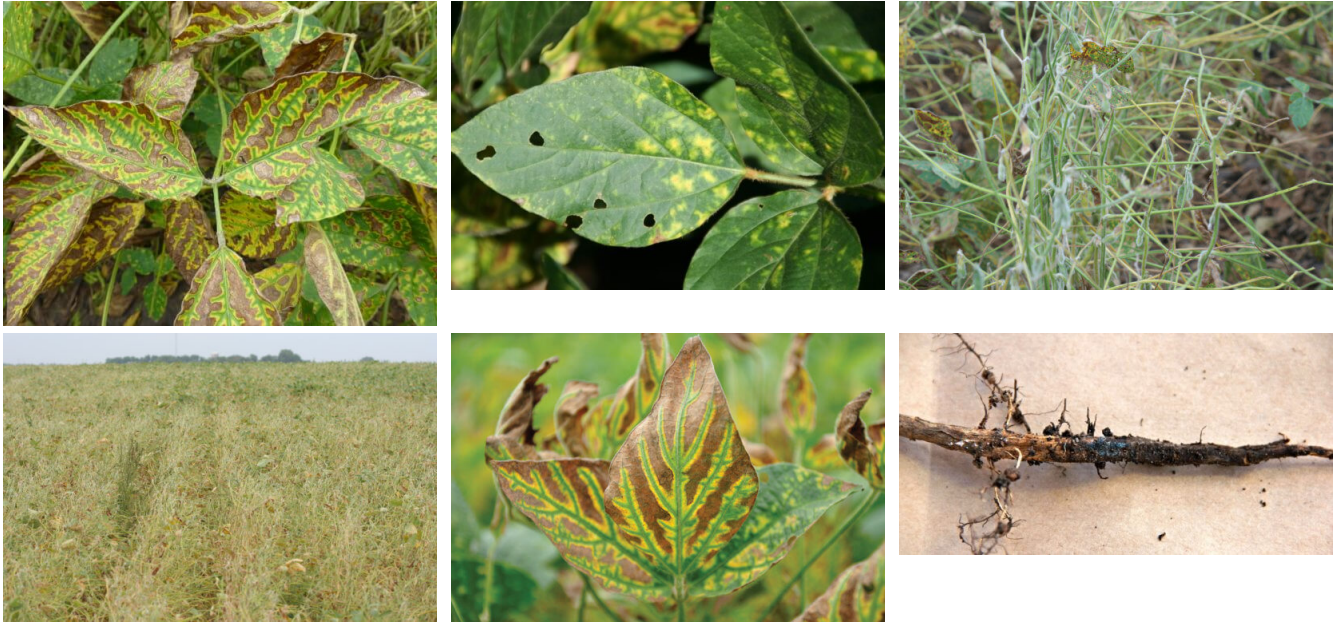
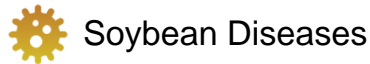


SUDDEN DEATH SYNDROME



Overview

Soybean Sudden Death Syndrome (SDS) has become one of the leading yield-limiting soybean diseases in North America. The disease is caused by the soilborne fungus *Fusarium virguliforme*. SDS has two phases—a root rot phase and a leaf scorch phase. The fungus is closely related to another soybean pathogen, *Fusarium solani* form B, that causes seedling disease and root rot.

The disease's importance varies greatly throughout production areas. In some years the disease may be present in a high percentage of fields across an entire state and in others it can be localized or rare. The foliar phase of the disease produces symptoms that can be confused with other diseases, most notably stem canker and brown stem rot. Phytotoxicity symptoms from some triazole fungicides also can be easily confused with those of SDS. It is well documented that there is a high degree of association between the presence of soybean cyst nematode (SCN) in a field and SDS development.

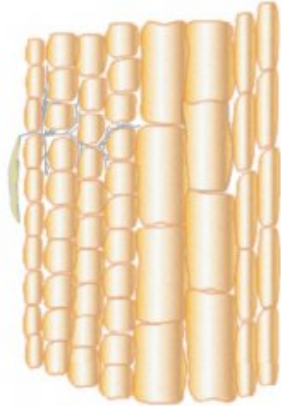
The SDS pathogen

The fungus survives the winter in both soybean and corn crop residue as well as in the soil. The fungus can infect young soybean roots shortly after germination. Infection is greater when seedling development is slowed by cool, wet soil conditions. The fungus will remain in the roots while the plant continues to grow. During the late vegetative or early reproductive

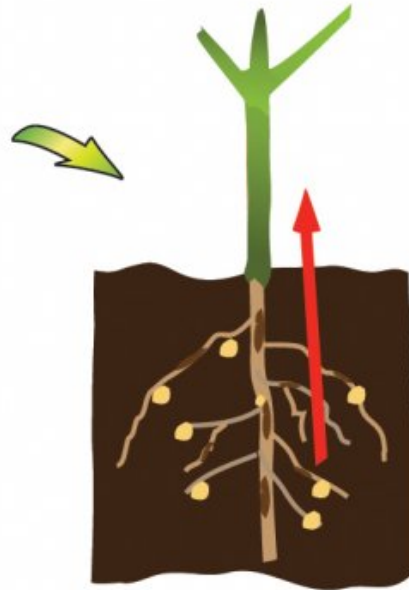
stages, the fungus produces a toxin that is moved upward through the plant to the leaves where it produces the associated foliar symptoms.



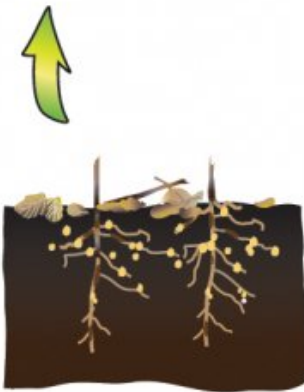
Early season infection of soybean roots.



Growth of fungus in root tissue.



Toxins produced by the fungus travel upwards from roots.



Inoculum survives in soybean and corn residue, as well as in soil.



Leaves may eventually drop and petioles remain attached to stem.



Leaf symptoms result from toxins moving into foliage.

Scouting

Diagnosing SDS can be challenging because other diseases and disorders cause similar symptoms. Foliar symptoms alone are not enough to diagnose SDS. It is important to dig plants and inspect them closely. When the stem is split open, the pith of an infected plant will be white even if roots are severely rotted. When the taproot is split, there is typically a gray to brown discoloration. All or only parts of a field may show symptoms. You may also need a laboratory diagnosis to distinguish SDS from other soybean diseases and disorders.

Foliar symptoms

Symptoms of SDS are easy to recognize. Symptoms first appear as small, pale green to yellow circular spots on the leaves during late vegetative or early reproductive growth stages. As the disease progresses, the areas between the leaf veins will first turn bright yellow, then eventually brown, with the veins remaining green. The brown tissue between veins may die and fall out, leaving large ragged holes and streaks in leaves. The leaves will detach from the petioles and fall to the ground. The petioles remain attached, giving the plant a somewhat skeletal appearance. Symptoms are generally more pronounced in the upper canopy. Flowers and pods may abort or not fill.

Root symptoms

A key symptom of SDS is a substantial amount of root discoloration along with root and crown rot. Diseased plants are easily pulled out of the ground because of decayed lateral roots and taproots. When split lengthwise with a knife, the internal tissue of the taproot will be gray to reddish brown, not healthy white. In advanced stages, the fungus may appear on the outer taproot as a blue mold.

Symptoms present on both leaves and roots are diagnostic for SDS

SDS may be mistaken for brown stem rot (BSR) or stem canker, because these diseases show similar leaf symptoms. It's important to distinguish between these diseases because the control measures are different:

- **SDS** is diagnosed by the symptoms on **both leaves and roots**. The outer tissue of SDS- infected stems can be rotted, but the stem's pith remains white.
- **BSR** infection results in a distinct brown center (pith) of the stem, but the roots are not affected.
- Plants infected with **stem canker** will develop brown cankers at the point of stem attachment on the main stem, but the roots are not affected. A "shepherd's crook" may also be present at the top of the plant.
- Certain **triazole fungicides**, particularly tebuconazole, when applied at extremely high temperatures (< 95 °F), may produce phytotoxic symptoms in the leaves that

can be easily confused with SDS. Like BSR and stem canker, the roots are not affected.

Five important clues to identify SDS:

1. **Watch for foliar symptoms.** Foliar symptoms can appear during the late vegetative stages, but most often are visible after flowering. The first symptoms to appear are yellow blotches between the veins that progress to large irregular patches. The vein tissue remains green.
2. **Split the stems.** If the center of the stem is brown, it is more likely BSR, or in some western growing regions, *Dectes* stem borer damage; if white, proceed to examining the roots.
3. **Dig up roots.** SDS causes root rot, while root systems of plants affected by BSR and *Dectes* remain healthy. Plants infected with the SDS pathogen are easily pulled out of the ground because the taproots and lateral roots have deteriorated. While not always present, a bluish mold on the outside of the taproot (fungal spores) is diagnostic for SDS.
4. **SDS symptoms appear earlier than BSR.**
5. **Be aware that stem canker is not as common as SDS.** Stem canker can occur in the same year and fields as SDS. In addition to foliar symptoms, stem canker will typically have cankers at the point of stem attachment on the lower stem, and defoliation is not as pronounced as with SDS.

Management

Sudden death syndrome tends to be most severe in well-managed soybean fields with a high yield potential. Fields with a history of SDS have a higher risk potential.

Infection by the SDS pathogen is favored by:

- **Slow seed germination and emergence** that prolongs the contact period between pathogen and soybean. These conditions are more likely to occur at early planting dates.
- **High soil moisture** during the vegetative growth period.
- **Unseasonably cool temperatures** prior to or during flowering and pod set.

The SDS pathogen spreads from field to field with the movement of soil on equipment, field activity, birds, animals, and soil movement by wind or water erosion. Although SDS can occur in fields not infested with SCN, heavy SCN pressure seems to worsen SDS.

- **Plant high-yielding SDS-resistant varieties**
Variety selection is the number one management tool. If SDS is causing defoliation in

your field, do not plant highly susceptible varieties. Ask your seed dealer for information on varieties with partial resistance or tolerance to SDS. Growers in the southern areas of the region currently have better options when selecting resistant varieties. It's harder to find SDS resistant varieties in the early maturity groups. This is currently a high research priority for soybean breeders.

- Several universities conduct extensive testing of varietal reaction to SDS. Select varieties with solid agronomics. In many areas, resistance to both SDS and SCN is needed. Keep in mind a variety may have good resistance to SDS and at the same time poor resistance to SCN or vice versa.
- **Plant early, but in warm, dry soil**
The pathogen prefers cool, wet soil for infection. Move planting dates a week or two after regular early planting dates or till to promote earlier warming of soils. This is easier to do in southern areas of the region than the northern ones, where yield potential may be lost the later a field is planted. North Central Soybean Research Program (NCSRP) researchers recommend to plant early as long as an SDS-tolerant variety is planted, but don't plant a susceptible variety in a field with a history of SDS. If you have a field with a history of SDS, try to plant it later than other fields.
- **Use high quality seed**
Quality seed has more vigor and germinates and emerges more quickly. Maintain crop fertility based on soil tests.
- **Fungicides**
Foliar fungicides are not effective against SDS since the fungus remains in the root system. Seed treatments containing the active ingredients adepidyn or fluopyram have provided excellent results in reducing yield losses to the disease in university trials. [See Fungicide Efficacy for Control of Soybean Seedling Diseases](#) for currently recommended products.
- **Manage soil compaction**
Compaction leads to higher levels of SDS. In some areas, depending on soil type, depth, and other factors, ripping or chisel plowing can have a significant impact on the amount of SDS that develops.
- **Harvest corn fields cleanly**
Research has demonstrated that corn is a good crop for harboring the SDS fungus, especially corn kernels. This is consistent with producers' observations that severe outbreaks of SDS can occur after a few years of continuous corn. A clean corn harvest that minimizes kernels on the ground will both improve corn yields and reduce the risk of SDS the next time soybeans are planted.

These recommendations are the cooperative effort of soybean researchers and Extension specialists throughout the United States and are funded with soybean checkoff dollars through the North Central Soybean Research Program

Distribution

[Sudden Death Syndrome, Crop Protection Network CPN-1011, 2016](#)

[Fungicide Efficacy for Control of Soybean Seedling Diseases, Crop Protection Network, CPN-1020, Updated annually](#)

[Scouting for Sudden Death Syndrome, Crop Protection Network CPN-1012B, 2016](#)

[Scouting for Soybean Stem Diseases, Crop Protection Network CPN 1002, 2015](#)

[The Relationship Between the Causal Agent of SDS and SCN in Wisconsin, University of Wisconsin, 2015](#)

[Soybean Death Syndrome Management Update \(webcast\), Plant Management Network, Focus on Soybeans, 2015](#)

Resources

Using ILeVO® with pre-emergence herbicides

Crop Protection Network CPN 1013, 2016

<https://soybeanresearchinfo.com/wp-content/uploads/2020/05/CPN-1013-Using-ILeVO-with-Preemergence-Herbicides.pdf>

Scouting for Sudden Death Syndrome

Crop Protection Network CPN-1012B 2016

<https://cropprotectionnetwork.org/publications/scouting-for-sudden-death-syndrome-in-soybean>

Scouting for Soybean Stem Diseases

Crop Protection Network CPN 1002, 2015

https://soybeanresearchinfo.com/wp-content/uploads/2019/03/CPN1002_ScoutingSoybeanStemDiseases051515.pdf

The Relationship Between the Causal Agent of SDS and SCN in Wisconsin

University of Wisconsin

https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SCN_SDS_2015_FINAL.pdf

Soybean Death Syndrome Management Update

Iowa State University, 2015

<http://www.plantmanagementnetwork.org/edcenter/seminars/soybean/SDSManagementUpdate/>

Sudden Death Syndrome

Crop Protection Network CPN-1011, 2016

<https://cropprotectionnetwork.org/publications/an-overview-of-sudden-death-syndrome>

Sudden Death Syndrome

University of Minnesota

<https://extension.umn.edu/pest-management/sudden-death-syndrome-soybean>



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