MISSISSIPPI
SOYBEAN SCOUTING GUIDE

A farmer reference for the identification and management of soybean pests and problems

MISSISSIPPI STATE UNIVERSITY

MSPB
MISSISSIPPI SOYBEAN PROMOTION BOARD

INTRODUCTION

The Mississippi Soybean Promotion Board (MSPB) and the soy checkoff work to increase the profitability of soybean production in Mississippi. The volunteer farmer-leaders who serve on the MSPB board of directors invest your checkoff dollars in research to improve soybean production practices to make your farm more profitable and ensure the sustainability of Mississippi soybean production.

This guide outlines scouting practices, common pests and other issues in Mississippi soybeans. Use this information to help identify and treat problems in the field. This guide is not meant to replace the expertise of an agronomist or crop consultant and should be used only as a reference.

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INTRODUCTION TO SCOUTING

Scouting fields gives farmers a wealth of information they can use to evaluate crop progress, determine in-season pest-management treatments and amass valuable data that can aid in future planting decisions. Getting that information requires a plan for how and when to monitor your fields.

HOW TO SCOUT

- Start at a different point each week. **Walk a random pattern in each field.** Don't consciously pick out good or bad spots.
- Many pest problems begin at field edges. **Walk into each field at least 30 feet from every border.** If a problem is found, try to find out whether it is isolated or widespread.
- As samples are **taken, look at plants around the sample site.** Scan the field while walking from one site to the next.
- If you find insects or weeds you don't recognize, consult your county extension personnel or another expert.

3 KEYS TO INTEGRATED PEST MANAGEMENT

1. Scout regularly & systematically
2. Treat only when a pest population reaches a profit-threatening economic threshold
3. When control is needed, apply the labeled rate of pesticide with properly calibrated equipment

LOOK FOR PATTERNS

- Problems in high or low spots may be related to soil conditions
- Problems on only one side of the field may be related to spray drift or an invasion from a field border
- Problems in isolated plants may indicate root or stem diseases
- Problem areas with sharply defined edges may indicate nematode injury

MANAGING A SOYBEAN CROP THROUGH GROWTH STAGES

VEGETATIVE STAGES

EMERGENCE TO COTYLEDON

VE

VC

MANAGEMENT PRACTICES:
Scout for adequate and uniform stand. If stand is poor or not uniform, replanting may be necessary.

FIRST TRIFOLIATE TO SECOND TRIFOLIATE

V1

V2

MANAGEMENT PRACTICES:
Scout for early-season weeds, insects and diseases.

Apply post-emergence herbicides if needed to control small emerged weeds.

REPRODUCTIVE STAGES

BEGINNING FLOWERING TO FULL BLOOM

R1

R2

MANAGEMENT PRACTICES:
Scout for insects and diseases. Spray foliar insecticide or fungicide, if needed. See Insect Control Guide for Agronomic Crops in Mississippi. Check soil moisture status using soil moisture sensors. Start or complete irrigation setup.

REPRODUCTIVE STAGES

BEGINNING POD

R3

MANAGEMENT PRACTICES:
Scout for insects and diseases. Spray foliar insecticide or fungicide, if needed. Identify drought stress, which can affect pod formation. Beginning irrigation, if used, is critical at this stage.

FULL POD TO BEGINNING SEED

R4

R5

MANAGEMENT PRACTICES:
Scout for insects and diseases. Late-season diseases and defoliation or pod-feeding by insects can severely impact yields. Spray foliar insecticide or fungicide, if needed.

FULL SEED

R6

MANAGEMENT PRACTICES:
Check soil moisture status for possible last irrigation.

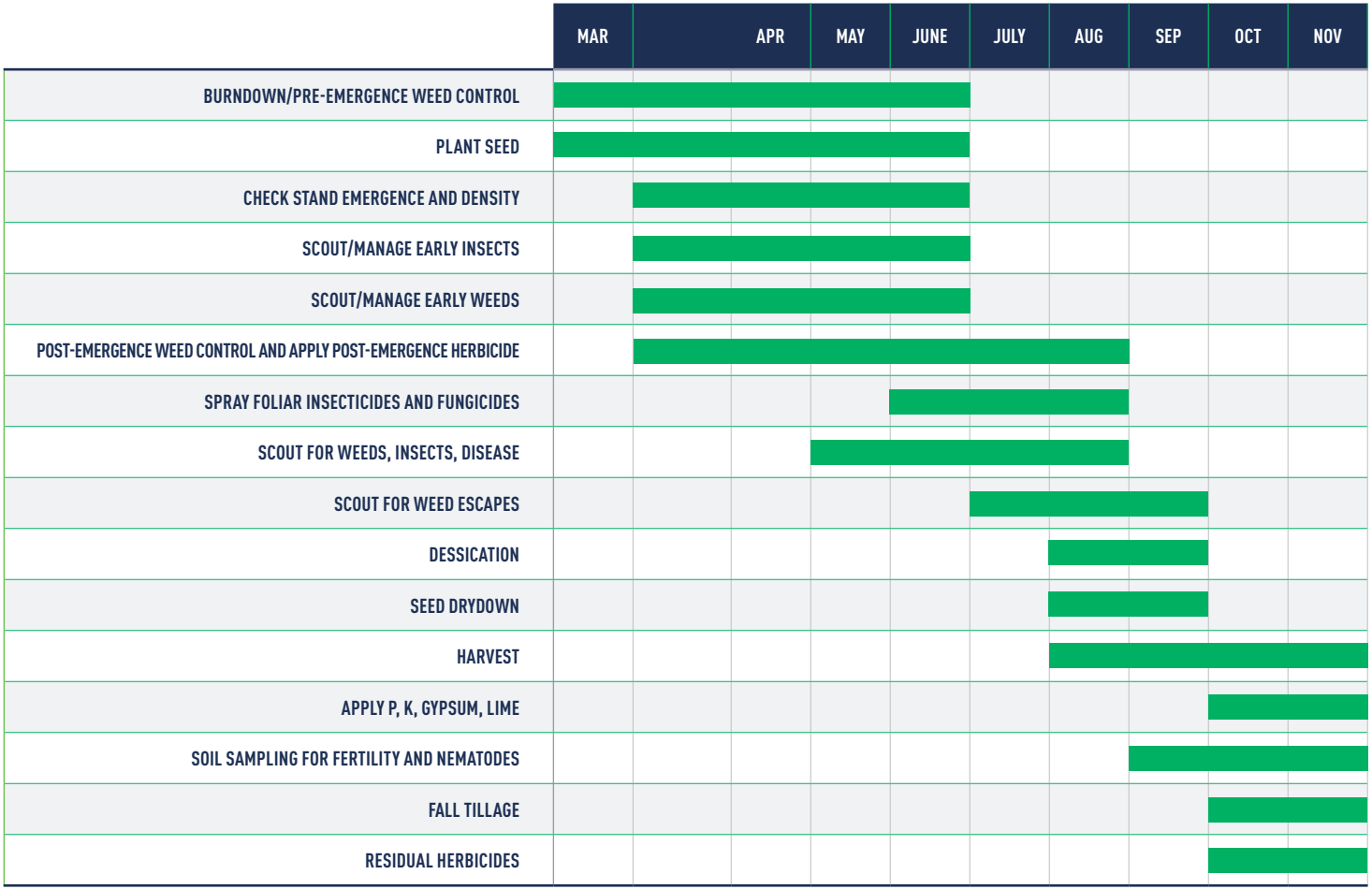
BEGINNING MATURITY TO FULL MATURITY

R7

R8

MANAGEMENT PRACTICES:
Scout for issues before harvest, e.g., green stem syndrome and redbanded stink bug. Utilization of desiccants is a viable option after stage R6.5. If the plant is still green, the best option is to harvest slowly and make sure the harvesting equipment is sharp and in excellent condition.

SCOUTING CALENDAR



SYMPTOMS AND POSSIBLE CAUSES

SYMPTOMS	POSSIBLE CAUSES
SEEDLING SYMPTOMS:	
Seedlings don't emerge	Low seed quality, root rots, herbicide injury, crusting or deep planting depth
Seedling death	Root and stem rots or herbicides (such as metribuzin and linuron) that inhibit photosynthesis
LEAF SYMPTOMS:	
Misshapen leaves	Herbicide injury, virus infection or thrips
Leaves yellow from edges	Potassium deficiency
Leaves yellow, veins green	Manganese deficiency
Leaves twisting in top, yellow in color	Insect (potato leaf hopper) smooth leaf varieties
Bronze leaves	Disease, virus or thrips
Holes in leaves	Foliage-feeding insects, hail damage or disease
Spotted leaves (or stems)	Diseases or tiny insects, such as thrips
Leaf yellowing spreads quickly from top; poor nodulation	Iron deficiency chlorosis
Light-colored leaves or yellowish plants	Nitrogen and sulfur deficiencies (N deficiencies may be caused by a number of problems, including poor nodulation and cyst nematode)
Interveinal chlorosis	Root disease (e.g., taproot decline or SDS), root-knot nematode or foliar fungicide phytotoxicity

SYMPTOMS	POSSIBLE CAUSES
WHOLE PLANT SYMPTOMS:	
Twisted or broken plants	Chemical damage (frequently from synthetic auxin herbicide) or stem-feeding insects, likely the three-cornered alfalfa hopper
Stunted plants	Viruses, nematodes, root diseases or chemical damage
POD SYMPTOMS:	
Absence of pods or seeds	Poor growing conditions earlier in season, pod-feeding insects, some viruses, translocated chemicals
ROOT SYMPTOMS:	
Stunted roots	Soil compaction or hardpan, root rots, nematodes, insects or chemical damage
Cysts on small roots	Usually caused by soybean cyst nematode
Galls on roots	Usually caused by root-knot nematode
Limited nodulation	Lack of rhizobia, low pH, molybdenum deficiency, insect injury, nematodes, inadequate fertility

WEED CONTROL

The majority of Mississippi soybean farmers now face herbicide-resistant (HR) weeds in their fields, most notably weeds that are resistant to glyphosate. This problem threatens the production of a profitable crop.

The key to weed management is the correct identification and treatment of weeds while they are small, combined with a diversified plan for control. A good weed-management plan involves field scouting to determine the size and species present. The most critical time to control weeds is up to four weeks after crop emergence. When using a pre-emergence herbicide, fewer weeds of some species emerge, which reduces the number of weeds that will need to be controlled by post-emergence herbicides. This reduction in weeds resulting from application of post-emergence herbicide MOA's is the primary goal to proactively manage against herbicide resistance.

Scout for early-season weeds that survived the pre-emergence herbicide application, especially HR species. Control them soon after planting to avoid competition with soybean plants.

A successful weed-control program should include both pre- and post-emergence herbicides with overlapping residuals and representing multiple herbicide modes of action, along with proper tillage, rotation of crop sequences and rotation of herbicides with different modes of action.

For more information on weed management and herbicide resistance, visit IWillTakeAction.com/weeds

COMMON COCKLEBUR

CLASSIFICATION:

Asteraceae family. A summer annual.

DESCRIPTION:

Height: Up to 3 feet tall.

Leaves: Up to 3 inches long divided into three asymmetrical lobes. The upper surface is shiny dark green with short hairs that are denser on the veins. The lower surface is pale green and soft. Leaves alternate on the stem.

Stems: Erect and slightly curved with many branches. The stems have yellow or green three-pronged spines at the base of each leaf or branch.

Flowers: Male flowers are small and green to rusty red. They are found in spikes at the end of the branches or in the upper leaf axils. Female flowers produce hard and prickly burs at maturity. They form lower on the stem at the leaf axils at the nodes.

MANAGEMENT CONSIDERATIONS:

There are numerous control options with herbicides, including:
Burndown prior to soybean planting: 2,4-D, Dicamba, Glyphosate, Glufosinate, glyphosate + 2,4-D or Dicamba, numerous others.
Pre-emergence: Best control with Chlorimuron (Group 2) herbicide or herbicide mixes containing chlorimuron.
Post-emergence: Best control with chlorimuron and imazaquin (Group 2), bentazon (Group 6), and glyphosate (Group 2) or mixes with glyphosate; also glufosinate (Group 10) and cloransulam (Group 2).

Photo credit: David J. Moorhead, University of Georgia, Bugwood.org

HORSEWEED *(MARESTAIL)*

CLASSIFICATION:

Asteraceae (sunflower) family. Emerges from March through November, so considered both a winter and summer annual.

DESCRIPTION:

Height: 1-9 feet tall.

Leaves: Alternate and crowded along the stem with simple blades.

Stems: Erect, simple, with stiff hairs. Branched above the inflorescence.

Flowers: Small white, pink or yellow disc flowers.

MANAGEMENT CONSIDERATIONS:

Horseweed can germinate 10 months out of the year and be a challenge to control. Once it begins flowering, it becomes very difficult to control with post-emergence herbicides, so treat when the weed is small, typically with an effective fall and/or spring burndown program. Deep tillage can help combat horseweed.

Photo credit: www.mississippi-crops.com

MORNINGGLORY SPECIES

CLASSIFICATION:

Convolvulacea (morningglory) family. Annual.

DESCRIPTION:

Height: Vine up to 6 feet long.

Leaves: Butterfly-shaped cotyledons. Alternate ivy- or heart-shaped leaves up to 4 inches long/wide. Depending on the species, leaves may have few hairs or be densely pubescent.

Stems: Climbing, hairy vines.

Flowers: Multicolored, funnel-shaped flowers with colors including red, blue, purple, white and variegated.

MANAGEMENT CONSIDERATIONS:

The vining/climbing nature makes this a difficult weed to control. Control with glyphosate, glufosinate, ALS inhibitors or PPO inhibitors is ideal when plants are four leaves or smaller and have not developed runners. Once runners develop, control is greatest with linuron plus 2,4-DB applied as a direct spray.

Photo credit: John D. Byrd, Mississippi State University, Bugwood.org

PALMER AMARANTH

CLASSIFICATION:

Amaranthaceae (pigweed) family. Annual.

DESCRIPTION:

Height: Up to 8 feet tall.

Leaves: Alternate, ovate-shaped, hairless leaves with long petioles, prominent veins and a white V-shaped watermark.

Stems: Erect, branched and hairless. May be tinged red.

Flowers: Arranged in thick spikes. Male and female flowers are produced on separate plants. Male flowers have soft, thin, triangular bracts that shed pollen. Female flowers have bristly, stiff, sharp bracts.

MANAGEMENT CONSIDERATIONS:

This is the primary weed problem in Mississippi, as it has developed resistance to glyphosate as well as both ALS- and PPO-inhibiting herbicides. Combat with multiple herbicide modes of action and supplement herbicide control with hand weeding to remove all escapes. A single plant can produce a million seeds, so take all measures to prevent these weeds from producing seed.

Photo credit: Bruce Ackley, The Ohio State University, Bugwood.org

Photo credit: Take Action

PRICKLY SIDA (TEAWEED)

CLASSIFICATION:

Sida spinosa from the Malvaceae family. Emerges from April through September. A summer annual.

DESCRIPTION:

Height: Can grow up to 3 feet.

Leaves: Two heart-shaped cotyledons and small spines at the base of each leaf and branch. Oval with tooth-leaf margins, alternately arranged.

Stems: Occasionally branched.

Flowers: Pale yellow with five petals.

MANAGEMENT CONSIDERATIONS:

Seed germination is promoted with high temperatures and enhanced when seeds are subjected to wet-dry cycles. Burndown applications of glyphosate, glufosinate or paraquat are effective for control prior to planting. Several pre-emergence herbicides or herbicide combinations in Groups 2, 14 and 15 provide effective residual control. Fewer, but effective, herbicide options are available for post-emergence control of prickly sida.

Photo credit: United Soybean Board Take Action

COMMON RAGWEED

CLASSIFICATION:

Asteraceae (sunflower) family. Annual.

DESCRIPTION:

Height: Up to 3 feet tall.

Leaves: Thick, oblong cotyledons, more common as Lacy, finely divided and slightly hairy leaves up to 4 inches long. Lower leaves are alternate while upper leaves are opposite.

Stems: Erect, branched and hairy.

Flowers: Greenish-yellow flowers about 1/8-inch long. Male flowers are produced in racemes at the end of stems, and female flowers are produced in the upper leaf axils.

MANAGEMENT CONSIDERATIONS:

Ragweed is very competitive. Resistance to glyphosate has been documented in Mississippi. Residual herbicides are critical for early-season control of common ragweed. PPO inhibitors, ALS inhibitors and PSII inhibitors, such as metribuzin and linuron, should be considered where infestations occur. Combat with effective pre-emergence herbicides followed with effective post-emergence herbicides.

Photo credit: Ohio State Weed Lab, The Ohio State University, Bugwood.org

Photo credit: Take Action

SICKLEPOD

CLASSIFICATION:

Fabaceae (bean/pea) family. Annual.

DESCRIPTION:

Height: 1-6 feet tall.

Leaves: Rounded cotyledons with three to five distinct veins. Alternate leaves with four to six egg-shaped leaflets.

Stems: Erect, branched and hairless.

Flowers: Distinctive yellow petals that arise from the leaf axils. Seeds are housed in long, sickle-shaped hairless pods.

MANAGEMENT CONSIDERATIONS:

The critical time to control sicklepod is the first four weeks after planting. Control with glyphosate or glufosinate is ideal when plants are four leaves or smaller. Seeds can contaminate harvested seed, so manage escapes before plants go to seed to prevent dockage at the elevator.

Photo credit: Rebekah D. Wallace, University of Georgia, Bugwood.org

BARNYARDGRASS

CLASSIFICATION:

Asteraceae (sunflower) family. Summer annual.

DESCRIPTION:

Height: Up to 5 feet tall.

Leaves: Leaf blades are flat, rolled in the bud, and the upper surface is usually hairless. The leaf sheath is usually open and more or less flattened.

Stems: Stems are flattened near the base.

Flowers: Flowers bloom from June through October. They range from 2 1/2 to 10 inches (6.4-25.4 cm) long and consist of branches densely clustered with knotlike flowers. Upper branches are stiff and stand erect to somewhat erect from the flowering stem. Lower branches spread farther apart than the upper branches. The flower head is held erect or droops and is sometimes purplish.

MANAGEMENT CONSIDERATIONS:

Ensure that no barnyardgrass is emerged at planting. Always use full rates of herbicides. Every spray application should contain multiple herbicide modes of action that exhibit pre- and post-emergence activity on barnyardgrass. One example is glyphosate plus S-metolachlor in soybean. Time post-emergence applications appropriately to optimize herbicide efficacy and spray coverage. Prevent late-season escapes that will contribute to the weed soil seed bank.

Photo credit: Take Action

BROADLEAF SIGNALGRASS

CLASSIFICATION:

Poaceae (grass) family. Semi-prostrate summer annual.

DESCRIPTION:

Height: Up to 3 feet tall.

Leaves: Seedlings have hairless blades that may be maroon-tinged with hairy, maroon-tinged sheaths. True leaves are short, wide, hairless blades that are rolled in the bud. Margins, collars, ligules and sheaths are hairy.

Flowers: Slender, 12-inch-long seed head with two to six smaller branches. Spikelets are somewhat flattened.

MANAGEMENT CONSIDERATIONS:

Emerges from April through July, making it difficult to manage. Control with both pre-emergence and post-emergence herbicides.

Photo credit: Rebekah D. Wallace, University of Georgia, Bugwood.org

ITALIAN RYEGRASS

CLASSIFICATION:

Poaceae (grass) family. Annual.

DESCRIPTION:

Height: 1 to 3 feet tall.

Leaves: Seedlings have shiny leaves. True leaves are flat, glossy, hairless blades that range from 2 to 10 inches long. Leaves are rolled in the bud, and ligules are membranous. Auricles are usually well-developed but sometimes lacking.

Flowers: Small, stalkless spikelets alternate along the 3- to 12-inch-long main flowering stem. Needlelike awns, or bristles, are on the individual flowers.

MANAGEMENT CONSIDERATIONS:

The best time to control Italian ryegrass is in the fall with tillage or herbicides. If plants emerge in the spring, treat with clethodim or paraquat when plants are small, as larger plants become difficult to control because of profuse vegetative growth and a dense root system.

Photo credit: www.mississippi-crops.com

Photo credit: Take Action

YELLOW NUTSEDGE

CLASSIFICATION:

Cyperaceae (sedge) family. Perennial.

DESCRIPTION:

Height: Up to 2 feet tall.

Leaves: Shiny, green and hairless with a noticeable ridge along the midvein. Leaves occur in groups of three from the base of the plant.

Stems: Three-sided, erect and unbranched.

Flowers: Yellow or brown spikelets that occur at the ends of the stem in a cluster.

MANAGEMENT CONSIDERATIONS:

Nutsedge is hard to control because it is a perennial weed and emerges from tubers throughout the growing season. Tillage will only temporarily disrupt the tubers. Glyphosate provides only marginal control. Basagran and some ALS herbicides offer fair to adequate control.

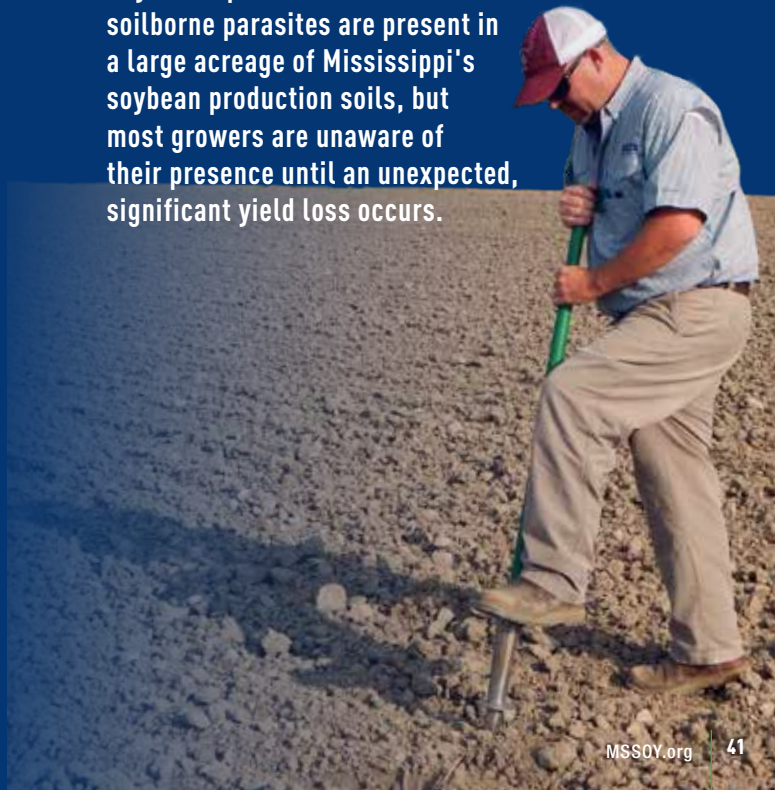
Photo credit: North Carolina State University, Bugwood.org

Photo credit: North Carolina State University, Bugwood.org

NEMATODE MANAGEMENT

The best way to detect nematodes is through soil sampling following harvest. Soil samples can then be submitted to the diagnostic laboratory for analysis to determine the specific nematode species present and the population density of nematodes present in the submitted soil sample. Nematode damage can be detected by routine visual scouting. Look for areas in the field where plants are stunted or off-color. The most important scouting tip to note about nematode issues is to be aware of the overall soil texture. Nematodes are pests of light-textured soils (sandy to silt loam), and are not problematic in soils containing high clay concentrations. Three species of nematodes are of economic importance in Mississippi: soybean cyst nematode, root-knot nematode and reniform nematode.

Reduced yield can be significant if soybeans are planted into soils with a high population of either reniform, root-knot or cyst nematodes. Where there is a large population of nematodes and a normally large root mass, a reduction in yield may only be noticeable after an extended period of favorable growing conditions. Caution! If a susceptible soybean variety is planted in this same location the next year, a large reduction in yield is possible. These hidden soilborne parasites are present in a large acreage of Mississippi's soybean production soils, but most growers are unaware of their presence until an unexpected, significant yield loss occurs.



ROOT-KNOT NEMATODE (RKN)

DESCRIPTION:

The root-knot nematode (RKN) is one of most damaging nematodes in Mississippi soybeans. Although this nematode is largely confined to sandy soils, it is capable of causing devastation where it occurs. The galls (or knots on the roots) are a distinctive feature of this nematode and make it easy to recognize, but galling is not a good indicator of susceptibility and resistance. In addition to galling, interveinal chlorosis in scattered areas throughout the field can be indicative of a root-knot nematode infestation.

DAMAGE:

The damage from this nematode is usually associated with spots or areas within a field and rarely occurs across the entire field.

SCOUTING TIPS:

Look for severely stunted plants during early vegetative stages. During reproductive growth stages, look for stunted plants or plants exhibiting interveinal chlorosis. Carefully remove plants from the soil profile and gently remove soil from roots to examine them for the presence of galling. Drought can enable this nematode to cause serious damage and subsequent yield losses.

MANAGEMENT CONSIDERATIONS:

The use of resistant varieties is the most effective management tool for RKN, but the number of resistant varieties is low, especially in Maturity Group 5 and earlier varieties. Crop rotation with corn, cotton and wheat is not a good management option for RKN, because these crops also serve as hosts for the nematode. If soybeans are planted in coarse-textured soils, soil samples should be taken every few years to provide an alert to any developing RKN problem.

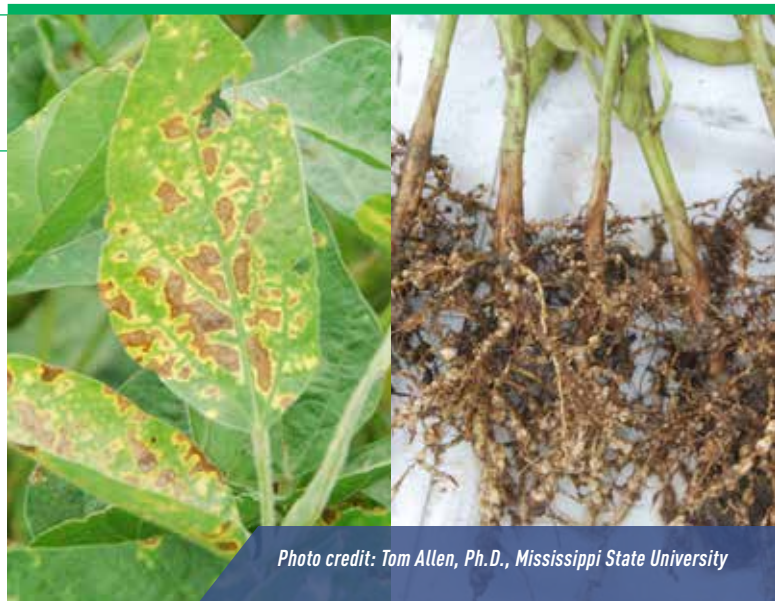


Photo credit: Tom Allen, Ph.D., Mississippi State University

RENIFORM NEMATODES (RN)

DESCRIPTION:

The reniform (RN) nematode will infect soybeans, but has not been a major threat to Mississippi soybean production. This nematode is largely confined to soils with a high silt content, so it is capable of causing yield losses as soybean acreage continues to increase on soils with these textures. Populations of this nematode can be extremely high, and in specific situations, an extremely high population is necessary before plant damage becomes noticeable.

DAMAGE:

The RN has been reported to cause much greater damage during drought stress; in years with adequate moisture, little damage may be observed. This nematode can reduce yield by several bushels per acre annually, and still remain unnoticeable.

SCOUTING TIPS:

Symptoms are not always clear-cut with RN in soybeans. Although there is stunting, the most common symptoms are yellowing and loss of yield.

MANAGEMENT CONSIDERATIONS:

There are no varieties resistant to this nematode. Use a biennial rotation of soybeans with corn, rice, grain sorghum or wheat, which are poor hosts for RN. Do not rotate with cotton since it is an excellent host for this nematode.

Photo credit: Tom Allen, Ph.D., Mississippi State University

SOYBEAN CYST NEMATODE (SCN)

DESCRIPTION:

Soybean cyst nematode (SCN) is the most important nematode pest of soybeans in the U.S. However, in Mississippi, yield losses as a result of SCN have declined in recent years. It does have serious potential for damage and is being constantly monitored for outbreaks or resurgences. The biggest challenges farmers face with SCN-infested fields are the lack of visible symptoms and yield losses, as well as determining the specific race (listed as HG-type in some literature) of the nematode present since the number of laboratories that help with this analysis is limited.

DAMAGE:

Irregular patches of stunted and/or yellow soybeans and a staggered growth pattern between plants that are affected and plants that are not affected in the same field. Areas in fields with irregular or staggered growth habits will increase in size and direction as tillage is conducted over time. Buildup of SCN in a field will result in a slow decline in yield over several years. In situations where the SCN populations build up to extremely high levels, soybean plants can die.

SCOUTING TIPS:

SCN may first appear in lower-yielding areas of a field since stress can be compounded. Because many of the current varieties seem to show slight foliar symptoms, watch out for yield reductions or areas not performing like they should.

MANAGEMENT CONSIDERATIONS:

Take soil samples. Soil sampling is the best tool for detecting SCN. Proper identification requires a laboratory analysis of the soil to determine the specific nematode and population numbers present. Plant resistant varieties. Different SCN-resistant soybean varieties come with different levels of resistance as well as resistance to different SCN HG types. Before purchasing an SCN-resistant variety, make sure the variety you choose has a sufficient level of resistance to the SCN population in your field. Rotate to non-host crops. By planting crops that are not SCN hosts, such as corn, alfalfa, wheat, barley, peanut and sorghum, you can prevent SCN from reproducing, hopefully resulting in an SCN-free field when you rotate back to soybean. However, multiple years of a non-host are required to sufficiently reduce SCN populations. Use the HG-type test to determine resistant varieties to plant. Seed treatment nematicides may reduce SCN population density, but should not be considered a long-term management practice.

Photo credit: Tom Allen, Ph.D., Mississippi State University

DISEASE MANAGEMENT

Diseases can and do cause economic losses for Mississippi soybean farmers. Several major diseases, including frogeye leaf spot, may be controlled with resistant varieties or fungicides once the disease is detected in the field. However, fungicide resistance has been reported in frogeye leaf spot populations in Mississippi and in at least one other foliar disease in the northern United States.

Other diseases, such as stem canker and sudden death syndrome (SDS), may only be prevented at or before planting by choosing resistant varieties or cultural practices like crop rotation. With these diseases, nothing can be done once symptoms are present in the field. To prevent diseases from reducing your soybean yields, consider implementing the following best management practices.

PLANTING RESISTANT VARIETIES

This is the first line of defense against diseases that rob soybean fields of yield. Selecting varieties that are resistant to foliar diseases reduces the need for fungicide application, which also reduces input costs. Remember that varietal resistance to Cercospora leaf blight, charcoal rot, Phomopsis seed decay, Pythium seed decay and damping-off, as well as aerial blight, is not available.

USING A SEED TREATMENT

Seed treatments can be a relatively inexpensive line of defense against soybean disease, especially when soybeans are planted into cool, wet soils. However, not all seed treatments are created equal. Use a seed treatment that controls a broad range of diseases and addresses the problems of a particular field for best results. Seed treatments are the only line of defense against early season seedling diseases caused by Fusarium, Pythium and Rhizoctonia, and seedling-associated diseases that include seed decay and damping-off (both pre- and post-emergence).

USING FOLIAR-APPLIED FUNGICIDES

Losses from some fungal leaf spot diseases such as anthracnose, pod and stem blight, soybean rust and some other mid- to late-season soybean diseases can be reduced economically with properly applied fungicides. In most cases, fungicides are more successful when applied to prevent rather than cure diseases. The use of foliar-applied fungicides can provide positive results when used correctly; however, they can be an expensive disappointment if improperly selected or incorrectly used.

SCOUTING

Regularly scout your fields for symptoms of diseases, which is the only clear way to identify disease problems. If you spot a disease in the field, first identify the specific disease before deciding on a management practice. Soybeans can withstand a certain amount of stress while experiencing minimal yield loss. If the threshold is not met, you may not protect your yield enough to pay for the treatment.

CROP ROTATION

Rotation of crops is a simple and effective way to maintain the health of the soil and prevent the incidence and severity of some diseases, such as frogeye leaf spot.

APPROPRIATE FERTILIZATION, IRRIGATION AND DRAINAGE

Follow MSU Extension Service's suggestions when using fertilizer, drainage and irrigation in your fields. Over-application of fertilizer, too little drainage or over-irrigating can contribute to the development of certain diseases.

SUDDEN DEATH SYNDROME (SDS)

DESCRIPTION:

A blue coloration may be found on the outer surface of taproots due to the large number of spores produced by the fungus responsible for SDS. Splitting the root reveals cortical cells have turned a milky gray-brown color while the inner core, or pith, remains white. Leaf symptoms first appear as yellow spots (usually on the upper leaves) in a mosaic pattern. Yellow spots merge to form chlorotic blotches between the leaf veins. As chlorotic areas die, leaves show yellow and brown areas contrasted against green veins. Affected leaves twist and curl and fall from plants prematurely. Flowers and pods abort, and seeds are smaller. Later-developing pods may not fill, and seeds may not mature. In situations where SCN is present at high soil populations and an SCN-susceptible variety is planted, the areas exhibiting SDS may be much larger in size.

DAMAGE:

Cool, moist conditions early in the growing season often result in greater disease incidence.

SCOUTING TIPS:

The infection of the fungus that causes SDS usually occurs early in the season, as it begins to infect the roots. Symptoms usually don't surface until late July or August. The disease is worse when soybeans are planted early into cool, wet soils, and when soils are saturated from ample rainfall throughout the summer.

MANAGEMENT CONSIDERATIONS:

Plant SDS-resistant varieties in fields with a known history of the disease. Reduce soil compaction and improve drainage to reduce excess soil moisture. Crop rotation and tillage practices can reduce the risk of SDS in soybeans. Foliar fungicide can neither protect plants from SDS nor reduce its impact once soybeans are infected. Currently, SDS is not a major problem in Mississippi.

Photo credit: Tom Allen, Ph.D., Mississippi State University

SOYBEAN RUST

DESCRIPTION:

Superficial, angular, tan to brown lesions can develop on the upper leaf surface. On the underside of the leaf, and opposite lesions, pustules form. Pustules are raised areas that contain spores. Observations to confirm the presence of soybean rust on the underside of the leaf require the use of a hand lens.

ENVIRONMENT:

Soybean rust is primarily a threat to late-planted soybeans (or double-crop soybeans). Soybean rust is a cool-weather disease. Spores infect at temperatures of 46 to 82 degrees. Leaves must be wet for infection to occur.

SCOUTING TIPS:

Soybean rust has not been a big problem in Mississippi, but it has the potential to be damaging. Keep an eye on the national movement of the pathogen with the aid of the soybean rust monitoring website (http://sbr.ipmpipe.org/cgi-bin/sbr/public.cgi), and consult with your crop adviser or extension agent to determine when to start scouting. Scouting for this disease generally begins at the flowering (R1) stage. Be prepared to scout for rust outbreaks in later plantings.

MANAGEMENT CONSIDERATIONS:

Early-planted, early-maturing varieties will rarely be damaged by rust invasions in the Mid-South, since it usually appears after these plantings have reached advanced reproductive stages. Application of foliar fungicides is an effective management tool if applied before significant rust presence and prior to R6.

Photo credit: Tom Allen, Ph.D., Mississippi State University

CERCOSPORA LEAF BLIGHT

DESCRIPTION:

Cercospora leaf blight is also referred to as late-season Cercospora because of its prevalence on soybeans in the late stages of growth and development. Light purple or bronze discoloration develops on the upper surface of leaves in the uppermost canopy. As disease progresses, affected leaves develop a dark purple, leathery appearance. Some leaves may be partly rolled at their margins, while others appear lightly crinkled. The earlier defoliation occurs, the greater the potential yield loss. Symptoms associated with the disease can also be expressed on pods, petioles and stems of the soybean plant. Seed infection results in purple areas on the seed coat (see the section on purple seed stain for more specific information regarding the infection of seed).

ENVIRONMENT:

Warm, wet weather, especially during periods of heavy dew, supports infection by the fungus. The pathogen is seedborne, overwinters on debris and is disseminated by wind.

SCOUTING TIPS:

Begin scouting at the R5 growth stage, when plants are beginning to fill seed. Check plants in wet spots or where moisture collects from extended dew periods.

MANAGEMENT CONSIDERATIONS:

There are no resistant varieties on the market for this disease, so other management practices must be considered. Use seed treatments to prevent early-season damping-off. Foliar fungicides provide only limited efficacy and no yield protection from this disease.

Photo credit: Tom Allen, Ph.D., Mississippi State University

FROGEYE LEAF SPOT

DESCRIPTION:

Frogeye leaf spot has been a major concern for Mississippi farmers over the past several growing seasons. Circular spots, or lesions, develop on leaves, typically on the newest leaves in the upper plant canopy. Spots have tan centers with a reddish-brown or purple outer ring. In severe cases, the disease can cause premature leaf drop, and symptoms will spread to stems and pods.

ENVIRONMENT:

It is especially problematic in continuous soybean fields. In susceptible soybean cultivars, diseased plants occur across entire fields. Warm, humid weather with frequent rainfall generally is conducive for disease development. Disease is likely to develop after frequent rains. Overhead irrigation can increase disease incidence and severity.

SCOUTING TIPS:

Scout early June, or when plants first reach reproduction stages (R1/R2), to September, or late R5. Check plants in wet spots or where moisture collects from extended dew periods and fields where soybeans were planted back-to-back. Scout weekly at several different field locations. Be aware that populations of quinone outside inhibitors (Q_0I)-resistant FLS are common and are likely to become more widespread.

MANAGEMENT CONSIDERATIONS:

Plant resistant varieties. Resistance to QoI fungicides has been documented in 73 Mississippi counties. Rotate fungicide chemistries (e.g, DMI and MBC) and apply multiple modes of action to susceptible varieties when warranted.

Photo credit: Tom Allen, Ph.D., Mississippi State University

SEPTORIA BROWN SPOT

DESCRIPTION:

Small, reddish-brown, angular spots develop first on primary leaves and then move up the plant. Adjacent lesions can grow together to form larger patches. Infected leaves quickly turn yellow and drop. The fungus is splashed onto lower foliage by rainfall or sprinkle irrigation. It is common in fields planted with soybeans for two or more consecutive years.

ENVIRONMENT:

Warm, humid, wet weather with frequent rainfall is the most conducive environment once plants reach reproductive stages. In particularly hot years, Septoria brown spot can appear to be more severe due to compounding plant stresses.

SCOUTING TIPS:

Check leaves in the lower canopy first, as that is where the disease starts to develop. Defoliation in the upper canopy is a sign that a foliar fungicide application may be warranted.

MANAGEMENT CONSIDERATIONS:

Use timely application of fungicides when warranted. Little information exists as to the efficacy of commercially available fungicides for brown spot management in the Mississippi soybean production system.

Photo credit: Tom Allen, Ph.D., Mississippi State University

CHARCOAL ROT

DESCRIPTION:

Infected plants grow slowly and have smaller leaves. Leaves of older plants turn yellow and wilt, but do not fall off. Gray or silvery discoloration of tissue with tiny black specks that look like pulverized charcoal are visible under the bark of the upper taproot and lower stem. Moisture-deficient field areas are generally the first to express plant symptoms.

ENVIRONMENT:

Hot, dry weather. During prolonged plant stress, such as extended drought, the charcoal rot fungus becomes extremely invasive throughout the taproot.

SCOUTING TIPS:

Most common when soil pH or fertility is low or plants are under drought or additional forms of stress, such as soil compaction.

MANAGEMENT CONSIDERATIONS:

There are an extremely limited number of commercially available varieties with documented resistance to charcoal rot. Seed treatments and foliar fungicides are not effective against charcoal rot. Prevent or reduce plant stress (drought, low fertility) to reduce potential damage from this disease. Rotation is not an effective management strategy since the fungus infects multiple rotational hosts like corn, cotton, grain sorghum and sweet potato.

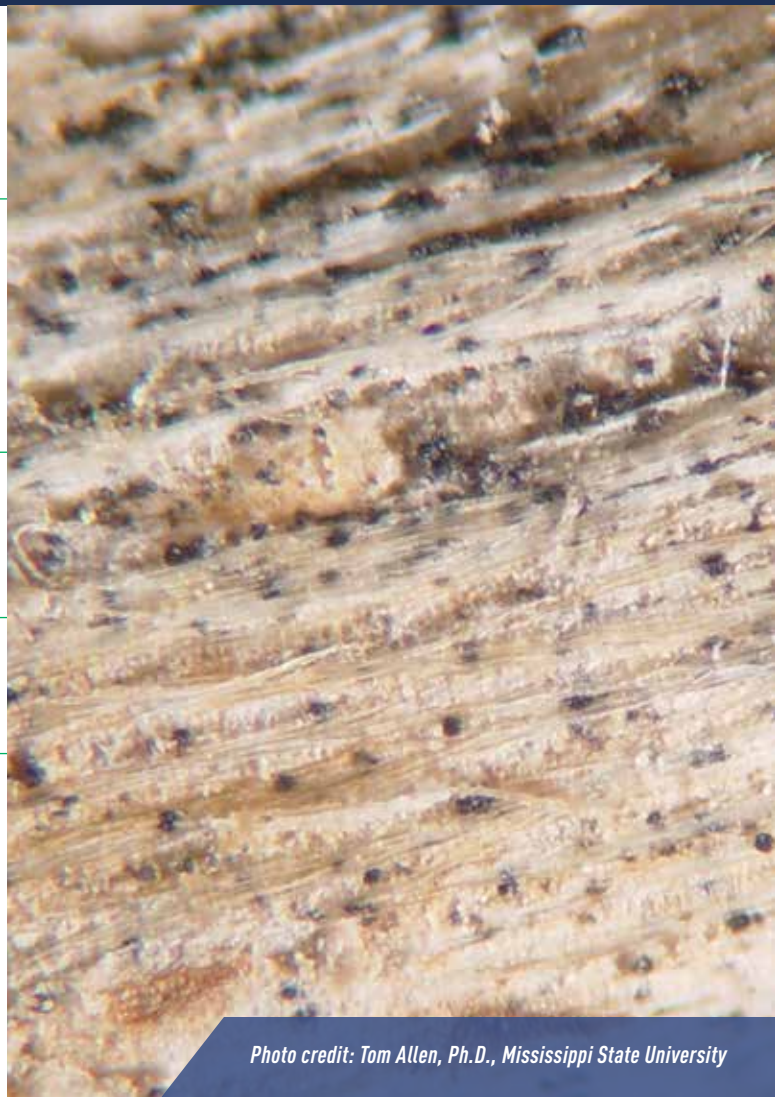


Photo credit: Tom Allen, Ph.D., Mississippi State University

PHYTOPHTHORA ROOT AND STEM ROT

DESCRIPTION:

Phytophthora root and stem rot occurs in field situations with standing water or saturated soils. In Mississippi, Phytophthora root rot is generally a rare occurrence. Plants will be wilting or dying and have root rot. Stems may be dark brown, and the discoloration can extend from the base of the plant to a foot above the soil line. When the stalk is cut, brown-to-black discoloration of vascular tissue and disking of the pith is visible. Rapid wilting results in a curling of the stem at the top of the plant, referred to as shepherd's crook. The pathogen moves through water in soil from plant to plant by reproductive swimming structures. Its dependence on water for mobility has resulted in it being referred to as a water mold.

ENVIRONMENT:

It is most likely to be a concern in heavy, poorly drained soils or low-lying areas of the field. The disease is favored by extended periods of excessive soil moisture following over-irrigation or heavy rainfall. In Mississippi, Phytophthora root rot commonly occurs in situations where irrigations are immediately followed by several inches of rain.

SCOUTING TIPS:

Look for symptoms to appear where soils have been waterlogged for extended periods of time, especially during hot weather.

MANAGEMENT CONSIDERATIONS:

Plant resistant varieties. Use seed treatments containing mefenoxam or metalaxyl for early-season control. Foliar fungicides are not an effective management tool for this disease. Promote practices that provide for good field drainage.

Photo credit: Tom Allen, Ph.D., Mississippi State University

PYTHIUM ROOT ROT

DESCRIPTION:

Plants appear to have generalized root rot, wilting and death of plants. In young seedlings, damping-off is common. Roots often appear withered. Seeds can also be infected — they appear rotted and soil will stick to them. The disease only occurs in seedling-age plants. This disease can result in complete stand loss.

ENVIRONMENT:

Saturated soils, such as low-lying areas during periods of cooler temperatures shortly after planting.

SCOUTING TIPS:

Look for symptoms to appear where soils have been waterlogged for extended periods of time. Pythium-like symptoms are often confused with herbicide injury, seedling-associated diseases or Phytophthora in older plants.

MANAGEMENT CONSIDERATIONS:

Use seed treatments that contain mefenoxam or metalaxyl, especially when planting into soil conditions that may be marginal (lower temperatures, chance of rain in the extended forecast coupled with cooler temperatures). Foliar fungicides are not effective at managing Pythium root rot.

Photo credit: Daren Mueller, Iowa State University, Bugwood.org

SOUTHERN BLIGHT

DESCRIPTION:

Most visible in soybeans during mid-reproductive stages. However, symptoms can also be observed during vegetative stages. Plants will suddenly wilt and die. Leaves remain attached to the dead stem, and a dense, white mat of fungal seed-like tissue appears on the stem and soil at the base of the plant. In situations where dead plants are observed, white to cream-colored, oval sclerotia can be found near the soil line. Sclerotia are the reproductive fungal structures required for the fungus to survive between seasons. The fungus can also survive between seasons in plant residue that remains in the field post-harvest.

ENVIRONMENT:

Hot, humid weather. Most commonly found in monocropped soybeans with adequate plant residue near the soil surface.

SCOUTING TIPS:

More common in sandy soils. However, the disease can occur in any soil class throughout Mississippi and is more problematic in fields that contain the root-knot nematode.

MANAGEMENT CONSIDERATIONS:

All varieties are susceptible to southern blight, but some less than others. If information is available regarding the susceptibility of commercially available varieties, use that in making variety decisions for fields with a history of southern blight.

Photo credit: Tom Allen, Ph.D., Mississippi State University

Photo credit: Tom Allen, Ph.D., Mississippi State University

STEM CANKER

DESCRIPTION:

The base of lower leaf nodes develop brown, slightly sunken lesions on one side of the stem. As the disease progresses, lesions expand along and around the stem, killing the plant. Leaves may turn yellow and brown between veins but remain attached after death. The pathogen enters production fields via infected seed or debris brought in by combines.

ENVIRONMENT:

Prolonged wet weather early in the season, followed by hot, dry conditions. Rainfall moves the pathogen from soil debris to lower plant petioles where infection begins.

SCOUTING TIPS:

More likely to be problematic in no-till fields. Cannot be controlled with foliar-applied fungicides.

MANAGEMENT CONSIDERATIONS:

Plant resistant varieties. There are no effective foliar fungicides.

Photo credit: Tom Allen, Ph.D., Mississippi State University

PHOMOPSIS

DESCRIPTION:

This is Mississippi's most common seed rot disease. Infected seeds may appear shriveled, cracked, and white or chalky, though they also may appear normal. The most devastating effect from this disease is the lowered quality of harvested seed that will result in significant dockage at the elevator. Infected seeds may not germinate or may produce seedlings with reduced vigor.

ENVIRONMENT:

The occurrence of Phomopsis seed decay tends to be more of an issue when harvest is delayed as a result of wet conditions for a measurable period of time beyond physiological maturity (R8). The disease is generally favored by wet, humid weather that occurs between R3 and R7.

SCOUTING TIPS:

Scouting for the disease is made difficult since this is a seed issue and, in general, fields exhibiting the specific symptoms cannot be observed by looking at the outside of the pod itself.

MANAGEMENT CONSIDERATIONS:

Use seed treatment to prevent early-season seedling disease. Foliar fungicides have been unreliable in preventing seed rot and pod infection, especially during extended rainfall at maturity (R8). Some resistant varieties are available. Rotate crops.

Photo credit: Tom Allen, Ph.D., Mississippi State University

PURPLE SEED STAIN

DESCRIPTION:

Seeds may have pink or purple spots that extend from the seed hilum. This does not affect yield, but value may be lowered by dockage at the elevator. The fungus that causes purple seed stain overwinters on residue remaining in the field from previous soybean crops.

ENVIRONMENT:

High humidity.

SCOUTING TIPS:

Scouting for purple seed stain is made difficult since seeds develop inside the pod.

MANAGEMENT CONSIDERATIONS:

No resistant varieties are available to reduce damage from purple seed stain. In addition, even though foliar fungicides are labeled for application to reduce incidence of purple seed stain, sporadic results have been reported from the southern U.S. crops.

Photo credit: Tom Allen, Ph.D., Mississippi State University

AERIAL WEB BLIGHT

DESCRIPTION:

Extensive yield losses (40-50%) have been reported in soybeans when conditions favor disease development and the crop goes untreated. Leaf symptoms appear as water-soaked, grayish-green lesions that turn tan to brown as the disease progresses. The pathogen may infect leaves, pods and stems in the lower canopy. Reddish-brown lesions can form on infected petioles, stems, pods and petiole scars, and on leaf tissue when dew is not present. Long strands of web-like hyphae can spread along affected tissue and small (1/16 to 3/16 of an inch in diameter), dark brown sclerotia form on diseased tissue.

ENVIRONMENT:

Warm, humid weather with frequent afternoon rain showers is the most conducive environment. Aerial blight has been observed in hot years with infrequent rain showers and heavy dew.

SCOUTING TIPS:

Scout fields for the presence of aerial blight early in the day, when dew is still present. Symptoms most often associated with the disease are aerial fungal growth between leaves, heavy water-soaking of infected leaves, and matted leaf material in the lower to middle canopy. Symptoms associated with the disease become more difficult to diagnose as leaf material dries and can be more easily confused with other foliar diseases.

MANAGEMENT CONSIDERATIONS:

There are no resistant varieties. Make timely applications of foliar fungicides when warranted. Fungicides in the quinone outside inhibitor (Q_oI) class are the best alternative for reducing yield losses associated with aerial blight. Use full rates of fungicides and high water volume (15-20 gallons per acre) with ground-based application equipment and high pressure (>60 psi). Aerial applicators cannot get the fungicide to the area of the plant for effective canopy penetration. Soybean plants are no longer at risk from the potential of yield losses when plants have reached the R5.7 growth stage.

Photo credit: Tom Allen, Ph.D., Mississippi State University

TAPROOT DECLINE

DESCRIPTION:

Chlorosis of upper leaves occurs first, followed by a gradual plant decline. Taproots, as well as lateral roots, will be extensively rotted and brittle to the touch when removed from the soil. When roots are split lengthwise, they have an internal vascular discoloration in the root center progressing into the lower stem. The only live roots remaining during final stages of plant life are the uppermost lateral roots.

ENVIRONMENT:

Little is known regarding the specific environment conducive for taproot decline. Research and observations suggest that fields of continuous soybean can contain the disease. The disease appears to be favored by cool, wet conditions, similar to SDS. In some cases, irrigation appears to be associated with increasing severity of the disease in some varieties.

SCOUTING TIPS:

Scout for the disease during late-R5 and early-R6, as the interveinal chlorosis associated with taproot decline is more prevalent then.

MANAGEMENT CONSIDERATIONS:

No preventive measures are known. Research trials are currently being conducted to learn more about the fungus that causes the disease as well as the potential susceptibility of commercially available soybean varieties and methods to reduce yield losses.

Photo credit: Tom Allen, Ph.D., Mississippi State University

TARGET SPOT

DESCRIPTION:

Target spot typically causes reddish-brown lesions with concentric rings that are often surrounded by a yellow halo on leaves in the lower to middle canopy post-flowering. In most years, target spot is an extremely common disease that does not result in yield losses. In rare situations where an extended period of favorable conditions persists, the disease can result in severe lower to middle canopy defoliation. Target spot symptoms can also be observed on pods, petioles, where nodes attach to the main stem, and on the stem itself.

ENVIRONMENT:

Wet conditions, and more specifically when leaf tissue remains wet for extended periods of time, and a wide range of temperatures can support the initiation of disease. Humidity greater than 80% is generally required for the fungus to infect soybeans. The fungus that causes target spot can survive extended periods of time on plant residue that remains in the field, and has a wide host range that can support the persistence of the organism.

SCOUTING TIPS:

Scout for the presence of the disease in the lower to middle canopy. Look for the presence of the most commonly recognized target-type lesion on leaves.

MANAGEMENT CONSIDERATIONS:

Crop rotation is one of the best management practices. Even though cotton is a host, the fungus that causes target spot in soybeans will not cause target spot in cotton. Tolerance within commercially available varieties has been observed. No lists of varieties with resistance to the fungus are available. Some susceptible varieties may respond worse than others due to extended periods of a conducive environment.

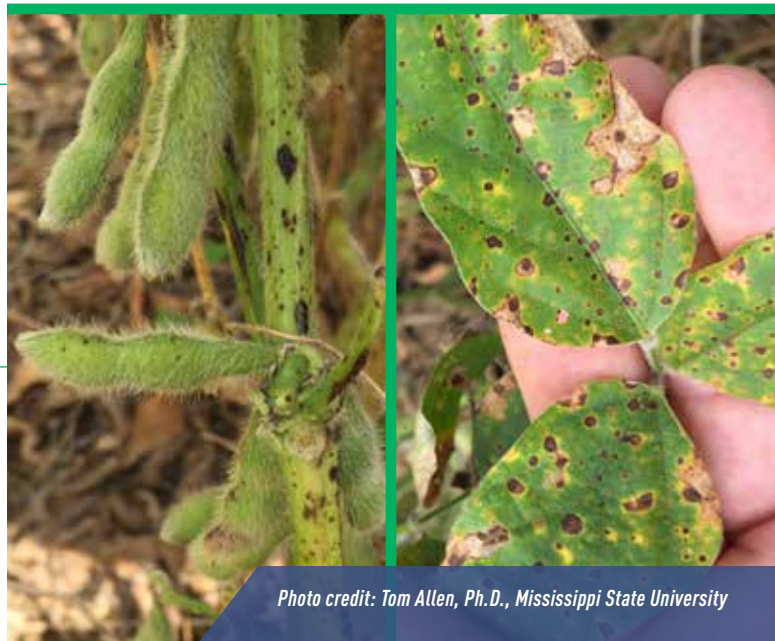


Photo credit: Tom Allen, Ph.D., Mississippi State University

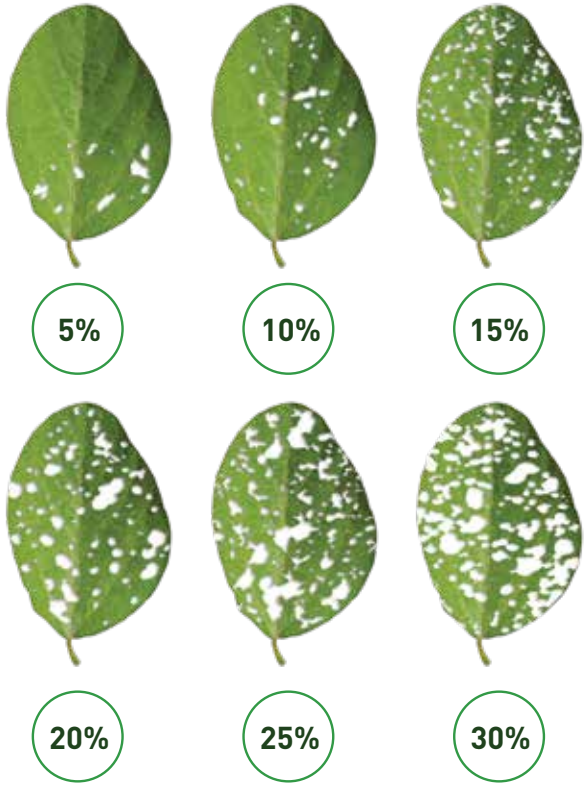
INSECT MANAGEMENT

Controlling damaging insect populations in Mississippi soybean fields poses a problem for farmers each year. The decision to treat should be based on thresholds, which is the point at which insect infestations should be treated in order to avoid economic loss.

Be on the lookout for these insects and others that may be in your field, and use this guide to scout your crops according to the Mississippi State University (MSU)-recommended thresholds for treatment to prevent loss.

Much greater detail on these insects can be found in the Insect Control Guide for Agronomic Crops. Visit the MSPB website, MSSOY.org, for an online version of the guide.

STAGES OF INSECT FEEDING DAMAGE



Foliage-eating insects are present in almost all soybean fields throughout the season, but most fields rarely suffer yield loss because the amount of leaf loss remains at low to moderate levels and soybean plants have the unique ability to compensate for foliage loss.

ARMYWORM COMPLEX

DESCRIPTION:

Armyworms are caterpillars that have four pairs of fleshy prolegs near the abdomen with an inverted "Y" on the head capsule. Armyworm eggs are laid in masses and covered with scales from the wings of the moths.

Beet armyworm: Light-green to olive-green smooth-bodied caterpillar with a stripe down each side and a black dot behind the head directly above the second pair of true legs.

Fall armyworm: Olive-green to dark-brown caterpillar with a dark band above a stripe running down each side, four black spots arranged in a square pattern near the rear on the eighth abdominal body segment and a dark-brown head with a cream-colored inverted "Y" separating the eyes on either side of the head.

DAMAGE:

Beet and fall armyworms primarily affect late-planted soybeans that have susceptible foliage late in the growing season when these pests usually appear. Severely damaged plants are very ragged in appearance.

SCOUTING TIPS:

Beet armyworms often feed on pigweed plants in and around soybean fields, so noticing defoliation of pigweed can alert growers the worms may be moving into the field. Fall armyworms often develop on grasses and move to soybeans when the grass is killed with herbicides. It is recommended to scout grassy fields prior to herbicide applications for presence of fall armyworm.

MANAGEMENT CONSIDERATIONS:

Treat both beet and fall armyworms only if defoliation is greater than 35% before R1 or 20% after R1. Insecticides in several classes can be used for effective control.

BEET ARMYWORM

Photo credit: Alton N. Sparks Jr., University of Georgia, Bugwood.org

FALL ARMYWORM

Photo credit: Angus Catchot, Ph.D., Mississippi State University

BEAN LEAF BEETLE

DESCRIPTION:

Bean leaf beetles can have many color phases. Colors range from red to yellow and may or may not have spots on the hind wings. Bean leaf beetles have a distinct black triangle-shaped mark behind the head at the base of the forewings. In the Delta region of Mississippi, there has been documented pyrethroid resistance in bean leaf beetle populations. Rotate classes of chemistry whenever possible.

ENVIRONMENT:

These insects feed on leaves, leaving small, rounded holes inside the leaf margins. Damage is often more visually alarming than serious as holes expand with leaf growth. Beetles can also feed on outer pod walls late in the season, causing the seed to rot and shrivel.

SCOUTING TIPS:

In the spring, bean leaf beetles feed on weeds and are attracted to early-planted soybeans.

MANAGEMENT CONSIDERATIONS:

If plants are not blooming or filling pods and beetles are present, treat when defoliation reaches 35%. If plants are blooming and filling pods and beetles are present, treat when defoliation reaches 20% or if 50% of the plants have pod feeding prior to R6. Insecticides in several classes can be used for effective control.

Photo credit: Frank Peairs, Colorado State University, Bugwood.org

GREEN CLOVERWORM

DESCRIPTION:

Slender, greenish caterpillars with faint white stripes along the body that have the same thickness from head to rear. They have three pairs of prolegs near the midsection and a pair of prolegs at the rear. They often wriggle violently when disturbed.

DAMAGE:

These insects feed on leaves between veins, leaving irregular holes. They are present through most of the growing season but seldom cause economic damage unless they reach very high populations.

SCOUTING TIPS:

Rarely an economic pest, they are most often concentrated in the upper canopy.

MANAGEMENT CONSIDERATIONS:

Before R1, treat at 35% defoliation or when more than 75 worms a half-inch or longer per 25 sweeps are present. After R1, treat when more than 38 worms a half-inch or longer per 25 sweeps are present, or at 20% defoliation. Insecticides in several classes can be used for effective control.

Photo credit: Daren Mueller, Iowa State University, Bugwood.org

SOYBEAN LOOPER

DESCRIPTION:

Light-green caterpillars with thin, light lines running the length of the body. The body is largest at the rear and tapers toward the head. They have two pairs of abdominal prolegs and one pair of anal prolegs at the back and form a characteristic hump or "loop" when crawling. The soybean looper has developed resistance to many insecticides but is often controlled by disease organisms late in the season.

DAMAGE:

These insects feed on leaves, leaving large holes. Heavy populations can strip entire fields of leaves.

SCOUTING TIPS:

Economic infestations occur mid- to late-season in Mississippi. Loopers are usually found in fields previously sprayed with insecticides, which can kill off natural enemies.

MANAGEMENT CONSIDERATIONS:

Before R1, apply insecticide when eight or more worms a half-inch or longer (drop cloth) are present per row foot or at 35% defoliation. After R1, apply insecticide when four or more worms a half-inch or longer are present per row foot or at 20% defoliation, or when 19 worms a half-inch or longer (drop cloth) are caught in 25 sweeps. Pyrethroids, organophosphates and carbamate insecticides should be avoided.

Photo credit: Angus Catchot, Ph.D., Mississippi State University

VELVETBEAN CATERPILLAR

DESCRIPTION:

Greenish to black caterpillars with faint white stripes along the body that have the same thickness from head to rear. The lines on the side of the body are usually much broader than those of the green cloverworm or looper. They have four pairs of abdominal prolegs. They often wriggle violently when disturbed.

DAMAGE:

They are ravenous feeders, usually starting at the top of the plant and feeding downward, causing complete defoliation if not controlled. Velvetbean caterpillars are primarily foliage feeders but will feed on petioles, causing pods to drop to the ground after a significant loss of foliage.

SCOUTING TIPS:

Velvetbean caterpillars are generally late-season pests of soybeans in Mississippi.

MANAGEMENT CONSIDERATIONS:

Before R1, treat at 35% defoliation or when more than 75 worms a half-inch or longer per 25 sweeps are present. After R1, treat when more than 38 worms a half-inch or longer per 25 sweeps are present, or at 20% defoliation. Insecticides in several classes can be used for effective control.

Photo credit: Scott Stewart, Ph.D., University of Tennessee

Pod feeders are the most dangerous insect pest, as they directly attack soybean yield. Insecticide treatments should primarily target these insects. Scouting for these insects is essential, as not all fields are subject to attack by pod feeders. Variety, row width and planting date all influence which insect pests are present.

CORN EARWORM

DESCRIPTION:

Green, brown, yellow or black caterpillars with light and dark stripes running the length of the body and prominent pale brown or orange heads (never dark brown). They have four pairs of abdominal prolegs and one pair of anal prolegs at the back. When disturbed, they curl into a tight circle but do NOT crawl with a looping motion. The body also has sparse hairs.

DAMAGE:

Feeding typically occurs first on foliage, later on blooms and pods.

SCOUTING TIPS:

Field infestation normally occurs during the reproductive stages of the soybean plant. Wide-row soybeans with open canopies and flowering are preferentially attractive for corn earworm.

MANAGEMENT CONSIDERATIONS:

Before R1, treat at 35% defoliation. After R1, use dynamic threshold in table below. Control = cost of insecticide plus application cost. Crop Value = price received for soybeans.

	Larvae/25 Sweeps				
	Control Costs ($/Acre)[1]				
Crop Value ($/bu)	10	15	20	25	30
6	7.4	11.0	14.7	18.4	22.1
7	6.3	9.5	12.6	15.8	18.9
8	5.5	8.3	11.0	13.8	16.5
9	4.9	7.4	9.8	12.3	14.7
10	4.4	6.6	8.8	11.0	13.2
12	3.7	5.5	7.4	9.2	11.0
13	3.4	5.1	6.8	8.5	10.2

Photo credit: Angus Catchot, Ph.D., Mississippi State University

STINK BUG COMPLEX

DESCRIPTION:

Stink bugs are shield-shaped and often emit a foul-smelling substance when threatened. Stink bugs preferentially feed on beans filling pods.

Brown Stink Bug: Dull brown and somewhat smaller than green stink bugs.

Green Stink Bug: Green bug that produces a distinct buzz when flying. On the underside, it has a small, pointed spine between the last two legs and black bands around the antenna.

Southern Green Stink Bug: Immature stages vary in color from black for very small nymphs to green for larger nymphs. However, the immature stages have a distinctive pattern of whitish spots on the abdominal segments. Adults have red to brick-red bands around antennal segments.

Redbanded Stink Bug: The redbanded stink bug has a distinct red band across its back. They usually arrive on fields as pods are starting to form in the R3-R4 growth stages and cause damage by feeding on the pods. Redbanded stink bugs are difficult to control and infest fields rapidly after R6 growth stage.

DAMAGE:

Stink bugs will suck juices from immature soybean seeds, resulting in pod drop, yield loss and deterioration of seed quality.

SCOUTING TIPS:

Stink bugs are most attracted to fields with developing pods.

MANAGEMENT CONSIDERATIONS:

If you use a drop cloth, the threshold is one bug per foot of row. If you are using a sweep net, the threshold is nine bugs per 25 sweeps. Count only stink bug nymphs larger than one-fourth of an inch. Brown stink bugs are more difficult to control with pyrethroid insecticides. When soybeans reach the R6 growth stage, treat only on populations of 20 stink bugs per 25 sweeps or higher and terminate stink bug applications at R6 + 7 days (R6.5). For redbanded stink bugs, treat when numbers reach four bugs per 25 sweeps or two bugs per 6 feet of row with drop cloth. Redbanded stink bugs must be monitored until R7 growth stage. Between R6.5 and R7, treat when have 10 or more bugs per 25 sweeps.

BROWN STINK BUG

Photo credit: Dominic Reisig, North Carolina State University

GREEN STINK BUG

SOUTHERN GREEN STINK BUG

REDBANDED STINK BUG

Photo credit: Angus Catchot, Ph.D., Mississippi State University

Stem-feeding insects regularly occur in soybeans but infrequently cause economic damage, with the exception of lesser cornstalk borer, which can be a serious pest following burned wheat and/or in sandy soil.

KUDZU BUG

DESCRIPTION:

Olive-green to dark-brown, small, shiny bugs that are strong fliers. When handled, they produce a foul-smelling secretion that can stain hands and cause irritation.

DAMAGE:

Kudzu bugs injure soybeans by feeding on stems and petioles. Kudzu bugs do not feed on pods. Damage is caused when severe infestations suck down the vigor of the plant by removing moisture and plant nutrients.

SCOUTING TIPS:

Migration from overwintering sites begins in March and April, and a second migration occurs in July and August. The edges of fields are colonized first before the bugs move to the interior sections. Wait until nymphs are present before spraying to avoid multiple sprays.

MANAGEMENT CONSIDERATIONS:

During the vegetative stages, treat when kudzu bugs average five bugs per plant. Often, only field borders will require treatment. During the reproductive stages, treat when you average 25 nymphs per 25 sweeps.

Photo credit: Dominic Reisig, North Carolina State University

THREE-CORNERED ALFALFA HOPPER

DESCRIPTION:

Shiny, green, wedge-shaped insects that have a blunted front end and pointed rear. Young insects appear similar to adults but have no wings.

DAMAGE:

This insect feeds on young soybean stems near the soil with damage largely occurring on plants less than 12 inches in height. The punctures in the stem caused by this bug may result in lodging issues later in the year, but lodging rarely reduces yield. They may also feed on leaf petioles and upper stems, leaving dark scars, but should not affect yields.

SCOUTING TIPS:

This insect overwinters in weedy plants and migrates to soybeans in May or June. Fields with weedy borders are more likely to see an infestation.

MANAGEMENT CONSIDERATIONS:

Check before plants are 10 inches tall, and treat if the insects threaten stand reduction. After plants are 10 inches tall, treat when you find 100 hoppers per 25 sweeps. Recent research indicates no apparent benefit from treatment during reproductive development.

Photo credit: Angus Catchot, Ph.D., Mississippi State University

NUTRITIONAL DEFICIENCIES

With increased yields in recent years, adequate fertilization becomes even more important. Producing more bushels per acre means more nutrients are being removed from the soil. The chart on page 103 demonstrates how many pounds of nutrients are removed from fields each year based on varying yield levels.

Soil samples provide a basemap for understanding a significant part of the yield equation — the soil's nutrient status. With proper collection and handling, the results of soil sampling and analysis can result in recommendations to supply adequate fertilization to meet soybean nutritional demands. This is important because under-fertilizing may cost farmers money through lower yields, while over-fertilizing may add costs to the operation that are not recouped through increased yields.

1 BUSHEL OF SOYBEAN CONTAINS

3.3 lb NITROGEN (N)

.73 lb PHOSPHORUS PENTOXIDE (P_2O_5)

1.2 lb POTASSIUM OXIDE (K_2O)

.21 lb MAGNESIUM (MG)

.18 lb SULFUR (S)

Yield Level	40	50	60
N	132	165	198
P_2O_5	29	37	44
K_2O	48	60	72
Mg	8	11	13
S	7	9	11

Adapted from: http://www.ipni.net/article/IPNI-3296

MISSISSIPPI STATE UNIVERSITY
DELTA RESEARCH AND EXTENSION CENTER

IRON-DEFICIENCY CHLOROSIS

DESCRIPTION:

Iron chlorosis is a nutritional deficiency that is often observed in eastern Mississippi but rarely in the Delta. Unlike most nutrient deficiencies that occur because the element is lacking in the soil profile, iron chlorosis is caused by the inability of the plant to take up the iron contained in the soil.

SCOUTING TIPS:

Iron-deficiency chlorosis most often occurs in cool, wet soils because of an increase in carbon dioxide and bicarbonate. In eastern Mississippi, the deficiency most often occurs when soil pH is greater than 7.0 and free carbonates are present in the soil. Typical symptoms of iron chlorosis are interveinal chlorosis in newly developed leaves, where the leaf tissue turns yellow while the veins remain green.

MANAGEMENT CONSIDERATIONS:

Iron chlorosis requires a program approach to manage. This includes selecting tolerant varieties, limiting residual-nitrogen fertilizer from previous crops and planting in-furrow applications of iron chelates.

Photo credit: Bobby Golden, Ph.D., Mississippi State University

Photo credit: Bobby Golden, Ph.D., Mississippi State University

PHOSPHORUS (P) DEFICIENCY

DESCRIPTION:

A soybean deficient in phosphorus will generally appear spindly, with smaller leaflets (leaves will appear more rounded and look like peanut leaves) and a stunted growth habit. In some cases, phosphorus-deficient soybeans will give the appearance of having a dark-green to almost blue appearance.

SCOUTING TIPS:

P deficiency most often occurs in cool, wet soils because of a decrease in P uptake. It may also be a problem if root function and growth are limited (from compacted or wet soils, or disease/pest damage) or early in the season during periods of rapid vegetative growth if the shoots experience better growing conditions than the roots. Leaf tissue testing is the best method to accurately diagnose phosphorus deficiency early in the season.

MANAGEMENT CONSIDERATIONS:

Leaf tissue testing is the best method to accurately diagnose phosphorus deficiency early in the season. Corrections can be made in-season prior to the V5 growth stage.

Photo credit: Bobby Golden, Ph.D., Mississippi State University

POTASSIUM (K) DEFICIENCY

DESCRIPTION:

Potassium (K) deficiency is the primary nutrient deficiency observed in all Mississippi areas of soybean production. Soybeans remove more potassium than any other row crop in Mississippi, removing approximately 1.2 pounds of potassium oxide, or K_2O, per bushel of harvested seed. Lower, older leaves will show symptoms of yellowing and chlorosis of the leaf margins and in-between veins first. In extreme cases, symptoms may move up the plant to newer leaves.

SCOUTING TIPS:

Like P deficiency, K deficiency also most often occurs in cool, wet soils. It may also be a problem if root function and growth are limited (from compacted or wet soils, or disease/pest damage) during periods of rapid vegetative growth.

Photo credit: Bobby Golden, Ph.D., Mississippi State University

SULFUR (S) DEFICIENCY

DESCRIPTION:

Sulfur is a secondary nutrient, but is generally removed in a greater quantity than what is supplied to the soybean crop in Mississippi. A 60 bushel per acre soybean crop will remove 11 pounds of S per acre when the grain truck leaves the turn row. Sulfur deficiency most often occurs in Mississippi soybeans that are seeded to lighter textured, low organic matter soils (lower CEC) and sandy ridges within a field. For many years farmers didn't need to worry about S fertilization, but as environmental regulation has abated atmospheric particulates, much of the free S formerly obtained from atmospheric deposition has ceased. Over the last 15 years, the shift to a more grain-based system in the Delta has resulted in more observations of S deficiency.

SCOUTING TIPS:

Sulfur is an immobile nutrient in the plant. Therefore soybeans will show S deficiency in the upper canopy. Sulfur deficiency symptomatology generally manifests in an overall yellowing or off-green color in young leaves and buds. Soybeans respond well to S application with improved yield and seed quality. For immediate response to an in-season application, use a product containing S in the form of SO_4.

Sulfur deficient

Photo credit: Bobby Golden, Ph.D., Mississippi State University

Sulfur efficient

Photo credit: Bobby Golden, Ph.D., Mississippi State University

MANGANESE (MN) DEFICIENCY

DESCRIPTION:

Manganese is a micronutrient required in small quantities by the soybean plant. Manganese is an enzyme activator and is essential for proper root growth. Deficiencies most often occur on high pH soils. In Mississippi, we have observed Mn deficiency on many of our heavy soils with pH greater than 7.0.

SCOUTING TIPS:

Unlike P and K, Mn is immobile in the plant. This means that symptomatology will most likely appear on the younger leaf tissue first, as Mn cannot easily be recycled from the older plant tissue. The characteristic symptoms for soybean include interveinal chlorosis while the veins will remain dark-green in color. There may be varying shades of chlorosis across a field landscape.

MANAGEMENT CONSIDERATIONS:

For best results, follow soil test recommendations.

Photo credit: Bobby Golden, Ph.D., Mississippi State University

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Technical editing for this guide was led by researchers from Mississippi State University and personnel from the Mississippi Soybean Promotion Board. MSPB/soy checkoff neither recommends nor discourages the implementation of any advice contained herein, and is not liable for the use or misuse of the information provided.

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