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# Sudden Death Syndrome of Soybean

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## What is Sudden Death Syndrome of soybean?

Sudden Death Syndrome (SDS) of soybean is a fungal disease that develops in soybean and can cause severe yield losses. SDS symptoms suddenly appear usually after the flowering/reproductive growth stages through pod fill (Figure 1). The plants that look normal can in a short time turn yellow and drop leaves. This disease is caused by a soil inhabiting fungal pathogen called *Fusarium virguliforme*.

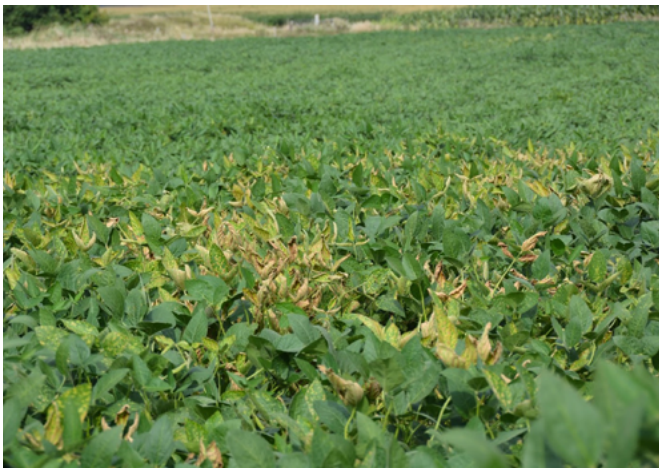

**Figure 1.** Sudden death syndrome infected plants in the field. (photo credit: Emmanuel Byamukama)

## What are the symptoms of SDS?

SDS symptoms can be found on both roots and foliage. On foliage, symptoms of SDS first appear as small, pale green, circular spots on leaves during the early reproductive growth stages (Figure 2).

**Figure 2.** Initial symptoms of sudden death syndrome (photo credit: Emmanuel Byamukama)

These spots enlarge into striking/flashy yellow irregular blotches between veins while the veins remain green (Figure 3). The yellow blotches turn brown shortly. In severe cases, the leaves drop prematurely leaving the petioles attached to the stem. Infected plants may not always show foliar symptoms.

Roots of a soybean plant infected with SDS are rotted and discolored. Diseased plants can easily be pulled out of the ground because of rotted lateral roots. If the plants are pulled when the soil is moist; small, light-blue patches can be seen on the surface of the taproot (Figure 4). When the tap root of the infected plant is split lengthwise, the internal tissue will be gray to brown, as opposed to the normal cream white color of a healthy plant (Figure 5).

The foliar symptoms can be confused with those caused by brown stem rot (BSR), stem canker, white mold, and charcoal rot, which are all fungal diseases

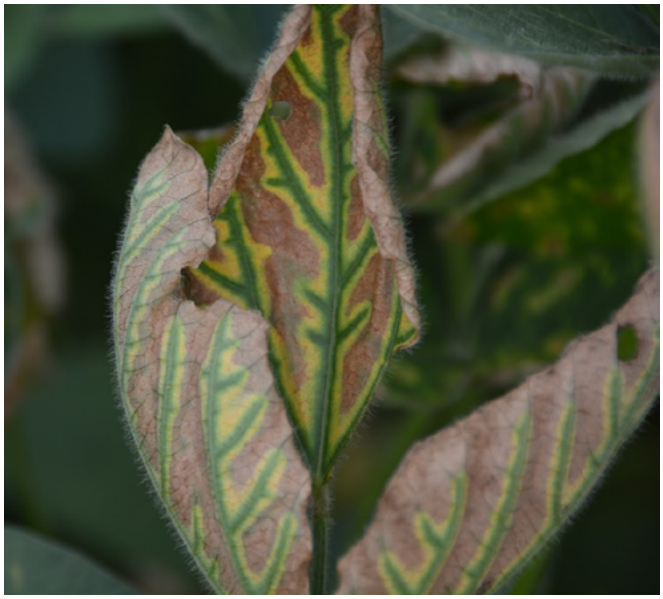

**Figure 3.** Foliar symptoms of sudden death syndrome. (photo credit: Emmanuel Byamukama)

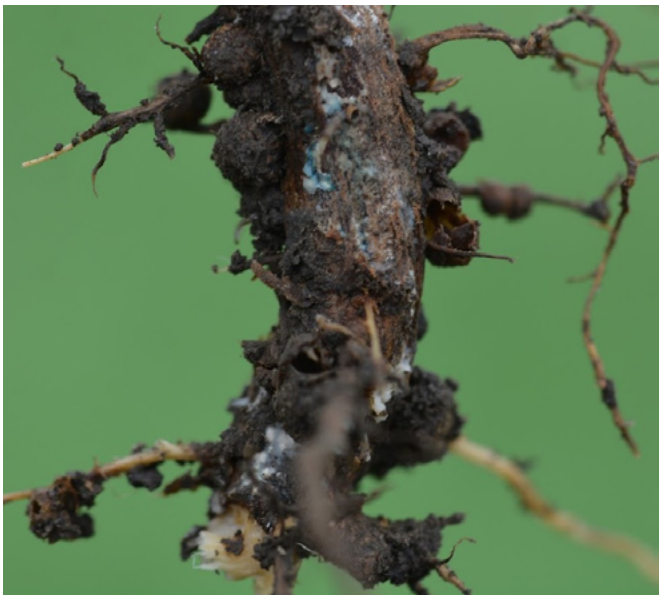

**Figure 4.** Blue mycelia on the soybean root is a typical sign of sudden death syndrome pathogen. (photo credit: Emmanuel Byamukama)

that develop in soybean. To distinguish between these, the taproot must be split to examine the cortical tissue of the plant (Figure 5). BSR causes distinct brown center (pith) of the stem (Figure 6), but the roots are not affected. Plants infected with stem canker have a reddish/brown canker on the main stem, while the roots are not affected. White mold infected plants will have cotton white mycelia on the outside of the stem. Plants infected with charcoal rot have tiny black spots that resemble charcoal dust on the lower part of the stem and part of the tap root when the skin is peeled off.

## Where does SDS come from?

While SDS is a relatively new disease problem in the mid-west, it has been occurring in the southern states for almost 25 years. SDS is found in our neighboring states; Minnesota, Iowa, and Nebraska. The pathogen


**Figure 5.** Discolored taproot with gray-brown pith (right split stem) caused by sudden death syndrome fungus. Healthy root is on the left side. (photo credit: APS)

**Figure 6.** Internal stem browning caused by brown stem rot pathogen. Right is healthy stem. (photo credit: Craig Grau, UW)

survives in crop residue or freely in the soil as thick-walled chlamydospores. The chlamydospores can withstand freezing temperatures and resist desiccation for several years. When the soil is warm in the spring, developing soybean roots stimulate the chlamydospores to germinate and then infect young soybean roots. Chlamydospores can be moved around with flowing water, wind soil erosion, and through any practices that move soil (e.g. farm machinery). Research conducted at Iowa State University shows that the fungus also survives well on corn kernels left on the soil during harvesting or shattered by hail.

## How does SDS infect soybean?

The pathogen infects soybean seedlings just as the seeds germinate, but symptoms may not be seen until after flowering. The fungus colonizes the root cortical tissue in the early growth stages of the plant (V1 through V6). At flowering, the fungus penetrates into the vascular tissue of the plant. The fungus then produces toxins that are translocated to the leaves. It is these toxins that scorch the leaves, eventually killing them. The fungus itself does not invade leaves.

## How much yield loss is caused by SDS?

Because SDS causes premature leaf drop and flower/pod abortion, yield losses can range from minimal to 100% depending on the cultivar and the stage of development when symptoms first appear. However, because SDS spreads in soil, usually only patches within the field may be infected. Over the years, inoculum can spread to larger patches or even the entire field.

## Does SDS occur alone?

There has been co-occurrence of SDS and soybean cyst nematode (SCN). The SDS fungus may take advantage of wounds on the roots caused by SCN. However the fungus can also infect plants on its own. Growers should have their soils tested for SCN if SDS symptoms are seen or are suspected.

## What are the risk factors for SDS?

Infection by the SDS pathogen is favored by:

- Cool and wet soils
- Early planting when soil temperatures are below 55 degrees F.
- Poor drainage
- Unseasonably cool temperatures and frequent rains prior to or during flowering and pod set

## How can SDS be managed?

SDS is a soil-borne pathogen and like any other root rot pathogen, there is little that can be done in-season to manage the disease. Therefore spraying with fungicide does not control SDS. Fortunately there are management options available for growers to manage SDS if SDS has been confirmed in the field.

SDS Management:

- Plant later in the spring, when the soil is warm. Too wet and cool soils at the time of planting promote infection by SDS pathogen. However, late spring planting can also reduce soybean yield.
- Plant high-yielding SDS-resistant varieties. Fortunately most of the soybean seed companies provide SDS resistance rating. Ask your seed dealer for information on varieties with partial resistance or tolerance to SDS.
- Apply a seed treatment for fields with a history of SDS. Currently, there are two active ingredients that are effective against SDS: fluopyrum (Ilevo) and pydiflumetofen (Saltro).
- Manage SCN. There is a close association between SCN and SDS. Management practices that reduce SCN also delay the onset of SDS. The two active ingredients above are also effective against SCN.
- Harvest corn fields cleanly. Corn kernels can harbor the SDS pathogen.



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