Distinguishing among Common Fungal Diseases in Soybean

- Accurate disease diagnosis is important for the implementation of appropriate management practices for future plantings.
- Foliar symptoms of some soybean diseases can be very similar.
- Sudden death syndrome (SDS) and brown stem rot (BSR) are important soybean diseases, but can be easily confused as foliar symptoms are very similar; however, internal pith browning only occurs in BSR.

The following diseases are caused by fungi that can be present in crop residue and in the soil. In each case, wet weather and moist soil conditions can favor infection and disease development. When present, foliar symptoms can be very similar, include chlorosis and browning of the tissue between the veins, and can be hard to distinguish from early crop maturity and drought stress (Figure 1). However, as described below, there are many ways to distinguish among fungal soybean diseases.

**Red Crown Rot**
Red crown rot is caused by *Calonectria pyrochroa* (also known as *Cylindrocladium parasiticum*). This disease primarily occurs in warm-temperate regions such as the Southern United States. The fungus colonizes soybean roots 3 to 4 weeks after planting. Infection by red crown rot is favored by moderate soil temperatures. Symptoms typically appear during or after pod set as interveinal chlorotic spots, which expand and turn brown. Defoliation, including loss of petioles, can occur within 2 weeks. Roots of infected plants appear black and the stem can appear gray-brown to red-brown about 2 to 4 inches above the soil line. Bright red fungal structures called ‘perithecia’ form on the surface of stems, near the soil (Figure 2). Infestations of root-knot nematode or soybean cyst nematode along with the presence of red crown rot can result in a severe disease situation.

**Stem Canker**
Stem canker is caused by *Diaporthe phaseolorum* var. *caulivora* in the Northern United States and *D. phaseolorum* var. *meridionalis* in the Southern United States. Symptoms of both northern and southern stem canker first appear during the early reproductive stages as small, red-brown lesions. Initial lesions are usually found near a lower leaf node and expand lengthwise as the season progresses. Lesions caused by northern stem canker turn dark brown as they age, are 2 to 10 cm long, and eventually girdle the stem, causing wilting and plant death (Figure 3). Lesions caused by southern stem canker rarely girdle the stem. Foliar symptoms, including interveinal chlorosis and necrosis that appear as a result of a phytotoxin produced by the fungus, are quickly followed by plant death. Top dieback with a characteristic curling or shepherd’s crook of the terminal bud may occur.
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Sudden Death Syndrome (SDS)
Sudden death syndrome is caused by Fusarium virguliforme. SDS is found across all soybean production regions in the United States and can be associated with compacted soils. Soybean cyst nematode may increase the incidence and severity of SDS. The fungus infects the roots and colonizes the base of the stem, sending toxins to the leaves. Symptoms of SDS may be seen during the soybean vegetative growth stages. However, they are most commonly seen during the early reproductive growth stages through pod fill. Leaflets on plants with severe foliar symptoms may detach from petioles. Unlike red crown rot, petioles remain upright and attached to the stem. Splitting the stem of a soybean plant with SDS will reveal a slight tan to light brown discoloration of the cortex, especially at the stem base, and a normal white to cream colored pith. Under moist conditions, plants with SDS may also display blue masses of spores on the tap root (Figure 4).

Brown Stem Rot (BSR)
Brown stem rot is caused by 2 genotypes of Phialophora gregata (syn. Cadophora gregata). This disease is prevalent in the North Central United States. Genotype A causes severe foliar symptoms, while genotype B causes little or no foliar symptoms. Most commercial soybean products have resistance to genotype A. The infection is more severe during cool, rainy growing seasons and when the pathogen infects roots early in the season. Stem symptoms can begin to appear as early as the vegetative growth stages, while foliar symptoms are most evident around R4 growth stage. Vascular tissue and pith browning is a characteristic symptom of BSR (Figure 5). Browning starts at the root level and usually at the leaf nodes, and as the disease progresses, browning can become more severe up the stem. Foliar symptoms consist of interveinal yellowing and browning of leaves. Affected leaves shrivel up, but remain attached to the stem. These symptoms can easily be confused with those of SDS. Plants can become stunted and may die prematurely. Severely damaged plants will have fewer pods, and limited seed number.

Summary
Fungi that cause red crown rot, stem canker, BSR, and SDS can be present in the soil or crop residue. Symptoms of these diseases are most severe when infection occurs early and with persistent wet weather conditions. Since foliar symptoms of these diseases look similar and initially develop during reproductive stages, an accurate diagnosis is critical for future management options. Distinct characteristic symptoms and geographic distributions can be used to correctly identify each disease:

Northern diseases - Northern stem canker, BSR, and SDS:
- Distinguish between SDS and BSR by splitting the stem and looking at pith coloration. The pith will be discolored with BSR while the pith will be white with SDS.
- Stem canker causes external stem lesions, SDS and BSR do not.

Southern diseases - Red crown rot, Southern stem canker, and SDS:
- The stem lesions of stem canker start at a lower leaf node and expand longitudinally, while red crown rot lesions are located near the soil line.
- The petioles of a soybean plant infected with SDS will remain upright and attached to the stem; however, they will fall off when infected with red crown rot.

Sources

Web sources verified 7/1/16. 130620060133 070116JMG

For additional agronomic information, please contact your local seed representative. Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. All other trademarks are the property of their respective owners. ©2016 Monsanto Company. 130620060133 070116JMG