SDSU Extension

iGrow Soybean

BEST MANAGEMENT PRACTICES

Chapter 27:
Emerging Disease, Insect, and Weed Pests in South Dakota Soybean Production

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New pests are always around the corner. As with other crop species introduced from other parts of the world, the pests of these plants frequently follow the plant. Once here, these pests often thrive because they do not have their natural predators. A recent example of a pest following the soybean plant is the Asian soybean aphid. The soybean aphid was first documented in North America in July of 2000. From then, its population rapidly grew and it's now part of the South Dakota soybean grower's annual insect pest management.

This chapter discusses emerging soybean disease, insect, and weed pests that may be of concern for South Dakota soybean growers. The emerging pests covered include frogeye leaf spot, sudden death syndrome, Asian soybean rust, brown marmorated stink bug, kudzu bug, and herbicide-resistant Palmer amaranth (pigweed).

Frogeye Leaf Spot

Frogeye leaf spot is a common foliar disease of the southern soybean-growing states. Typically, the disease can occur sporadically in the central states, but can be seen farther north when weather conditions are favorable. Frogeye leaf spot favors warm, humid weather for development. Spores are spread short distances by wind or splashing rain. Dry weather severely limits disease development. The disease period in South Dakota is July through August. Occurrence is considered rare and is mainly seen in the southeastern parts of state.

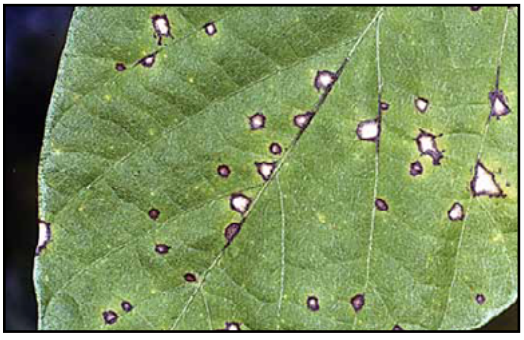

Figure 27.1. Soybean leaf showing frogeye leaf spot lesions. (Photo courtesy of Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org)

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Symptoms for frogeye leaf spot include small lesions on leaves that are circular to angular spots which vary in size (Fig. 27.1). The lesions are first visible on the upper surface of the leaf. Frogeye leaf spot lesions have distinctive brown spots that are surrounded by narrow red or dark reddish-brown margins. The central area of the aging lesions becomes ash-grey to light brown. Older lesions are light to dark brown and frequently are translucent, having a grey to white center, which may contain minute dark spots. Smaller lesions may coalesce to form larger, irregular spots on leaves.

Young leaves are more susceptible to the infection than older leaves. During a wet year, frogeye leaf spot symptoms may appear uniformly over the foliage. In years with intermittent wet periods, symptoms may appear layered within the plant canopy. When plants are heavily infected, leaves may die and fall prematurely. This can result in early defoliation of soybean plants. Persistent high rainfall and humidity may cause stems and seed pods to become infected. Lesions on pods are reddish brown, may appear sunken, and are circular or elongated in shape. Older lesions on pods become brown to gray, usually with a narrow, dark-brown border.

The fungus that causes frogeye leaf spot will survive in infested soybean residues and infected seed. Therefore, tillage and crop rotation are very effective in reducing the population from one season to the next. If tillage is an option, earlier tillage operations are more effective in reducing pathogen populations. It is best to till infested residues directly after the soybean harvest, rather than after a subsequent corn rotation.

Another management consideration is soybean variety selection. Some soybean varieties are less susceptible to frogeye leaf spot than others.

Sudden Death Syndrome

Sudden death syndrome (SDS) is a major soybean disease in many Midwestern U.S. areas (Fig. 27.2). SDS was first discovered in 1971 in Arkansas and since then has been confirmed throughout most soybean-growing areas of the U.S. Currently, the occurrence of SDS in South Dakota is considered rare; however, it is suspected to be in the state. SDS is a fungal disease that also occurs in a disease complex with the soybean cyst nematode (SCN, *Heterodera glycines*). SDS is among the most devastating soil-borne soybean diseases seen in the United States. It can be difficult to assess the total crop losses, but yield losses of up to 80% have been reported.

Figure 27.2. Leaf showing sudden leaf collapse and distinct foliar symptoms from sudden death syndrome. (Photo courtesy of SDSU Extension Plant Pathology)

The disease symptoms seem to be more pronounced after flowering. SDS foliar symptoms may appear any time from bloom through pod fill. Normally symptoms appear between the R3 and R6 growth stages. Timing of symptom expression depends on weather conditions, maturity group and other characteristics of the cultivar, and general vigor of plant. Other symptoms include inter-venial chlorosis resembling brown stem rot symptoms; yellow blotches between the veins progress to large irregular patches. Yellow patches turn brown and die, while the veins remain green. Symptoms are more pronounced on top leaves. Infected leaves drop, but the petioles remain on the stems. Pod drop may also occur. No stem browning develops as with brown stem rot. SDS conversely may cause a root rot. Infection is favored by cool moist soils.

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Sudden death syndrome can be managed by choosing resistant or shorter season cultivars, practicing a crop rotation program, and burying crop residue. Do not irrigate after soybean flowering.

Asian Soybean Rust

Asian soybean rust is a foliar disease caused by the fungus *Phakopsora pachyrhizi*. It is an aggressive disease capable of causing defoliation and significant yield loss. Asian soybean rust was found for the first time in North America in November 2004. Since then it has become a problem in the southern U.S. soybean-growing states. Soybean rust requires very moist and mild temperatures to successfully overwinter and its spores are rapidly transported long distances by air currents.

To cause outbreaks in the northern soybean-growing states, the fungus has to spread north via southern winds during the spring and summer. Air temperatures and relatively humid conditions in the North Central region of the U.S. are generally not conducive for soybean rust development, and harsh winter weather conditions reduce its overwintering ability.

Based on the historical spread and general trajectories, it is unlikely that soybean rust will be serious problem in South Dakota and if it does occur, soybeans will most likely have progressed beyond their vulnerable crop stages.

Brown Marmorated Stink bug

The brown marmorated stink bug *(Halyomorpha halys)* is a relatively new invasive pest in the U.S. It was first found in Pennsylvania around the year 2000. Since then it has been gaining prominence in the eastern U.S. This is a very mobile insect, and it spreads quickly to other parts of the country. When populations are high, it can damage fruit, vegetable, and field crops including corn and soybean. It can also be a household pest because of its habit of coming into homes in the fall (much like the Asian ladybeetle does). Figure 27.3 shows where brown marmorated stink bug was found through early 2011. It remains to be seen how well this insect will fare in northern states.

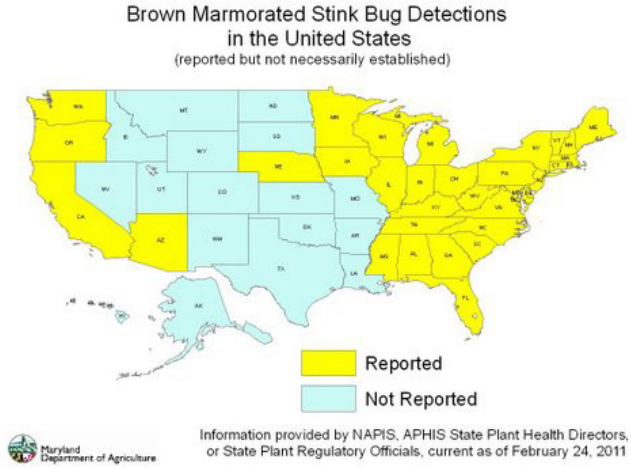

Figure 27.3. Detections of brown marmorated stink bug. (Source: Maryland Department of Agriculture)

Brown marmorated stink bug is similar in appearance to other stink bugs occasionally found in South Dakota soybean fields. The brown marmorated stink bug has several distinct features (Fig. 27.4) that include white bands on the antennae, white triangular notch shapes along the abdomen and a smooth edge (not toothed) along the pronotum or "shoulders," which have rounded tips.

Insects that resembles brown marmorated stink bug include the brown stink bug (only very rarely a soybean pest in northern states) and spined soldier bug (a beneficial predatory insect, Fig. 27.5). Both of these species have sharp, pointy shoulders which quickly distinguish them from brown marmorated stink bug.

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Left: Figure 27.4. Brown marmorated stink bug with distinctive markings. (Photo courtesy of David R. Lance, USDA, APHIS PPQ) **Right: Figure 27.5. Spined soldier bug, a beneficial predatory stink bug sometimes found in soybeans.** (Photo courtesy of Clemson University – USDA Cooperative Extension Slide Series)

Figure 27.6. Soybeans shriveled from stink bug feeding. (Photo courtesy of John Tooker, Penn State)

Left: Figure 27.7. Adult Japanese beetle. (Photo courtesy of Bugwood.org) **Right: Figure 27.8. Japanese beetle feeding damage on soybeans.** (Photo courtesy of Marlin Rice)

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Brown marmorated stink bugs have one generation per year. They overwinter as adults and emerge in the spring. They feed on plant juices through straw-like mouthparts, and preferentially feed on fruiting bodies. In soybeans, they shrivel seeds within the pods (Fig. 27.6) and in corn they attack developing kernels.

Japanese Beetle

The Japanese beetle *(Popillia japonica)* is an invasive insect that has been in the U.S. for several decades. It has a very broad host plant range and feeds on a wide variety of horticultural crop plants, crops, and turf grass. Recently it has been reported as an occasional pest of corn and soybean in Ohio, Illinois, Iowa, and Nebraska. It has been found in South Dakota in urban areas associated with ornamental plants. In the future, the Japanese beetle may become a significant pest in soybean fields.

The Japanese beetle is ⅓ to ½ inch long and has a bright metallic green head and shiny brown wings (Fig. 27.7). It has one generation per year and spends about ten months as a white grub in the soil, feeding on root hairs. Adults emerge in late June and are found feeding on plant foliage in July and August. Adults chew around leaf veins, causing a lacy or "skeletonized" defoliation pattern on soybean (Fig. 27.8). On corn, they may feed on silks and ear tips in addition to foliage.

Kudzu Bug

Kudzu bug *(Megacopta cribraria)* is also known as the bean plataspid or globular stink bug (Fig. 27.9). This is an emerging soybean pest found in the southeastern U.S. It was first found in Georgia in 2009 and has rapidly spread to surrounding states. In Georgia, it has been reported to affect soybean yields up to 47%. Little is known about the kudzu bug's basic biology. It overwinters on kudzu, an invasive weed in southern states. It is not known whether other plants may also serve as an overwintering host. The distribution of kudzu does not extend as far north as South Dakota. If the kudzu bug requires kudzu as an obligate overwintering host, it is unlikely to become a problem in South Dakota.

Figure 27.9. Adult kudzu bug. (Photo courtesy of North Carolina State University)

Herbicide-resistant Palmer Amaranth (pigweed)

Palmer amaranth is a fast-growing annual weed in the pigweed family (Fig. 27.10). Other members of the pigweed family are red root pigweed and waterhemp. A native to most of the southern half of North America, Palmer amaranth populations are expanding northward. Palmer amaranth is a dioecious plant (plants are either male only or female only) and it can hybridize with other pigweed species.

This weed produces an enormous amount of seed (500,000 seeds/plant), is fast growing, and is highly competitive. Plants can grow up to 10 feet in height. Palmer amaranth has become one of the most troublesome weeds in the Southeast because of its fast growth rate, high seed production, and development of herbicide resistance. The resistance issue is why so many soybean growers in the southern U.S. are concerned with this weed. Different populations of this weed have developed resistance to the Photosystem II inhibitors herbicides (Atrazine, Diuron, etc.), to the Dinitroanilines herbicides (Pendimethalin, Trifluralin, etc.), to the ALS inhibitors herbicides (Imidazolinones, Sulfonylureas, etc.), and to the Glycines herbicides (Glyphosate).

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Currently no populations of Palmer amaranth contain resistance to all classes of these herbicides, but there are some populations with plants resistant to two of the four. Unfortunately, given time and improper management, Palmer amaranth has proven its potential to become resistant to any herbicide that is repeatedly used. Following management guidelines can help slow the growth of this weed (Table 27.1).

Table 27.1. Palmer amaranth guidelines.

1. Use both pre-mergence and post-emergence herbicides that have different modes of action.
2. Reduce soil seed banks by continuously maintaining good weed control.
3. When scouting fields, survey weed populations each season and record observations, especially weeds that escape known herbicide application.
4. Prevent the infestation of this weed in your field and hand remove if necessary.
5. In fields where herbicide resistance is known or highly suspected, clean vehicles and equipment prior to moving to fields where resistance is not suspected.
6. Do not continue to treat weeds with herbicides that continue to show an inability to control the target weed.

Figure 27.10. Mature Palmer amaranth plant.
(Photo courtesy of Joe Daubenmier, Dupont Co., Inc.)

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References and additional information

Horak, M.J., D.E. Peterson, D.S. Chessman, and L.M. Wax. 1994. Pigweed Identification – A Pictorial Guide. S-80. Kansas State University and USDA-ARS, Kansas State University Extenson, Manhattan, KS. Available at: http://www.ksre.ksu.edu/library/crpsl2/s80.pdf

Osborne, L.E., D.L. Deneke, T. Chase, and M. Langham. 2010. Soybean Disease – A Pictorial Guide for South Dakota. EC932. South Dakota State University, SDSU Extension, Brookings, SD.

Westphal, A., T.S. Abney, and G. Shaner. 2006. Diseases of Soybean – Frogeye Leaf Spot. BP-131-W. Purdue University and USDA- ARS, Purdue Extension, West Lafayette, IN. Available at: http://www.extension.purdue.edu/extmedia/BP/BP-131-W.pdf

Westphal, A.T., L. Xing, T.S. Abney, and G. Shaner. 2006. Diseases of Soybean – Sudden Death Syndrome. BP-58-W. Purdue University and USDA-ARS, Purdue Extension, West Lafayette, IN. Available at: http://www.extension.purdue.edu/extmedia/BP/BP-58-W.pdf

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Deneke, D., K. Tilmon, and C.L. Strunk. 2013. Emerging disease, insect, and weed pests in South Dakota soybean production. In Clay, D.E., C.G. Carlson, S.A. Clay, L. Wagner, D. Deneke, and C. Hay (eds). iGrow Soybeans: Best Management Practices for Soybean Production. South Dakota State University, SDSU Extension, Brookings, SD.

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