



Stem Canker

Introduction

Stem canker is a disease of soybean in the United States and Canada where infections occur primarily on the lower portion of the stem. Multiple fungi in the genus *Diaporthe* cause the disease. However, identifying and managing stem canker is similar regardless of which fungus is involved.

Symptoms and Signs

Often, the first symptoms of stem canker are dead plants with dried leaves still attached to petioles late in the season. Diseased plants usually occur in patches within fields (Figure 1). Initial symptoms typically appear on the lower third of the stem shortly after flowering (growth stage R1).

The lesions start as small, reddish-brown spots at the base of a branch or leaf petiole and then expand to form slightly sunken cankers that are reddish-brown with reddish margins (Figure 2). Cankers may remain on one side of the stem and can extend over several nodes or girdle the stem, killing the plant (Figure 3). In some cases, *Diaporthe* fungi cause top dieback by forming a dark brown canker on the upper four to six internodes, which kills only the top of the plant (Figure 4).



Figure 1. When stem canker appears in a field, you will see dead plants with their leaves attached.



Figure 2. An example of the reddish-brown stem canker lesions on the stem.



Figure 3. Cankers may extend over several nodes on the stem.



Figure 4. Top dieback occurs when cankers form on upper stem nodes.

Diaporthe fungi may also be associated with gray streaking in the lower stem and taproots. Interveneinal foliar chlorosis and necrosis may occur as a result of a toxin the fungus produces, but it is difficult to distinguish foliar symptoms from several other soybean diseases that cause similar symptoms (see Diseases with Similar Symptoms, page 4).

Disease Cycle

The fungi that cause stem canker survive in residue or in the soil for several years. Seed can be infected, but fungal spores from infested residue are usually the primary source of the fungus. Several weed species also serve as hosts, including black nightshade, curly dock, morningglory, and others. However, many of these weed hosts do not show symptoms of stem canker.

The fungus produces spores during rainy weather, which then splash onto plant tissue. Infection occurs during the early vegetative stages of soybean growth, although cankers are not visible until the plant enters reproductive stages. Secondary spore production on infected plant tissue can occur, but later infections will not have as great an impact on disease development.

Infection can occur over a wide range of temperatures, but the fungus requires extended moist periods to infect. Disease can develop to epidemic levels when rainy weather persists during the early vegetative stages of soybean growth.

Disease Diagnosis

Several other soybean diseases can cause similar symptoms, which can make diagnosis difficult (see Diseases with Similar Symptoms, page 4). Cankers may be isolated between nodes, or extend from a node to the soil line (Figure 5). Plants infected with the fungus that causes stem canker typically do not have interior taproot discoloration. You may need a laboratory diagnosis to distinguish stem canker from other diseases.



Figure 5. Stem canker can be difficult to diagnose because lesions often extend below the soil line.

Yield Loss and Impact

Yield loss from stem canker can approach 50 percent on susceptible cultivars under favorable conditions. Stem canker can cause premature death of soybeans in large areas of the field (Figure 6). These plants often have fewer and smaller seeds.



Figure 6. Severe stem canker infestations can cause premature death and yield loss.

The impact on yield is greatest when plants are infected early in the vegetative stages and weather is conducive for disease development. Infections that occur during reproductive stages often affect yield less. Soybeans with partial resistance to stem canker must be infected very early in the season for extensive yield loss to occur.

Management

The best way to manage stem canker is to plant resistant soybean varieties. Consult your seed dealer to obtain current information about varieties with stem canker resistance.

Rotating crops to a nonhost may reduce the amount of inoculum available to infect the next soybean crop. Soybean rotations to nonhosts such as corn, wheat, and



Figure 7. Severe stem canker may require several management techniques, including planting resistant varieties, rotating crops, and tillage.

sorghum are recommended for at least two years after a severe disease infestation (Figure 7). If stem canker is severe, avoid rotating the field with alfalfa, which is also a host.

Evaluations for stem canker control indicate that fungicides may not be effective when susceptible cultivars are used. However, fungicides can manage stem canker in cultivars with moderate resistance. Apply sprays during early vegetative stages.

Fields under minimum or no-till production are at higher risk for stem canker development because they have more crop residue. Incorporating infested crop residue into the soil will reduce the survival rate of the fungus and the amount of fungus available to infect the next soybean crop. You can further reduce disease development by planting fields with a history of stem canker last.

Fields high in soil organic matter or with high fertility are also at increased risk for disease. Maintain adequate fertility to reduce disease impact.

Diseases With Similar Symptoms

Table 1. Symptom expression on roots, stems, and leaves for stem canker, brown stem rot, Fusarium wilt, Phytophthora stem rot, sudden death syndrome, tobacco streak virus, and white mold on soybean.

| Disease | Roots | Exterior Stem | Interior Stem | Leaf Symptoms |
|--------------------------------------|---|---|---|---|
| stem canker | healthy | dark red-brown canker at node that can extend over several nodes; lesions often not entirely around stem | discoloration or browning near lesion | interveinal chlorosis and necrosis, typically leaves remain attached to plant |
| brown stem rot | healthy | healthy | brown discoloration in pith (center of stem) | interveinal chlorosis and necrosis |
| Fusarium wilt | brown vascular tissue | healthy | brown vascular tissue | leaves yellow and wilt, remain attached |
| Phytophthora stem rot | root discoloration | dark brown lesion beginning at the taproot and extending up several nodes on the stem and surrounding the entire stem | brown internal discoloration on plants at any stage | leaves yellow and wilt, remain attached |
| sudden death syndrome | root discoloration and rotting; internal browning of tap root | healthy | brown or gray discoloration in below outer stem layer but pith is white | interveinal chlorosis and necrosis of leaves, leaves drop after death |
| tobacco streak virus | healthy | dark red-brown canker at node(s) -not always present | brown discoloration of the pith at node(s) | healthy; bud proliferation and plants stay green after maturity |
| white mold (Sclerotinia stem rot) | healthy | white cottony mold stuck to lower stem, black, hard sclerotia may be present | black sclerotia embedded in stem tissue | leaves wilt and turn grayish green between veins, remain attached |

Brown Stem Rot (BSR — *Phialophora gregata*)

The foliar symptoms of brown stem rot (BSR) include yellowing and necrosis between veins. The stem symptoms include brown, discolored pith tissue, especially near the nodes of soybean stems (Figure 8).

How to distinguish BSR from stem canker:

Stem canker's foliar symptoms may be similar to those of BSR, so the real difference is visible in the stem. Split the plant stems to confirm the discolored pits that are characteristic of BSR-infected plants.

Figure 8. Stems infected with brown stem rot have brown discoloration and disking in the pith.



Fusarium Wilt (*Fusarium oxysporum*)

Fusarium wilt-infected leaves turn yellow, die, and remain attached to the stem (Figure 9). Plants affected by Fusarium have brown vascular tissue in the roots and stems, which cause plants to eventually wilt and possibly die (Figure 10).

How to distinguish Fusarium wilt from stem canker:

Plants with Fusarium wilt have brown vascular tissue in the roots and stems — plants with stem canker do not. Also, plants with Fusarium wilt do not show external decay or stem lesions above the soil line.

Figure 9. (Top) Plants with Fusarium wilt will die prematurely and retain leaves, similar to stem canker.

Figure 10. Brown discoloration in the lower stem is indicative of Fusarium wilt.

**Phytophthora Root and Stem Rot (PRR — *Phytophthora sojae*)**

Phytophthora root and stem rot (PRR) occurs in wet, waterlogged, compacted soils. Symptoms of this disease generally appear during or shortly after waterlogged soil conditions.

How to distinguish PRR from stem canker:

The stems of Phytophthora-infected plants have a characteristic dark brown lesion on the outer stem tissue that continues from the roots up to the third or fourth node (Figure 11).

Figure 11. Long brown lesions that continue from the roots to the middle of the stem are characteristic of Phytophthora root rot.

**Sudden Death Syndrome (SDS — *Fusarium virguliforme*)**

Sudden death syndrome (SDS) occurs in wet, compacted soils. SDS symptoms are expressed as yellowing and necrosis between the veins of leaflets during the soybean plant's mid- to late reproductive stages. The veins of symptomatic leaves will remain green.

How to distinguish SDS from stem canker:

SDS-infected plants will not have a stem lesion as stem canker-infected plants do. As the foliar symptoms of SDS progress, the leaflets will eventually curl or shrivel and drop off with only the petiole remaining (Figure 12), instead of remaining attached and dead as they do with stem canker.

Figure 12. Brown to gray discoloration in the lower cortex of the plant indicates infection by the fungus that causes sudden death syndrome.



Tobacco Streak Virus (TSV)

Tobacco streak virus (TSV) causes bud blight, leaf and flower bud proliferation (Figure 13), green stem disorder, and sometimes a lesion or blotch near the nodes (for example, red node). The internal stem tissue of infected plants also can be brown near the nodes.

How to distinguish TSV from stem canker:

Stem canker will not cause bud proliferation. TSV lesions near the node are much smaller than stem canker lesions.

Figure 13. Bud proliferation is very common in plants infected by tobacco streak virus.



White Mold (Sclerotinia stem rot — *Sclerotinia sclerotiorum*)

White mold (Sclerotinia stem rot) is typically more of a problem in years when conditions are rainy and cool during flowering. Lesions develop on the nodes and expand up the stems. Infected leaves often die and remain attached to the stem.

How to distinguish white mold from stem canker:

Sclerotinia-infected plants can be identified by the presence of white fungal growth on the outside of the stems (Figure 14). In addition, the white mold fungus produces sclerotia that are hard and black.

Figure 14. White fungal growth and black fungal sclerotia are present on plants affected by white mold.



Find Out More

To learn more about stem canker, visit the NCSRP Soybean Research Information and Initiative (SRII) website (www.soybeanresearchinfo.com) or consult your land-grant institution. Other publications in the *Soybean Disease Management* series are available by visiting the SRII website or your land-grant institution's website.

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