fungal leaf diseases 2 weeks before tasseling to 2 weeks after tasseling.
- At that point, at least a 15% whole-plant infection is needed to justify a fungicide treatment.

Also consider these factors to make a reasonable decision:

- First, consider the weather. Fungi in general and rusts in particular need free water (on the leaves) and continued wet weather to continue to flourish.
- Next, consider the probability of other fungal leaf blights developing in the field and in your particular hybrid. Cropping history and corn residue levels can affect development of diseases such as gray leaf spot.
- Consider the price of corn and cost per application.

Photo from Eric Alinger, Pioneer Field Agronomist

Southern Rust Continued

Impact On Yield

Both rust diseases of corn can cause substantial yield losses under severe disease pressure; however, southern rust generally poses a greater risk to corn yield than common rust. Yield loss due to rust depends on timing of infection, amount of leaf area damaged, and location of damaged leaves on the plant. If significant damage to upper leaves occurs early in the life of the hybrid, yield losses will be higher. If damage is confined to lower leaves of the corn plant or occurs in the later reproductive stages of development, little economic loss would be expected. Consequently, the latest-planted corn in an area is at higher risk for yield loss due to leaf diseases.

Common rust usually does not reach levels in the Corn Belt that would justify a fungicide application; however, severe infections can occur under conditions favorable for disease development. Such conditions were experienced in several Midwestern states in 2009, a growing season that was characterized by lower than normal temperatures throughout much of July and August *(Lutt et al., 2016)*. Pioneer fungicide research trial locations in Illinois and Indiana experienced intense common rust pressure in 2009. At one research location in Indiana, the average yield response to fungicide treatment was over 22 bu/acre *(Jeschke, 2017)*. Yield response to fungicide treatment varied greatly with common rust pressure at the research locations and hybrid genetic resistance to common rust

Symptoms

Southern rust looks very similar to common rust, but several characteristics distinguish the two. Southern rust pustules are usually confined to the upper leaf surface, while common rust is found on both upper and lower surfaces. Southern rust is more orange or reddish-orange in appearance, while common rust is red or cinnamon-brown. Southern rust pustules have a circular appearance, while those of common rust have an elongated, jagged appearance.

Photo from Eric Alinger, Pioneer Field Agronomist

Tar Spot

***Tar Spot** is a foliar disease of corn that has recently emerged as an economic concern for corn production in the Midwestern U.S.*

It is not a new disease, having been first identified in 1904 in high valleys in Mexico. Historically, tar spot's range was limited to high elevations in cool, humid areas in Latin America, but it has now spread to South American tropics and parts of North America. It first appeared in the U.S. in 2015. During the first few years of its presence in the U.S., tar spot appeared to be a minor cosmetic disease that was not likely to affect corn yield. However, widespread outbreaks of severe tar spot in multiple states in 2018 proved that it has the potential to cause a significant economic impact.

Timing/Conditions For Development

Tar spot is favored by cool temperatures (60-70 °F, 16-20 °C), high relative humidity (>75%), frequent cloudy days, and 7+ hours of dew at night. Tar spot is polycyclic and can continue to produce spores and spread to new plants as long as environmental conditions are favorable.

Management Tips

With its very limited history in the U.S., much remains to be learned about the long-term economic importance of this disease and best management practices. The pathogen that causes tar spot overwinters in corn residue but to what extent the amount of residue on the soil surface in a field affects disease severity the following year is unknown. Spores are known to disperse up to 800 ft, so rotation or tillage practices that reduce corn residue in a field may be negated by spores moving in from neighboring fields. Observations so far suggest that rotation and tillage probably have little effect on tar spot severity.

Duration of leaf surface wetness appears to be a key factor in the development and spread of tar spot. Farmers with irrigated corn in areas affected by tar spot have experimented with irrigating at night to reduce the duration of leaf wetness, although the potential effectiveness of this practice to reduce tar spot has not yet been determined.

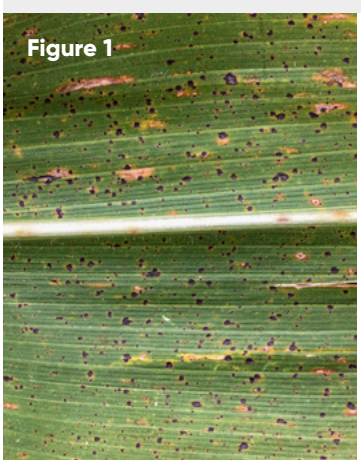
Yield potential of a field appears to be positively correlated with tar spot risk, with high productivity, high nitrogen fertility fields seeming to experience the greatest disease severity in affected areas. Research on P. maydis in Latin America has also suggested a correlation between high nitrogen application rates and tar spot severity.

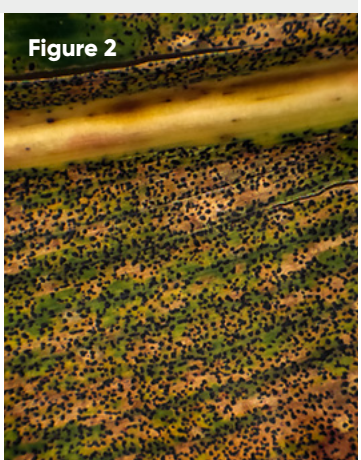
Impact On Yield

Commercial corn hybrids vary widely in their susceptibility to tar spot. Hybrid selection should be a primary consideration in managing for tar spot.

Symptoms

Tar spot is the physical manifestation of fungal fruiting bodies, the ascomata, developing on the leaf. The ascomata look like spots of tar, developing black oval or circular lesions on the corn leaf **(Figure 1)**. The texture of the leaf becomes bumpy and uneven when the fruiting bodies are present. These black structures can densely cover the leaf and may resemble the pustules of rust fungi **(Figure 1 & Figure 2)**. Tar spot spreads from the lowest leaves to the upper leaves, leaf sheathes, and eventually the husks of the developing ears.





Photos from Mark Jeschke, Pioneer Agronomy Manager

Soybean

Anthracnose

Anthracnose *is a fungal disease of soybean that occurs worldwide wherever soybean is grown.*

Anthracnose in soybean is primarily caused by the fungal species Colletotrichum truncatum in the Midwestern U.S. but may also be caused by several related species. Colletotrichum species that infect soybeans have a wide host range, including alfalfa, velvetleaf, and ragweed; however, anthracnose of corn is caused by a different pathogen. Anthracnose can infect stems, leaves, and pods of soybean and is generally present in soybean fields to some degree every season.

Timing

Anthracnose is favored by warm, humid, and wet environments and can cause severe yield reductions under these conditions.

Conditions For Development

Soybeans are susceptible to infection at all stages of development. Plants and seed may be infected. If infected seed is planted, early disease development may result in damping off (seed or seedling rot causing plant death). Dark brown lesions develop on cotyledons, stem may collapse, and seedling may die under severe infection. More commonly, plants become infected during bloom and podfill (reproductive stages) due to spores spread from infected plant residue.

Management Tips

Rotation to non-host crops is a proven strategy to reduce anthracnose inoculum in a field. As soybean residue breaks down over time, it deprives the pathogen of its survival host.

Tillage that buries or shreds crop residue, enhancing its breakdown in the soil, is beneficial in reducing anthracnose inoculum in prior fields of soybeans or other host crops.

Impact On Yield

Significant yield reductions are rare in the Midwestern U.S., but they are more common in the South.

Symptoms

Symptoms appear on stems, pods, and leaf petioles as irregularly-shaped brown blotches. Severe symptoms may include leaf rolling, premature defoliation, and stunted plants. Pods may be shriveled and contain less seed, moldy seed, or no seed. In some cases, pods can be diseased, and the seed may be infected but without symptoms in the seed.

Cercospora Leaf Blight

Cercospora Leaf Blight *is caused by a fungal pathogen, Cercospora kikuchii.*

It can develop throughout the U.S. and Canada. The disease is becoming more common in the Midwest.

Timing

Generally occurs during pod-filling stages (August), affecting both leaves and seeds of soybeans.

Conditions For Development

Infection is favored by humid conditions and temperatures of 75 - 80°F or higher.

Management Tips

A one- to two-year rotation to corn or small grains will reduce inoculum levels. Other legumes should not be included in the rotation. Tillage, where practical, can be used to incorporate and hasten the decomposition of crop residue on which ***Cercospora*** pathogen survives.

Genetic Resistance Soybean varieties vary in their response to Cercospora, but a high level of resistance is not currently available. Nevertheless, many commercial varieties demonstrate at least some degree of tolerance.

Impact On Yield

Plants infected early from diseased seed may lose their cotyledons, become stunted, or die. Loss of leaf tissue or entire leaves may occur. Extensive blighting of fields is common with severe infections. Defoliation may reduce yield if disease occurs early relative to pod fill. Significant yield loss is more common in southern states than in northern and central states.

Symptoms

The Cercospora leaf blight phase generally begins in August at the start of pod fill on late-planted soybeans. Sun-exposed leaves on the upper part of the plant develop a bronze to reddish-purple discoloration. Discoloration results from numerous irregular-shaped lesions that range from small specks to 1/2-inch spots, and may extend to the upper stems, petioles and pods.

Lesions form large necrotic blotches as the disease progresses and lesions merge. As plants mature, infected leaves develop a leathery appearance. The disease severely affected upper leaves may drop but the petioles remain on the plant; lower leaves of the plant remain green and attached. Infection sites on petioles and stems are sunken red lesions that can be up to 1/4 inch in length.

Photo from Eric Alinger, Pioneer Field Agronomist

Frogeye Leaf Spot

***Frogeye Leaf Spot** is a perennial threat in much of the United States, especially in the South and Mid-South.*

It can development in any season when conditions are right.

Diligent scouting and appropriate, preventive action or treatment when needed will help prevent disease losses due to frogeye leaf spot. Risk factors include summer climate, geography, soybean variety, fungicide resistance, field history and planting practices.

Timing

Frogeye leaf spot can occur at any time, so watch for signs early and often, especially 7 to 14 days after periods of rain or fog followed by warm weather. Signs may appear on upper or lower leaf surfaces, stems, and pods. Diseased plants are usually widespread within a field.

Conditions For Development

Frogeye leaf spot was first reported in the U.S. in 1924. Though a bigger problem in the South and the Mississippi River Valley, the disease can cause problems in Nebraska and Kansas during periods of high heat and humidity. Strobilurin-resistant frogeye leaf spot has been confirmed in Illinois, Missouri and most Southern soybean growing states.

Warm, wet conditions favor frogeye leaf spot infection. Watch for:

- Temperatures of 77-85° F
- Frequent rain
- High relative humidity (>90%)

Management Tips

Infection risk is increased by:

- Conservation tillage
- Continuous soybean production
- Overreliance on a single fungicide mode of action

Risk factors related to planting:

- Narrow rows
- High seeding density
- Heavy surface residue

Photos from Eric Alinger, Pioneer Field Agronomist

Frogeye Leaf Spot Continued

Impact On Yield

Some high-yielding varieties are susceptible, and the American Phytopathological Society, the University of Nebraska and Kansas State University report yield losses of up to 20% when frogeye leaf spot infects susceptible varieties

Symptoms

Frogeye leaf spot is caused by the fungus Cercospora sojina. Unlike other soybean diseases, it produces disease on younger upper foliage, rather than older foliage at the base of plants. Diseased plants tend to have a layered appearance because infection is more severe on young leaves.

The first sign of frogeye leaf spot usually occurs after flowering, but can occur at any stage. Check tops and undersides of leaves for tan-brown elliptical lesions with brown to purple borders. Under humid conditions, inspection with a hand lens may reveal long, silver, spore-bearing hyphae extending from black dots on the underside of leaves.

The most common initial signs are small, yellow spots on leaves. The spots enlarge to a diameter of about ¼ inch. Lesion centers become gray to brown and have reddish purple margins, and are often mistaken for herbicide drift or other leaf diseases. Under severe disease pressure, lesions can coalesce into irregular shapes and cause leaf drop.

Stem lesions are somewhat red when young and darken with age. They lack the characteristic tan center and reddish purple border of leaf lesions. Pod lesions are circular or oblong, reddish-brown and slightly sunken. Infected beans may appear shriveled and may have cracked seed coats.

Under humid conditions, lesions on any part of the plant may develop dark centers when the fungus is producing spores.

Photos from Eric Alinger, Pioneer Field Agronomist

Septoria Brown Spot

Septoria Brown Spot *is a foliar disease of soybeans caused by the fungal pathogen* ***Septoria glycines.***

The first occurrence of Septoria glycines in the United States was documented in South Carolina in 1923. Today, Septoria brown spot is widely distributed across the country and is especially prevalent in agricultural systems in which soybeans are grown continuously. Although it is the most common foliar disease of soybean, Septoria rarely causes significant yield loss. Septoria glycines primarily infects legumes, but can use velvetleaf as an alternate host.

Conditions For Development

Warm temperatures (60-85 °F) and humid conditions promote conidia sporulation of Septoria glycines. Extended periods of leaf wetness are conducive for disease development. Conidia are spread throughout the canopy via wind or rain splash. Soybean monoculture, or rotation with other legumes, allows the pathogen to overwinter in crop debris

Management Tips

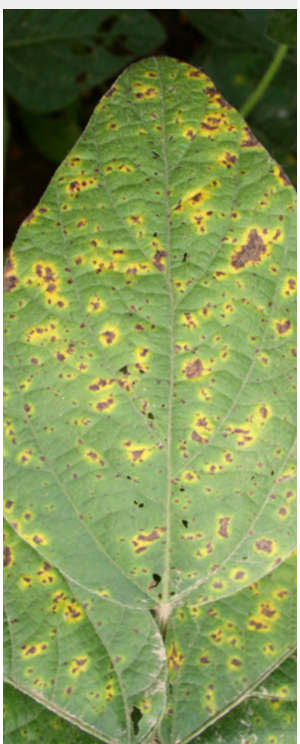
The potential effect on yield can be estimated by assessing the severity of infection during podfill, particularly at R6. There is no variety that is completely resistant to Septoria brown spot, but partial resistance does exist. Rotating to a non-host crop outside of leguminous species is effective at decreasing the inoculum in the field. Tillage can effectively bury crop debris and cause a rapid decay of the fungus. Foliar fungicides applied from R3-R6 can slow the development of Septoria glycines through the middle to upper canopy during podfill.

Impact On Yield

Under severe disease pressure, yield losses up to 9% may occur.

Symptoms

Septoria brown spot overwinters on infected soybean residue and infects new seedlings around V2 after spores are splashed from the soil surface. Lesions appear as small brown flecks with indefinite margins, typically paired with chlorotic regions. Lesion coloration can range from rusty brown to brown with a purple hue. When lesions enlarge, they coalesce into irregularly-shaped brown areas. Infected leaves can become chlorotic and drop off of the plant; this typically happens in the lower to mid canopy. If rainfall is heavy and frequent later in the season, there is a potential that Septoria glycines can move to the upper canopy.



Soybean Rust

***Soybean Rust** is a disease caused by the fungus **Phakopsora pachyrhizi** and has been identified in Australia, Africa, Asia, South America and most recently in North America.*

Soybean rust is an airborne fungal disease that causes lesions on the leaves, stem and pods, premature defoliation, fewer pods, lighter seeds and poor seed quality. Lesions appear as irregularly shaped spots that develop spore-containing pustules. These lesions, usually confined to the veins or close to the veins, gradually increase in size and turn brown or reddish as the disease progresses.

Timing

Rust spores typically cannot survive cold winters, but would likely overwinter in the southern U.S. and spread north with weather systems in the spring.

Conditions For Development

Soybean Rust develops and spreads aggressively, with pustules producing spores for periods up to 21 days, in environments with the following:

Moisture: 3-6 continuous hours of leaf wetness; humidity of at least 75-80%

Temperature: Ideal range is 13-26˚C *(55-79˚F)*

Solar Radiation: Low solar irradiation *(i.e., cloudy conditions, thick upper leaf canopy)*

Management Tips

Low Pressure: Vigilance is imperative. Warning systems and systematic scouting programs should be used to stay on top of the disease. Based upon the information from these two sources, fungicides may be applied as a preventive measure or for management when there is at least 10% incidence of the disease in a field.

High Pressure: Carefully timed preventive measures are essential. Cultural practices such as alternate host elimination can contribute to disease prevention, but chemical control will also be necessary. Two to seven fungicide applications should be applied at regular intervals (14-21 days) at or before the R1 growth stage. Because of the frequent need to apply fungicides, measures should be taken to manage resistance development.

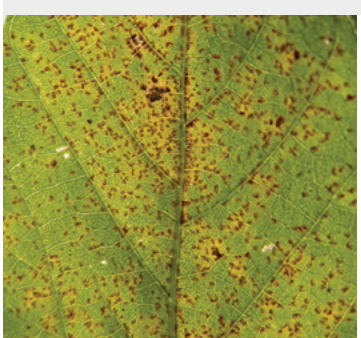
Impact on yield

Yield loss due to rust depends on timing of infection, amount of leaf area damaged, and location of damaged leaves on the plant. If significant damage to upper leaves occurs early in the life of the hybrid, yield losses will be higher. If damage is confined to lower leaves of the corn plant or occurs in the later reproductive stages of development, little economic loss would be expected.

Symptoms

Soybean rust affects the plant leaves, in some cases symptoms can appear on the petioles. Visible symptoms appear as reddish-brown pustules on the upper and lower leaf surface.

The disease is difficult to detect as it commonly develops in the shaded, moist conditions of the lower canopy. Detection involves being vigilant for hotspots, or clumps of diseased plants, and systematic field scouting.



Target Spot

Target Spot *is a foliar disease that has been reported in all soybean growing regions of the U.S. Target spot is caused by the fungus Corynespora cassiicola that overwinters on crop debris.*

Timing

Generally occurs late in growing season and affects lower canopy.

Conditions For Development

Initial infections require high humidity (> 80%) or free moisture. Dry weather conditions will suppress disease development.

Management Tips

Typically, this disease is managed by using high-yielding soybean cultivars, managing surface crop residue, and avoiding soybean monoculture.

Impact On Yield

Yield losses of 18 - 32% have been reported on susceptible cultivars in some areas of the country when conditions favored disease for a prolonged period of time.

Symptoms

Leaf lesions are reddish-brown round to irregularly- shaped spots that range in size from 3/8 to 5/8 in. in diameter. Lesions are frequently surrounded by a yellowish green halo. Larger spots on leaves often develop diagnostic zonate patterns, hence the common name target spot (Fig. 1). Infected areas on stems and petiole are dark brown and range from specks to elongated lesions. Lesions on pods are typically small (1/32 in.), circular purple or black spots with brown margins.

White Mold

Soybean White Mold *is an annual threat in the northern United States (north of Interstate 70) from Nebraska to the Atlantic Coast, though it may appear anywhere when conditions are right.*

Timely, preventive action is necessary to maximize yield in the presence of white mold. Geographic location is only one piece of the puzzle. Also consider spring climate, planting practices, soybean variety, microclimate and field history when weighing the potential of white mold development.

Timing

Cool, wet conditions during spring flowering (R1) are ideal for white mold growth.

These conditions that increase disease risk include:

- Temperatures below 85° F
- Frequent rain
- High relative humidity

Management Tips

Most severe infestations are found in denser, faster-closing varieties. While no variety has absolute resistance, some varieties offer varying levels of resistance to white mold.

Practices that accelerate canopy development and enhance yield potential can increase risk of infection, including:

- Early planting
- Narrow rows
- High seeding densities
- High soil fertility

Impact On Yield

Harvest on or near infected fields with care, since white mold is easily spread. Sclerotia form within and on the outside of plant stems, then drop to the soil surface during harvest. They can be present in harvested soybeans, but are not toxic to livestock and the fungus should be killed during the roasting process.

Because sclerotia are released during the harvesting process, they can easily be spread to new fields. Harvest infected fields last and thoroughly clean equipment when leaving infected fields.

Under ideal disease conditions, it only takes one soybean crop to jump from 5 or 10% infected soybean plants in a field to 50% the following season. Correct disease diagnosis and implementing an effective management strategy before harvest will help minimize the spread of sclerotia and reduce the risk of severe disease in subsequent years.

White Mold Continued

White Mold Disease Cycle:

Sclerotia: Dark, irregularly shaped white mold survival structures. Resembling mouse droppings, they function much like seeds, protecting the organism until conditions allow it to germinate.

About ¼ – ½ inch long, sclerotia form within the white, cottony growth inside and outside soybean stems. Within these structures, the disease survives in soil for up to 10 years.

Only sclerotia within 2 inches of the soil surface can germinate.

Tilling infected fields can bring deeper sclerotia to the surface and propagate the disease.

When conditions are right, sclerotia germinate and produce apothecia.

Apothecia: Tan, spongy, mushroom-like structures that grow from sclerotia. At full maturity, they reach ¼ to ½ inch in length. They can be found beneath soybean canopies on or just below the soil surface when soil is moist and dim light reaches through the canopy.

The quantity of apothecia is relative to the number of sclerotia near the soil surface when necessary environmental conditions are met. Apothecia can form under the canopies of non-host plants, such as corn, small grains and forage legumes.

Many other mushrooms grow in soybean fields, including birdnest mushroom. Correct diagnosis is critical to implementing an effective management program.

When conditions favor white mold development, a small number of apothecia can infect a relatively significant number of soybean plants as they release airborne spores.

Spores: Spores are produced under the cap of apothecia. Each apothecium can release more than 10 million microscopic spores over several days, which are carried by the wind to surrounding plants. After release, spores survive for only a few days.

Spores land on senescing soybean blossoms and are able to germinate within soybean plants during a period of prolonged leaf wetness (16 – 48 hours).

Birdnest Mushroom

White Mold Continued

Soybean plants: Soybean plants are most vulnerable to white mold infection during bloom phase. With adequate moisture, airborne spores that land on surrounding plants use senescing petals as the gateway to infecting the plant. Plant-to-plant infection is possible, but not common.

Once fungal spores germinate on petals, the infection is able to spread throughout the plant to pods, nodes and stems.

Infection

Infection signs are not immediately visible. The obvious signs may be apparent within 3 to 4 weeks of infection, but generally go unnoticed for another week or more.

Check stems of potentially infected plants to diagnose white mold. The first signs are gray to white lesions at nodes. Lesions rapidly spread above and below infected nodes and are often covered in fluffy, white growths.

Diagnosing white mold by foliar damage is not reliable. Wilted leaves die and turn brown, but often remain attached to the stem past maturity.

These signs of foliar damage are similar to other diseases, including stem rot, Phytophthora root rot, sudden death syndrome and stem canker. Stems should be inspected to confirm white mold diagnosis

Resources

Attributes & Control Ratings: Corn Fungicide

Fungicide (common and trade names)	Company	Active Ingredients (FRAC Group)	Rate (fl oz/A)	Anthracnose Leaf Blight	Common Rust	Eyespot	Grey Leaf Spot	Northern Leaf Blight	Southern Rust	Tar Spot	Harvest Restrictions (Days)
Aproach® fungicide	Corteva Agriscience	Picoxystrobin *(Group 11)*	3 – 12	●	◐	●	◐	●	●	●[1]	7
Aproach® Prima fungicide		Picoxystrobin *(Group 11)* Cyproconazole *(Group 3)*	3.4 – 6.8	●	●	●	●	●	●	◐	30
Headline AMP fungicide	BASF	Pyraclostrobin *(Group 11)* Metconazole *(Group 3)*	10 – 14.4	●	●	●	●	●	●	◐	20
Priaxor fungicide		Fluxapyroxad *(Group 7)* Pyraclostrobin *(Group 11)*	4 – 8	●	●	●	●	◐	●	●	21
Revytek fungicide 12		Mefentrifluconazole *(Group 3)* Fluxapyroxad *(Group 7)* Pyraclostrobin *(Group 11)*	8 – 15	●	●	●	◐	◐	●	◐	21
Veltyma fungicide		Mefentrifluconazole *(Group 3)* Pyraclostrobin *(Group 11)*	7 – 10	●	●	●	◐	◐	●	◐	21
Stratego YLD Fungicide 10	Bayer	Prothioconazole *(Group 3)* Trifloxystrobin *(Group 11)*	4 – 5	●	●	●	●	●	●	●	14
Delaro Fungicide		Prothioconazole *(Group 3)* Trifloxystrobin *(Group 11)*	8 – 12	●	●	●	●	●	●	◐	14
Lucento fungicide	FMC	Bixafen *(Group 7)* Flutriafol *(Group 3)*	3 – 5.5	●	●	●	◐	●	●	◐	R4
Trivapro fungicide	Syngenta	Propiconazole *(Group 3)* Benzovindiflupyr *(Group 7)* Azoxystrobin *(Group 11)*	13.7	●	●	●	●	●	●	◐	30
Miravis Neo fungicide		Pydiflumetofen *(Group 3)* Propiconazole *(Group 7)* Azoxystrobin *(Group 11)*	13.7	●	●	●	●	◐	●	◐	30
Quilt XCEL fungicide		Propiconazole *(Group 3)* Azoxystrobin *(Group 11)*	10.5 – 14	●	◐	◐	●	●	●	◐	30

[1] 2(ee) recommendation available: use in a two pass program with Aproach Prima for best results.

● Excellent ● Very Good ● Good ● Fair ● Poor ● Unknown ● Not labeled

Rating sources: Crop Protection trial data; Crop Protection Network – 2020 ratings.

Attributes & Control Ratings: Soybean Fungicide

Fungicide (common and trade names)	Company	Active Ingredients (FRAC Group)	Rate (fl oz/A)	Anthracnose	Brown Spot	Cercospora Leaf Blight	Frogeye Leaf Spot	Septoria Brown Spot	Soybean Rust	Target Spot	White Mold	Harvest Restrictions (Days)
Aproach® fungicide	Corteva Agriscience	Picoxystrobin *(Group 11)*	6 – 12	Good	Fair	Fair	Fair	Good	Good	Unknown	Very Good	14
Aproach® Prima fungicide		Picoxystrobin *(Group 11)* Cyproconazole *(Group 3)*	5 – 6.8	Unknown	Good	Good	Very Good	Very Good	Very Good	Fair	Not labeled	14
Viatude™ fungicide		Picoxystrobin *(Group 11)* Prothioconazole *(Group 3)*	12 – 16	Unknown	Unknown	Unknown	Unknown	Not labeled	Unknown	Unknown	Excellent	36
Priaxor fungicide	BASF	Fluxapyroxad *(Group 7)* Pyraclostrobin *(Group 11)*	4 – 8	Very Good	Fair	Fair	Fair	Excellent	Very Good	Fair	Poor	21
Revytek fungicide 12		Mefentrifluconazole *(Group 3)* Fluxapyroxad *(Group 7)* Pyraclostrobin *(Group 11)*	8 – 15	Unknown	Very Good	Unknown	Very Good	Very Good	Unknown	Fair	Poor	21
Stratego YLD Fungicide 10	Bayer	Prothioconazole *(Group 3)* Trifloxystrobin *(Group 11)*	4 – 4.65	Very Good	Good	Fair	Fair	Very Good	Very Good	Poor	Not labeled	21
Delaro Fungicide		Prothioconazole *(Group 3)* Trifloxystrobin *(Group 11)*	8 – 11	Unknown	Very Good	Unknown	Good	Very Good	Unknown	Not labeled	Not labeled	21
Lucento fungicide	FMC	Bixafen *(Group 7)* Flutriafol *(Group 3)*	3 – 5.5	Unknown	Very Good	Unknown	Very Good	Very Good	Unknown	Fair	Unknown	21
Trivapro fungicide	Syngenta	Propiconazole *(Group 3)* Benzovindiflupyr *(Group 7)* Azoxystrobin *(Group 11)*	13.7 – 20.7	Unknown	Very Good	Poor	Fair	Very Good	Very Good	Unknown	Not labeled	14
Miravis Neo fungicide		Pydiflumetofen *(Group 3)* Propiconazole *(Group 7)* Azoxystrobin *(Group 11)*	13.7 – 20.8	Unknown	Unknown	Unknown	Very Good	Not labeled	Unknown	Unknown	Unknown	14
Quilt XCEL fungicide		Propiconazole *(Group 3)* Azoxystrobin *(Group 11)*	10.5 – 21	Very Good	Good	Fair	Fair	Very Good	Very Good	Poor	Not labeled	R6

Excellent · Very Good · Good · Fair · Poor · Unknown · Not labeled

Rating sources: Crop Protection trial data; Crop Protection Network – 2020 ratings.

Recommendations: Corn Fungicide

Aproach®

Onmira™ active

FUNGICIDE

Diseases Controlled			
Anthracnose Leaf Blight	Gray Leaf Spot	Northern Corn Leaf Spot	Southern Corn Leaf Blight
Anthracnose Stalk Rot	Leaf Spots	Physoderma Brown Spot	Tar Spot
Eye Spot	Northern Corn Leaf Blight	Rust, Common, Southern	Yellow Leaf Blight

Rate *(fl oz/A)*	Treatment Instructions
3 - 6	Make a single 3-6 fl oz application between V4 to V7 for early season disease control/suppression. On susceptible inbreds or hybrids, for early season disease control of Northern corn leaf spot, Northern corn leaf blight, Gray leaf spot, or Common Rust, use the 6 fl oz rate. For continued control through the season, a planned program should be followed.
6 – 12	Make 6 to 12 fl oz applications at 7 to 14-day intervals. For best results apply between VT to R3 and make applications prior to disease development. Use the higher rate and shorter interval when disease pressure is high.

- **Pre-Harvest Interval:** Grain or ear – 7 days | Silage – 0 days
- **Max Sequential Applications:** 2 before switching to a fungicide with a different mode of action
- **Max Annual Corn Rate:** 36 fl oz/A
- DO NOT tank mix Aproach with an adjuvant or crop oil when spraying corn between the V8 and VT stages of growth

Aproach® Prima

Onmira™ active

FUNGICIDE

Diseases Controlled			
Anthracnose Leaf Blight	Gray Leaf Spot	Northern Corn Leaf Spot	Southern Corn Leaf Blight
Anthracnose Stalk Rot	Leaf Spots	Physoderma Brown Spot	Tar Spot
Eye Spot	Northern Corn Leaf Blight	Rust, Common, Southern	Yellow Leaf Blight

Rate *(fl oz/A)*	Treatment Instructions
3.4	Apply early season for preventive disease control or suppression. Additional treatments should be made depending on disease pressure and environmental conditions.
3.4 – 6.8	Begin applications prior to disease development. Use higher rate and shorter interval when disease pressure is high.

- **Minimum Re-Treatment Interval:** 7 days
- **Pre-Harvest Interval:** Grain or ear – 30 days | Silage – 21 days
- **Max Sequential Applications:** 2 of a picoxystrobin containing product before switching to a fungicide with a different mode of action
- **Max Annual Corn Rate:** 6.8 fl oz/A *(0.585 lb picoxystrobin; 0.036 lb cyproconazole)*
- Do not tank mix Aproach Prima with an adjuvant or crop oil when spraying corn between the V8 and VT stages of growth.

Recommendations: Soybean Fungicide

Aproach®

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FUNGICIDE

Diseases Controlled			
Aerial Web Blight	Brown Spot	Downy Mildew	Powdery Mildew
Anthracnose	Cercospora, Blight, Leaf Spot	Frogeye Leafspot	Rust
Alternaria Leaf Spot	Purple Seed Stain	Pod and Stem Blight	Target Spot (Corynespora Cassiicola)

Rate *(fl oz/A)*	Treatment Instructions
6 – 12	Begin applications prior to disease development and continue on a 7- to 14-day interval. Use higher rate and shorter interval when disease pressure is high.

Diseases Controlled

White Mold

Rate *(fl oz/A)*	Treatment Instructions
9 – 12	Make initial preventive application at 100% bloom (1 flower blooming on all plants) and follow with 2nd application 10-14 days later when flowers at most nodes throughout the plant.

- **Minimum Re-Treatment Interval:** 14 days
- **Pre-Harvest Interval:** Grain, Forage and Hay – 14-days
- **Max Sequential Applications:** 2 before switching to a fungicide with a different mode of action
- **Max Annual Grain Soybean Rate:** 36 fl oz/A
- **Max Forage Or Hay Soybean Rate:** 12 fl oz/A

Aproach® Prima

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FUNGICIDE

Diseases Controlled			
Aerial Web Blight	Brown Spot	Downy Mildew	Powdery Mildew
Anthracnose	Cercospora, Blight, Leaf Spot	Frogeye Leafspot	Rust
Alternaria Leaf Spot	Purple Seed Stain	Pod and Stem Blight	Target Spot

Rate *(fl oz/A)*	Treatment Instructions
6.8	Begin applications prior to disease development and continue on a 14 to 28-day interval. Use higher specified rate and shorter interval when disease pressure is high.

- **Minimum Re-Treatment Interval:** 14 days
- **Pre-Harvest Interval:** Forage – 30-days | Hay – 14-days
- **Max Sequential Applications:** 2 of a picoxystrobin containing product before switching to a fungicide with a different mode of action
- **Max Annual Grain Soybean Rate:** 13.6 fl oz/A *(0.585 lb picoxystrobin; 0.072 lb cyproconazole)*
- **Max Forage Or Hay Soybean Rate:** 6.8 fl oz/A *(0.195 lb picoxystrobin; 0.036 lb cyproconazole)*

Viatude™

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FUNGICIDE

Diseases Controlled
White Mold

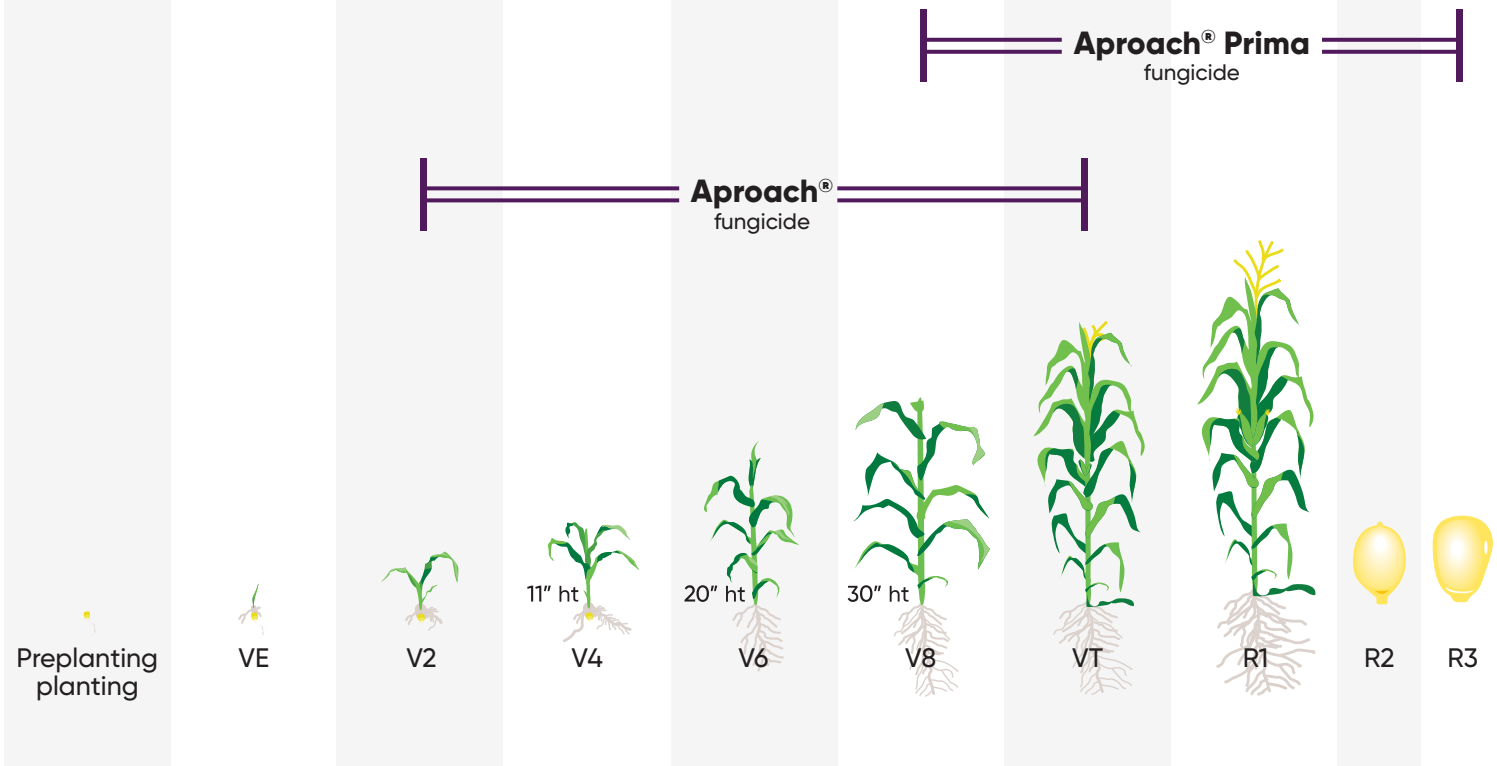
Recommended Rate *(fl oz/A)*	Treatment Instructions
12 - 16	Begin applications at 20-50% bloom or prior to the onset of disease on a 10- to 14-day interval. Use the higher rate and shorter application interval when conditions are favorable to disease development

- **Pre-Harvest Interval:** 36 days *(grain)*
- **Minimum Re-Treatment Interval:** 10 days
- **Max Rate:** 16 fl oz/A *(0.196 lb picoxystrobin; 0.065 lb prothioconazole)*
- **Max Annual Rate:** 48 fl oz/A *(0.539 lb picoxystrobin; 0.179 lb prothioconazole)*
- **Max Annual Applications:** 3

- DO NOT make more than 2 sequential applications of Viatude before switching to a fungicide with a different mode of action registered for the same use.
- For any of the diseases listed above, use the high rate in the rate range under heavy disease pressure.

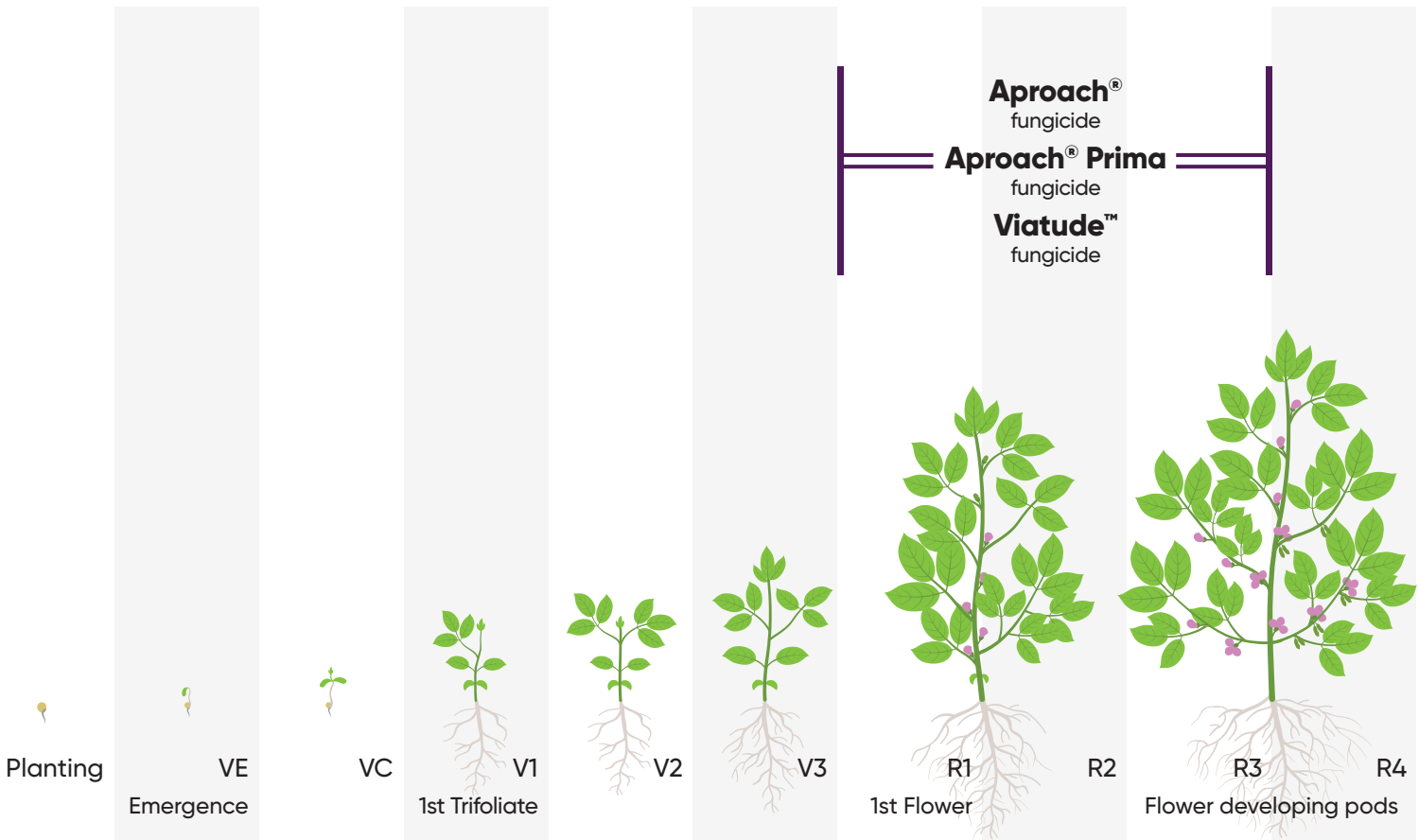
Optimal Timing: Corn

Aproach® fungicide (V3 – V12)
Aproach® Prima fungicide (V10 – R3)



Optimal Timing: Soybean

Aproach® fungicide (R1 – R3)
Aproach® Prima fungicide (R1 – R3)
Viatude™ fungicide (R1 – R3)



For more information on Corteva Agriscience™ fungicides, please contact your local Corteva territory manager or call **800-258-3033**.

Sources:

Crop Protection training material
Pioneer Agronomy Library
University of Minnesota- Extension
University of Arkansas Department of Agriculture Research & Extension

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