A Guide to Common Soybean Diseases in The South

A Guide to Common Soybean Diseases in The South

The potential always exists for a fungal, viral, or bacterial disease to develop in a soybean crop. Yield loss related to a disease can be minimal or dramatic depending on the disease, the environment, time of infection, and the soybean product. Knowing the disease history of a field and keeping abreast of reported disease developments during the growing season can help make important management decisions to help protect yield potential.

Many of the diseases caused by fungi overwinter on infected crop residue. Because of climatic conditions within an area, some fungi-caused diseases are unable to overwinter; however, the spores can arrive via wind currents from areas where the disease can overwinter. Plants become infected when splashing rain, water movement through the soil onto roots, or wind brings the pathogen to the plant. The fungi then enter plant tissue by 1) growing a germ tube that pierces into tissue, 2) through stomata, or 3) through wounds caused by hail, wind, insects, or mechanical means.

Fungicidal seed treatments can help protect seed and seedlings from most fungi-caused seed and seedling diseases. Foliar fungicides can help protect yield potential, depending on the fungal disease and application timing for the disease. Fungicide resistance has developed with some fungi; therefore, it is important to properly identify the

causal fungus for proper fungicide selection. To help deter the development of fungicidal resistance, it is highly suggested that fungicides be rotated based on mode of action. Depending on the pathogen, improved soil drainage and soil compaction management can help reduce the potential for fungal infections. Destruction of residue through tillage can help speed up the deterioration of a pathogen source.

Bacterial diseases can also overwinter on infected residue. The bacterium can contact plants through water movement in the soil, splashing rain, wind-driven rain, and mechanical means such as cultivating when plants are wet. Infection occurs when bacterium enter the plant through wounds or natural tissue openings such as stomates.

Viral diseases rely on a vector such as aphids or thrips to infect a plant. As the vector feeds, infected juices are injected into plant tissue. Scouting for insects that have the potential to vector viral diseases and applying a timely insecticide may help protect plants from becoming infected via insect feeding. Caution should be taken not to spray insecticides without proper identification as many beneficial insects can also be killed.

Bacterial Blight

Identification, Characteristics, and Diagnosis

- Caused by the bacterium *Pseudomonas savastanoi* pv. *glycinea*.
- Pathogen overwinters on residue and can be seed-transmitted.
- Pathogen spreads by wind, rain, and by cultivation when plants are wet.
- Lesions can occur on all aboveground plant tissue; leaves in the mid to upper canopy are favored.
- Initial infection appears as small, angular, water-soaked spots that turn yellow, become brown with a yellow halo around the spot, then die.
- Dead tissue may drop from leaves; however, leaves usually remain attached to the plant.
- Favored by cool, wet weather. Hot, dry weather stops development.
- Infected seedlings may be stunted or die.

Management

- Plant resistant soybean products and disease-free seed.
- Rotate with non-host crops.
- Avoid cultivating when plants are wet.
- Manage residue through tillage.

Bacterial blight lesions on a soybean leaf.

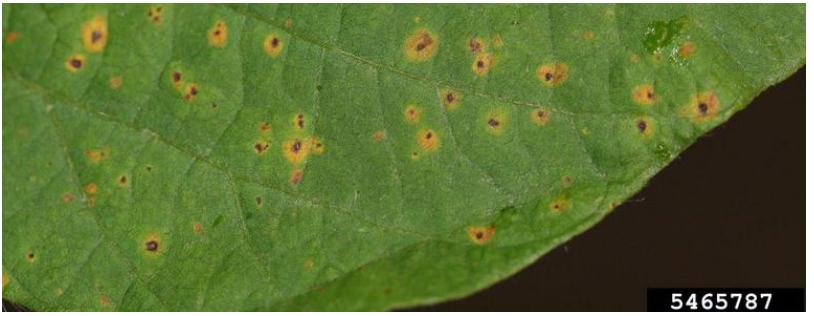
Bacterial Pustule

Identification, Characteristics, and Diagnosis

- Caused by the bacterium *Xanthomonas axonopodis* pv. *glycines*.
- Pathogen overwinters on infested soybean residue and seed.
- Pathogen is spread by splashing or windblown water, and cultivation when plants are wet.
- Initial symptoms include the development of small, yellow-green lesions with higher reddish-brown centers on upper leaf surfaces.
- More mature lesions produce a small, slightly raised, pale-colored pustule at the center of the lesion on the underside of the leaf.
- Lesions can be small to large, irregular, and necrotic.
- Leaves can become ragged in appearance as dead tissue drops from the leaf.
- Premature defoliation may occur, which can reduce seed count and size.
- Favored by warm (86 to 92°F) and wet weather.

Management

- Plant resistant soybean products.
- Utilize tillage to help decompose residue.
- Avoid cultivation when plants are wet.



Bacterial blight lesions on a soybean leaf. Picture courtesy of Daren Mueller, Iowa State University, Bugwood.org

Aerial Blight

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Rhizoctonia solani* AG1-1A. Overwinters as sclerotia in soil or on plant residue.
- Foliar symptoms usually occur during late vegetative growth stages on lower leaves.
- Initial leaf lesions appear water-soaked and grayish-green.
- Mature lesions are tan to brown.
- Reddish-brown lesions can develop on petioles, stems, pods, and petiole scars.
- Long strands of web-like hyphae can spread along affected tissue and small, dark-brown sclerotia can form on diseased tissue.
- Favored by warm (77 to 90° F) temperatures, high relative humidity, and wet weather.

Management

- Plant soybean products with high tolerance ratings.
- Avoid planting soybean in previous rice fields with a history of sheath blight of rice (same disease agent, different common name).
- Rotate with non-host crops for 2 years.
- Wider row widths and reduced population recommended.
- Delaro® is a recommended foliar fungicide available for soybeans*.
- To limit the potential for fungicide resistance, do not make more than two sequential applications of this fungicide or any Group 11 fungicide before rotating to a fungicide from a different group.

Water-soaked, greenish lesions caused by aerial blight on soybean leaves. Picture courtesy of T. Allen, Mississippi State University Extension.

For more information about Delaro, please visit **https://www.cropscience.bayer.us/products/fungicides/delaro and contact your retailer. The ideal application window for applying a fungicide is between the growth stages R2 and R5. More than one fungicide application may be needed in environments with high disease pressure.*

Soybean Rust

Identification, Characteristics, and Diagnosis

- Caused by the windborne fungus *Phakopsora pachyrhizi*.
- Does not overwinter in most Midwestern areas. Spores are carried by wind currents from southern locations into the Midwest.
- Initial infection may appear as small, brown or brick-red dots on the upper surface of mature leaves of the lower canopy.
- Later, raised pustules (viewable with a 30X lens) resembling small volcanoes develop in angular lesions on the underside of leaves in the center and lower canopy. The pustules release spores through a central opening.
- Optimum conditions for infection include a minimum of 6 hours of leaf wetness (10 to 12 hours considered very favorable) and temperatures ranging from 70 to 80°F (infection can occur as low as 59°F).

Management

- If local sentinel plots indicate the presence of soybean rust, scouting should be diligent and thorough, particularly in early-planted fields, early-maturing soybean products, low-lying or fields with prolonged wetness, and fields with early canopy closure.
- Delaro® is a recommended foliar fungicide available for soybeans*.

Soybean rust.

- To limit the potential for fungicide resistance, do not make more than two sequential applications of this fungicide or any Group 11 fungicide before rotating to a fungicide from a different group.

For more information about Delaro, please visit **https://www.cropscience.bayer.us/products/fungicides/delaro and contact your retailer. The ideal application window for applying a fungicide is between the growth stages R2 and R5. More than one fungicide application may be needed in environments with high disease pressure.*

Cercospora Leaf Blight

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Cercospora kikuchii*.
- Pathogen overwinters on soybean residue and infected seeds.
- Pathogen is dispersed by splashing water and wind.
- Usually noticed during reproductive growth stages.
- Light- to dark-purple areas develop on sun-exposed leaves and eventually cover the entire leaf.
- Leaves become leathery, dark, reddish-purple, bronzed, and/or blighted.
- Infected pods may have a purplish discoloration.
- The fungus also causes purple seed stain.
- Favored by warm (at or above 82°F) and humid (heavy dew) conditions.

Management

- Delaro® is a recommended foliar fungicide available for soybeans*.
- To limit the potential for fungicide resistance, do not make more than two sequential applications of this fungicide or any Group 11 fungicide before rotating to a fungicide from a different group.

Cercospora leaf blight.

- Earlier-maturing soybean products may not be infected.
- Individual soybean products may have higher tolerance levels.
- Utilize tillage to help decompose infected residue.

For more information about Delaro, please visit **https://www.cropscience.bayer.us/products/fungicides/delaro and contact your retailer. The ideal application window for applying a fungicide is between the growth stages R2 and R5. More than one fungicide application may be needed in environments with high disease pressure.*

Charcoal Rot

Identification, Characteristics, and Diagnosis

- Caused by the soilborne fungus *Macrophomina phaseolina*.
- Infection generally occurs within 2 to 3 weeks after planting when soils are wet; however, the disease becomes dormant unless hot, dry conditions occur during the growing season.
- During reproductive growth stages, developing leaves may be small, rolled, lose vigor, turn yellow, wilt, die, and remain attached to petioles.
- Infected plants may mature early and develop tiny, black sclerotia that resemble charcoal powder beneath the epidermis on the lower stem, taproot, and pith.
- Black streaks may develop in the woody portion of the crown.
- Lower stems may appear silvery or light-gray.
- Favored by high temperatures (82 to 93°F) and light-colored soils under drought conditions.
- Infected plants may be noted first on field edges and ridges where soil is more prone to drought.

Management

- Plant soybean products that have higher levels of tolerance or resistance.
- Plant early-maturing soybean products early to reduce the potential of plants achieving reproductive growth stages during typical high-heat months.
- Plant a non-host crop for 1 to 2 years to help reduce pathogen populations.
- Use conservation tillage and planting methods to conserve soil moisture.
- Avoid high seeding rates and irrigate (if possible) to help reduce stress.
- Maintain fertility.

Charcoal rot.

Pod and Stem Blight

Identification, Characteristics, and Diagnosis

- Caused by various species of the fungi *Diaporthe* and *Phomopsis*. *Diaporthe sojae* is the preferred scientific name.
- Pathogens overwinter on infected seed and soybean residue.
- Linear rows of dark specks (fungal fruiting bodies) develop on stem nodes, pods, and petioles.
- Upper plant canopy turns yellow and dies.
- Seed quality can be reduced.
- Pod infection can occur at flowering; however, most are infected around the R7 growth stage (beginning pod maturity).
- Injury to pods by insects favors pod infection.
- Favored by wet weather during maturation growth stages and delayed harvest.

Management

- Crop rotation.
- Utilize tillage to promote decay of infected residue.
- Harvest in a timely manner to reduce the risk of extended exposure of the mature crop to wet weather.
- Utilize seed treatments to protect seed.
- Delaro® is a recommended foliar fungicide available for soybeans*.
- To limit the potential for fungicide resistance, do not make more than two sequential applications of this fungicide or any Group 11 fungicide before rotating to a fungicide from a different group.

Linear lesions produced by pod and stem blight. Picture courtesy of Daren Mueller. Iowa State University, Bugwood.org

For more information about Delaro, please visit **https://www.cropscience.bayer.us/products/fungicides/delaro and contact your retailer. The ideal application window for applying a fungicide is between the growth stages R2 and R5. More than one fungicide application may be needed in environments with high disease pressure.*

Phomopsis Seed Decay

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Diaporthe longicolla*.
- Infected seed can be shriveled, undersized, and have a white or chalky appearance.
- The interior of pods can contain a white, cottony mold.
- Favored by warm, wet weather during pod fill.
- Early-maturing soybean products may be more prone to infection.

Management

- Do not plant infected seed.
- Seed treatments may help improve emergence.
- Plant resistant soybean products.
- Select fuller-season (for the area to be grown) soybean products.
- Utilize tillage to help promote residue deterioration.
- Control weedy hosts such as velvetleaf.
- Harvest in a timely manner to reduce the risk of extended exposure of the mature crop to wet weather.

Phomopsis seed decay.

Southern Stem Canker

Identification, Characteristics, and Diagnosis

- Stem canker has been divided into two groups (northern and southern).
- Southern stem canker is caused by the fungus *Diaporthe phaseolorum* var. *meridionalis*.
- Initial infection can occur around V3 growth stage at which point, seedlings can die quickly or survive and develop stem symptoms during pod set.
- Symptoms during reproductive growth stages appear as small reddish-brown spots on stems near a lower node.
- Spots develop into long (1 to 3 inches) cankers running up the stem from the point of infection.
- Cankers can girdle the plant causing plant death from interrupted nutrient and water flow.
- On dead plants, the cankers are hard to distinguish from non-infected stem tissue. Plant death can occur from a fungus-generated toxin.
- Foliar symptoms appear during reproductive stages as yellowing between the veins, usually on one side of the leaf. Leaves turn brown, die, and remain attached to the stem.
- Pith of dead stems is light brown and plants can easily snap because of brittleness.
- Favored by s extended periods (24 to 96 hours) of moderate temperatures (72 to 86°F) and wet weather.

Management

- Plant resistant soybean products.
- Rotate to a non-host crop for two years to reduce pathogen population.
- Use tillage to help destroy infested residue.
- Applying a labeled fungicide at or before V3 infection may help protect plants.

Southern stem canker.

Downy Mildew

Identification, Characteristics, and Diagnosis

- Caused by a fungus-like organism, *Peronospora manshurica.*
- Infection occurs in the spring when the oospores germinate and infect seedlings.
- Upper surfaces of young leaves develop pale-green to light-yellow spots which enlarge into pale- to bright-yellow lesions.
- White to gray fungal tufts develop on the underside of the lesion.
- Oldest lesions become grayish-brown to dark-brown with yellowish-green margins.

Management

- Plant resistant soybean products.
- Rotate with a non-host crop for one year or more.
- Rarely affects yield; therefore, foliar fungicides are not recommended.
- Residue management.
- Seed treatments can help protect seedlings from initial infection.

Downy mildew on soybean leaves.

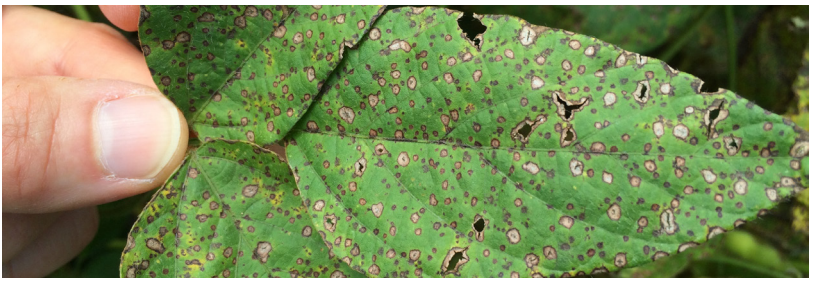
Frogeye Leaf Spot

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Cercospora sojina*.
- Symptoms initially appear during reproductive growth stages as dark, water-soaked lesions on younger leaves with centers that become ash-gray to light-brown.
- Later, the lesions become circular to angular with a purple to dark-brown margin around the tan to gray center.
- On leaf undersides, the center of the lesions may have a dark-black area where spores are being produced.
- Favored by warm (77 to 86°F) temperatures and prolonged periods of dew or light rain.

Management

- Plant resistant soybean products.
- Crop rotation and tillage to encourage residue decomposition can help reduce pathogen levels.
- Delaro® is a recommended foliar fungicide available for soybeans*.
- To limit the potential for fungicide resistance, do not make more than two sequential applications of this fungicide or any Group 11 fungicide before rotating to a fungicide from a different group.



Frogeye leaf spot.

For more information about Delaro, please visit **https://www.cropscience.bayer.us/products/fungicides/delaro and contact your retailer. The ideal application window for applying a fungicide is between the growth stages R2 and R5. More than one fungicide application may be needed in environments with high disease pressure.*

Fusarium Root Rot

Identification, Characteristics, and Diagnosis

- Caused by the several species of *Fusarium,* a soilborne fungus.
- Infected seedling roots become reddish-brown or dark- to light-brown and decay (damping-off).
- Older plants have reddish to black lesions on lateral roots and the tap root. As disease progresses, roots become black, the cortex decays, and fissures develop on the surface of the tap root.
- Plants may be stunted, and leaves turn yellow from the edges inward with the veins remaining green for a short time; leaves eventually die and drop from the petioles.
- Associated with stress (drought, herbicide damage, soybean cyst nematode pressure, and in combination with iron chlorosis).

Management

- Rotate with non-host crops.
- Utilize seed treatments.
- Plant into warm, well-drained soils.
- Manage compacted soils through tillage.
- Maintain good fertility.
- Cultivation may promote new root growth when soil is thrown against the stem base.

Root damage caused by Fusarium root rot. Picture courtesy of Mary Ann Hansen, Virginia Polytechnic Institute and State University, Bugwood.org.

Fusarium Wilt

Identification, Characteristics, and Diagnosis

- Caused by the soilborne fungus *Fusarium oxysporum*.
- Plant wilting typically occurs when plants are in late reproductive growth stages. Hot, dry conditions increase wilting potential.
- The vascular system in the stem and roots becomes brown, leaves become yellow, and defoliation can occur.
- Favored by cool temperatures and wet soils during early vegetative growth stages.

Management

- Manage soil compaction.
- Delay planting until soil temperatures favor rapid germination.
- Rotate to non-host crops.
- Utilize seed treatments.

Wilting associated with Fusarium wilt. Picture courtesy of Daren Mueller, Iowa State University. Bugwood.org.

Phyllosticta Leaf Spot

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Pleosphaerulina sojicola*.
- Overwinters in infected soybean residue.
- Infection appears as circular, oval, irregular, and V-shaped lesions on leaves.
- Lesions are gray or tan with a narrow, dark margin. Black specks (pycnidia) may be visible in older lesions.
- Favored by cool, moist conditions.

Management

- Rotate to non-host crops.
- Utilize tillage to help destroy residue.

Phyllosticta lesions on a soybean leaf. Picture courtesy of Daren Mueller, Iowa State University Extension and Outreach.

Phytophthora Root Rot

Identification, Characteristics, and Diagnosis

- Caused by the soilborne fungal-like pathogen *Phytophthora sojae*.
- Can infect seedlings and plants in reproductive growth stages.
- Infected seedlings and plants at early vegetative stages have stems that appear bruised and soft, secondary roots are rotted, leaves are yellow and brown, and plants can wilt and die.
- Plants infected later in the season have brown lesions on the roots, rotted roots, and a dark, chocolate-brown stem lesion extending upward several inches from below the soil line.
- Leaves turn yellow, wilt, and remain attached to the plant after dying.
- Favored by wet, poorly-drained soils, clay soils, and compacted soils.
- There are 25 different races of this pathogen.

Management

- Plant resistant soybean products relative to the identified race within the field.
- Utilize seed treatments.
- Improve field drainage.
- Rotate to non-host crops.
- Consider tillage to help destroy residue.
- Cultivation may promote new root growth when soil is thrown against the stem base.

Soybean seedlings killed by Phytophthora.

Phytophthora lesion on a soybean stem.

Pythium Damping Off

Identification, Characteristics, and Diagnosis

- Caused by a group of soilborne fungal-like organisms (Oomycetes) related to *Phytophthora*. Prominent *Pythium* species include *Pythium ultimum*, *P. heterothallicum*, *P. irregulare*, *P. attrantheridium*, *P. sylvaticum*, and *P. perplexum*.
- Pre-emergence infection results in seeds failing to germinate and deteriorating.
- After emergence, Pythium-infected roots develop lesions, become discolored, deteriorate, and rot, resulting in seedling death (seedling blight or damping-off). Because of rotted roots, seedings can be easily pulled from the soil.
- Seedlings can be killed within 24 hours if environmental conditions are favorable for disease development.
- *Pythium* species can survive up to 10 years in soil and be reintroduced when plants become infected.
- Secondary infections can occur because of the pathogen's ability to travel with water and be introduced into previously non-infested fields through flooding.
- Favored by saturated soils.

Management

- Seed treatments should be used, particularly for fields with a history of *Pythium* infection.
- Improve field drainage through tiles, ditching, and compaction reduction.
- Delay planting until soil temperatures favor rapid germination.

Damping-off resulting from Pythium infection.

Red Crown Rot

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Calonectria ilicicola*.
- Pathogen overwinters on infected residue in and on the soil.
- Root infection can occur soon after planting; however, initial symptoms may not appear until mid- to late-reproductive growth stages.
- Brick-red reproductive structures appear (usually during high soil moisture) on the base of the stem at the soil line, roots become black with areas of rot, and leaves have interveinal yellow or brown blotches.
- Favored by moderate soil temperatures (77 to 86°F) and wet soil.

Management

- Rotate to non-host crops for two or more years; avoid planting peanuts.
- Delay planting until soil conditions are favorable for rapid emergence.
- Manage nematode populations.
- Utilize tillage to help destroy residue.

Red lesions on soybean stems resulting from red crown rot.

Foliar symptoms of red crown rot. Picture courtesy of Dr. Guy B. Padgett, LSU AgCenter.

Rhizoctonia Damping-Off and Root Rot

Identification, Characteristics, and Diagnosis

- Caused by the soilborne fungus *Rhizoctonia solani*.
- The pathogen can survive for years by overwintering in infected soybean residue and in the soil.
- The disease can cause early-season stand loss because of seed rot, root rot, and lesions that form on the hypocotyl. The hypocotyl lesions are reddish-brown and sunken.
- Dead seedlings can be scattered within a field or in concentrated areas.
- Mid- to late-season symptoms appear as premature yellowing, stunted growth, and have the reddish-brown sunken lesion.
- Favored by warm, wet conditions; however, infection has occurred across a wide range of temperatures and soil moisture conditions.

Management

- Improve soil drainage and reduce compaction.
- Utilize fungicide seed treatments.
- Rotate with wheat and corn.
- Fertility and soil pH should be managed per soil test results.

Rhizoctonia lesions on soybean stems. Picture courtesy of Daren Mueller, Iowa State University, Bugwood.org.

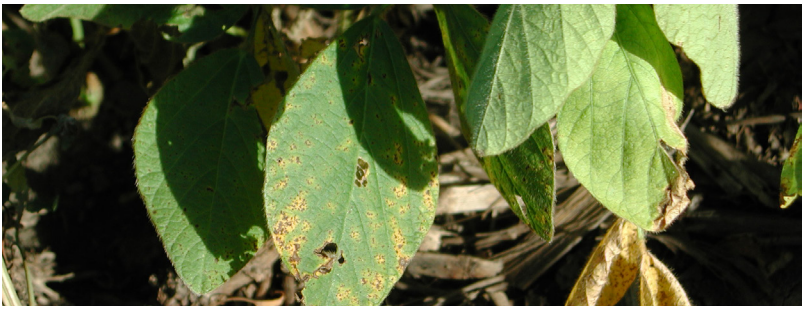
Septoria Brown Spot (Brown Spot)

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Septoria glycines*.
- Irregular, dark-brown lesions or spots that are often surrounded by a yellow halo develop on lower leaves.
- Lesions can be small specks to 1/5 inch in diameter and coalesce to form larger spots.
- Defoliation can occur.
- Favored by wet weather and temperatures ranging from 79 to 83°F.

Management

- Delaro® is a recommended foliar fungicide available for soybeans*.
- To limit the potential for fungicide resistance, do not make more than two sequential applications of this fungicide or any Group 11 fungicide before rotating to a fungicide from a different group.
- Rotate to a non-host crop for at least 1 year (avoid continuous soybean).
- Improve field drainage if possible.
- Planting later may reduce the potential for a saturated environment.



Septoria brown spot.

For more information about Delaro, please visit **https://www.cropscience.bayer.us/products/fungicides/delaro and contact your retailer. The ideal application window for applying a fungicide is between the growth stages R2 and R5. More than one fungicide application may be needed in environments with high disease pressure.*

Sclerotium Blight, Southern Blight

Identification, Characteristics, and Diagnosis

- Caused by the soilborne fungus *Sclerotium rolfsii*.
- Sclerotia overwinter in soil and can remain viable for 3 to 4 years.
- The fungus infects plants when conditions are wet and hot (77 to 95°F).
- Seedlings are subject to damping-off.
- Brown spots develop and expand on leaves. Leaves finally turn brown and remain attached.
- Lesions can develop at the soil line and extend up the stem several inches with a white fungal mass on or above the lesion.
- Residue nearby infected plants may have fungal growth.
- Small, yellow/red/brown fruiting structures (sclerotia) can be observed on the stem.
- Soybean plants are susceptible from emergence through pod fill. The greatest concern is when infection occurs during vegetative growth stages.

Management

- Rotate to corn or other non-host crops for at least 1 year.
- Do not plant tomatoes because of susceptibility.
- Reduce the potential for transfer of soil or residue to non-infected fields.
- Deep tillage to bury microsclerotia may reduce their longevity.

Sclerotium fruiting bodies on a soybean stem caused by Sclerotium blight. Picture courtesy of Clemson University - USDA Cooperative Extension Slide Series, Bugwood.org.

Sudden Death Syndrome

Identification, Characteristics, and Diagnosis

- Caused by the soilborne fungus *Fusarium virguliforme*.
- Initial visual symptoms appear as small, yellow spots on leaves during reproductive growth stages (infection usually occurs on seedlings).
- The spots progress to interveinal chlorosis (yellowing) and eventually the leaf tissue dies.
- Leaves may fall prematurely, leaving petioles attached.
- Foliar symptoms can resemble stem canker, charcoal rot, and chemical injury.
- Roots are rotted, pith tissue remains white, and xylem (cortical tissue) is gray to brown.
- More severe in the presence of soybean cyst nematode (SCN) (*Heterodera glycine*), and in low, wet field areas.
- Favored by cool, wet conditions and may be worse following corn as the pathogen also causes stalk rot.

Management

- Plant soybean products with higher tolerance ratings. Earlier-maturing products may have a lower potential for infection.
- Utilize soybean seed treatments.
- Delay planting until soil conditions are drier and warmer.
- Improve field drainage, reduce soil compaction, and manage SCN.

Sudden death syndrome of soybean.

Target Leaf Spot

Identification, Characteristics, and Diagnosis

- Caused by the fungus *Corynespora cassiicola*.
- Lower leaves develop small, brown specks (spots) that are round to irregular with a possible yellow halo.
- Mature spots may be 3/8 to 5/8 inches or more in diameter. Some may have a zonate appearance.
- Areas of infection on stems and petioles are dark-brown and range from specks to elongated lesions.
- Lesions developing on pods are circular, usually small (1/32 inch), and purple or black with brown margins.
- Favored by high humidity (greater than 80%) or free moisture and cool to moderate soil temperatures. Dry conditions help suppress the disease.

Management

- Plant tolerant soybean products.
- Reduce surface residue through tillage.
- If possible, avoid planting back-to-back soybean.
- Fungicides are not recommended because the disease has a low potential for yield reduction.

Target spot lesions on a soybean leaf.

Columbia Lance Nematode

Identification, Characteristics, and Diagnosis

- *Hoplolaimus columbus.*
- Very common in coarse-textured soils, primarily in Southeastern states.
- Feeds internally and externally on soybean roots.
- Oval patches of stunted and/or wilted plants parallel to soybean rows.
- Feeding lesions can coalesce and appear like a root rot.
- Taproot and secondary roots are pruned.
- Nitrogen uptake and nodulation can be reduced resulting in yellowish plants.
- Wilting can occur regardless of ample moisture.

Management

- Some soybean products may have tolerance.
- Utilize an in-furrow or seed treatment nematicide.
- Rotate to peanuts (corn or cotton can increase populations).

Lesion Nematode

Identification, Characteristics, and Diagnosis

- Several species of *Pratylenchus*.
- Common in coarse-textured soils, primarily in Southeastern states.
- Penetrates roots to feed and lay eggs.
- Feeding lesions can coalesce and appear like a root rot.

Management

- Some soybean products have tolerance.
- Utilize an in-furrow or seed treatment nematicide.
- Delay planting.
- Rotate with corn.

Soybean Cyst Nematode (SCN)

Identification, Characteristics, and Diagnosis

- *Heterodera glycines*.
- More common in sandy soils; however, SCN is well distributed throughout most soil types.
- Penetrate roots to feed.
- Evidence of feeding may be unnoticed until plants are under stress.
- Common symptoms include yellowish leaves and stunting.
- Nitrogen-fixing nodule formation can be reduced.
- Feeding wounds can be entry points for other diseases.
- Female cysts (initially white) that contain up to 500 eggs develop on roots. As cysts mature, their color changes from white, to yellow, to brown. Brown cysts have died and become the overwintering stage.
- Hot weather can reduce reproduction while cool to moderate weather can increase reproduction.
- Genetic variance occurring within SCN populations creates distinct and different HG-types

Management

- Plant soybean products that are resistant to field-identified races.
- Utilize an in-furrow or seed treatment nematicide.
- Rotate to non-host crops.
- Manage weedy hosts.
- Maintain adequate fertility.
- Soil sample in the fall to determine SCN populations and HG types.

Sting Nematode

Identification, Characteristics, and Diagnosis

- *Belonolaimus longicaudatus*.
- Found in very sandy soils.
- Feeds externally on roots and lays eggs in the soil.
- Common symptoms include poor growth, stubby roots, and possibly a tap root with few lateral roots, but no fibrous roots.

Management

- Utilize an in-furrow or seed treatment nematicide.
- Rotate to non-host crops.

Reniform Nematode

Identification, Characteristics, and Diagnosis

- *Rotylenchulus reniformis.*
- Found in any soil type.
- Survives winter as either wormlike pre-adults or eggs.
- Common symptoms include stunted plants and roots.
- Soil particles adhere to egg masses.

Management

- Plant resistant soybean products.
- Utilize an in-furrow or seed treatment nematicide.
- Rotate to non-host crops.

Bean Pod Mottle Virus (BPMV)

Identification, Characteristics, and Diagnosis

- Vectored by the bean leaf beetle, *Cerotoma trifurcate* Förster.
- Foliar symptoms range from mild chlorotic mottling on upper leaves to puckering and severe mosaic in lower leaves.
- Delayed maturity or green stems are often observed near harvest.
- Seed coat mottling may be present.
- The virus overwinters in bean leaf beetles, which infect seedlings as they feed.
- The virus can also overwinter in perennial weeds and infected seed.
- Plant infection by BPMV and soybean mosaic virus (SMV), vectored by soybean aphid (*Aphis glycines*), may cause severe dwarfing, foliar distortion, leaf necrosis, leaf mottling, and severe yield loss.

Management

- Managing emerging and first-generation bean leaf beetles in the spring with timely and labeled insecticides can reduce populations of the virus-laden insects.
- Controlling alternative BPMV hosts (cowpea (*Vigna unguiculate*), other bean species, and *Demodium* species) can help reduce the inoculum source.
- Delayed planting may increase early-season death of bean leaf beetles, reducing the vectoring population.

Bean pod mottle virus. Picture courtesy of Edward Sikora, Auburn University, Bugwood.org.

Soybean Mosaic Virus

Identification, Characteristics, and Diagnosis

- Vectored by the soybean aphid, *Aphis gylcines*.
- A green/yellow mosaic pattern is the most common initial symptom on leaves.
- More mature leaves may exhibit a yellow/brown mosaic pattern.
- Premature defoliation is common.
- Infected seeds exhibit a brown or black mottling.
- The virus is spread from plant to plant by soybean aphid feeding.
- Plant infection by SMV and bean pod mottle virus (BPMV), vectored by bean leaf beetles (*Cerotoma trifurcate* Förster), may cause severe dwarfing, foliar distortion, leaf necrosis, leaf mottling, and yield loss.

Management

- Seeds should be virus-free.
- Plant resistant soybean products.
- Early planting may minimize aphid transmission at an early crop growth stage.
- Insecticide applications are not recommended because some insecticides may increase soybean aphid movement in the field, increasing the dissemination of the virus.

Soybean mosaic virus symptoms. Picture courtesy of Daren Mueller, Iowa State University, Bugwood.org.

Soybean Vein Necrosis Virus (SVNV)

Identification, Characteristics, and Diagnosis

- Vectored by soybean thrips, *Neohydatothrips variablilis* Beach.
- Virus infection can occur throughout the growing season; however, symptoms are most visible after flowering, around mid-June.
- Initial symptoms appear as thread-shaped vein clearing along the main leaf veins; severe infections may result in purple to dark-brown lesions across most of the leaf..
- Veins become yellow and necrotic as the growing season progresses.
- Several areas on a leaf may have lesions.
- Early lesions lack defined edges.
- Highest canopy leaves are most affected because emerging leaves are prime feeding sites for soybean thrips.
- Favored by cool temperatures and mild winters followed by a warm spring, which may help increase thrips populations.

Management

- Control soybean thrips with timely and labeled insecticides.
- Control alternate virus hosts, ivyleaf morning glory (*Ipomoea hederacea* Jacq), cowpea (*Vigna unguiculate*), and mung bean (*Vigna radiata*), can help reduce the inoculum source.

Soybean vein necrosis virus.

Tobacco Ringspot Virus (TRV)

Identification, Characteristics, and Diagnosis

- Vectored by dagger nematode (*Xiphinema americanum*) at a low level; also transmitted by infected seed and mechanical distribution. The virus can be viable within the seed embryo for at least 5 years.
- Infection causes leaves to become thicker, darker, and necrotic.
- Infected stems remain green longer than healthy stems, pith and branches may become brown, and shepherd's crooking may develop.
- Stunting is common and fewer seeds are produced.
- Pods are undeveloped or aborted because of insufficient pollen production, which can cause a proliferation of new buds and pods (green bean syndrome).
- Favored by hot, dry weather.

Management

- Plant virus-free seeds.
- Manage dagger nematode populations.
- Control weed hosts such as Palmer amaranth (*Amaranthus palmeri*) and lambsquarter (*Chenopodium album*).
- Plant soybean fields next to corn rather than pastures.

Tobacco Ringspot Virus.

Sources (verified June 2019)

Fungus Foliage Diseases of Soybeans. PPD N. 503. 1990. Reports on Plant Diseases. Integrated Pest Management. https://ipm.illinois.edu/.

Thomas-Murphy, J. Alternaria leaf spot. Diseases of Soybeans. Field Crops. Cornell University. https://fieldcrops.cals.cornell.edu/.

Geisler, L.J. Anthracnose. CROPWATCH. University of Nebraska – Lincoln. https://cropwatch.unl.edu/.

Malvick, D. Anthracnose on soybean. University of Minnesota. https://extension.umn.edu/.

Faske, T. and Kirkpatrick, T. Aerial blight of soybean. University of Arkansas. https://www.uaex.edu.

Allen, T. July 22, 2011. Aerial web blight of soybean. Mississippi Crop Situation. Mississippi State University Extension. http://www.mississippi-crops.com.

Kelly, H.M. and Stewart, S. Soybean rust. Institute of Agriculture. The University of Tennessee https://guide.utcrops.com.

Smith, D. Asian soybean rust. Wisconsin Field Crops Pathology. University of Wisconsin. https://fyi.extension.wisc.edu/.

Coker, C., Hurst, K., Kirkpatrick, T., Rupe, J., Tingle, C., and Trent, M. 2005. Asian soybean rust. FSA7531. Agricultural and Natural Resources. University of Arkansas. https://www.uaex.edu.

Malvick, D. 2018. Bacterial blight of soybean. University of Minnesota. https://extension.umn.edu/..

Faske, F., Kirkpatrick, T., Zhou, J., and Tzanetakis, I. 2014. Soybean diseases. Arkansas Soybean Production Handbook. Chapter 11. University of Arkansas. https://www.uaex.edu/.

Giesler, L.J. Bacterial pustule. CROPWATCH. University of Nebraska. https://cropwatch.unl.edu./.

Giesler, L.J. Bean pod mottle virus. CROPWATCH. University of Nebraska. https://cropwatch.unl.edu.

Malvick, D. Bean pod mottle virus on soybean. University of Minnesota. https://extension.umn.edu/.

Smith, D. Bean pod mottle virus. Wisconsin Field Crops Pathology. University of Wisconsin. https://fyi.extension.wisc.edu/.

Westphal, A., Abney, T.S., and Shaner, G. 2006. Brown stem rot. Diseases of Soybean. BP-41-W. Purdue University. https://www.extension.purdue.edu/.

Kelly, H.M. and Stewart, S. Cercospora leaf blight. Institute of Agriculture. The University of Tennessee https://guide.utcrops.com.

Hershman, D.E. 2009. Cercospora leaf blight in Kentucky. Plant Pathology Fact Sheet. PPFS-AG-S-20. University of Kentucky. https://plantpathology.ca.uky.edu.

Smith, D. 2014. Cercospora leaf blight and purple seed stain of soybean. Wisconsin Field Crops Pathology. University of Wisconsin. https://fyi.extension.wisc.edu/.

Malvick, D. 2018. Charcoal rot on soybean. University of Minnesota Extension. https://extension.umn.edu/.

Hershman, D.E. 2011. Charcoal rot of soybean. Plant Pathology Fact Sheet. PPFS-AG-S-02. University of Kentucky. http://plantpathology.ca.uky.edu.

Soybean pod and stem blight. Integrated Crop Management. Iowa State University. https://crops.extension.iastate.edu/.

Malvick, D. 2018. Stem canker on soybean. University of Minnesota Extension. University of Minnesota. https://extension.umn.edu/.

Kleczewski, N. 2017. Stem canker on soybeans. Field Crops Disease Management. http://extension.udel.edu/.

Kelly, H.M. and Stewart, S. Downy mildew. Institute of Agriculture. The University of Tennessee https://guide.utcrops.com.

Faske, T. and Kirkpatrick, T. Downy mildew of soybean. University of Arkansas. https://www.uaex.edu.

Kelly, H.M. and Stewart, S. Frogeye leaf spot. Institute of Agriculture. The University of Tennessee https://guide.utcrops.com.

Faske, T. 2016. Soybean disease update and management: Frogeye leaf spot. University of Arkansas. http://www.arkansas-crops.com/.

Nelson, B. Fusarium root rot. Soybean Diseases. North Dakota State University. https://www.ndsu.edu/.

Thomas-Murphy, J. Fusarium wilt. Field Crops. Cornell College of Agriculture and Life Sciences. https://fieldcrops.cals.cornell.edu/.

Soybean management guide. Clemson University. https://scsoybeans.org/.

Padgett, G. Nematode management in soybean. Louisiana State University. https://www.lsuagcenter.com/.

Mulrooney, R.P. 2011. Soybean cyst nematode. PP-02. University of Delaware. https://extension.udel.edu/.

Sisson, A. Phyllosticta leaf spot. Integrated Crop Management. Iowa State University. https://crops.extension.iastate.edu/.

Phyllosticta leaf spot of soybean. Crop Protection Network. https://cropprotectionnetwork.org/.

Malvick, D. 2018. Phytophthora root and stem rot on soybean. University of Minnesota. https://extension.umn.edu/.

Smith, D. Phytophthora root and stem rot. Wisconsin Field Crops Pathology. University of Wisconsin. https://fyi.extension.wisc.edu/.

Zitnick-Anderson, K., Markell, S., and Nelson, Jr., B. 2014. Pythium damping-off of soybean. PP1737. https://www.ag.ndsu.edu.

Allen, T. 2012. Soybean seedling disease identification: Pythium damping-off and root rot. Mississippi Crop Situation. Mississippi State University. http://www.mississippi-crops.com.

Padgett, B. 2011. Red crown rot. Root & Lower Stem Diseases. Soybean Disease Atlas. LSU AgCenter. Louisiana State University. https://www.lsuagcenter.com/.

Scott, K. and Dorrance, A. 2017. Rhizoctonia damping-off and root rot of soybeans. Ohioline. The Ohio State University. https://ohioline.osu.edu/.

Kelly, H.M. and Stewart, S. Brown spot. Institute of Agriculture. The University of Tennessee https://guide.utcrops.com.

Faske, T. and Kirkpatrick. Brown spot of soybean. University of Arkansas. https://www.uaex.edu.

Kleczewski, N. 2017. Southern blight in soybeans. Field Crops Disease Management. University of Delaware. https://extension.udel.edu/.

Faske, T. and Kirkpatrick, T. Southern blight of soybean. University of Arkansas. https://www.uaex.edu/.

Zhou, J. and Tzanetakis, I.E. Soybean mosaic virus. University of Arkansas. https://www.uaex.edu.

Mueller, D. 2013. Soybean vein necrosis virus identified in Iowa. Integrated Pest Management. Iowa State University. https://crops.extension.iastate.edu/.

Byamukama, E., Dorrance, A., Jardine, D., Malvick, D., Markell, S., Nachappa, P., Sisson, A., and Sweets, L. 2015. Soybean vein necrosis virus. Soybean Disease Management. CPN-1003. Crop Protection Network. www.soybeanresearchinfo.com/.

Zhou, J. and Tzanetakis, I.E. Soybean vein necrosis virus. University of Arkansas. https://www.uaex.edu/.

Kelly, H.M. and Stewart, S. Southern stem canker. Institute of Agriculture. The University of Tennessee https://guide.utcrops.com.

Spurlock, T. 2015. Sudden death syndrome of soybean found. Arkansas Row Crops. University of Arkansas. http://www.arkansas-crops.com.

Kelly, H.M. and Stewart, S. Target leaf spot. Institute of Agriculture. The University of Tennessee https://guide.utcrops.com.

Faske, T. and Kirkpatrick, T. Target spot of soybean. University of Arkansas. https://www.uaex.edu.

Zhou, J. and Tzanetakis, I.E. Tobacco ringspot virus. University of Arkansas. https://www.uaex.edu.

Malvick, D. 2018. Sclerotinia stem rot (white mold) on soybean. University of Minnesota Extension. https://extension.umn.edu.

Smith, D. White mold of soybean (Sclerotinia stem rot). Wisconsin Field Crops Pathology. University of Wisconsin-Madison. https://fyi.extension.wisc.edu.

Legal Statements