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DISEASES OF SOYBEAN

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Brown Stem Rot

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Brown stem rot is considered a minor disease problem in the North Central Region, but in severely infected soybean plantings it can cause up to 30 percent yield loss. The disease is not found in southern states, possibly because it requires somewhat cooler weather (60°F to 80°F) during early pod development. Foliar symptoms do not appear until pods start to fill, around stage R3-R4, and may be confused with other diseases and disorders, such as sudden death syndrome or drought damage. Brown stem rot can be severe in fields with poor soil fertility and when moisture and temperature are otherwise favorable for soybean seed development.

Photo provided by Weidong Chen, USDA-ARS, Prosser, Washington

Figure 1. *Leaf symptoms of brown stem rot.*

Symptoms

The soilborne, brown stem rot pathogen infects soybean roots early in the season, but the plants remain asymptomatic until pods begin to fill. When they do appear, symptoms can be expressed in two ways, depending on the environment and pathogen genotype. In one case, only internal vascular browning occurs. In the other, vascular browning occurs along with leaf necrosis and chlorosis.

When leaves display symptoms of interveinal chlorosis and necrosis, the cause is believed to be a pathogen-produced toxin. Except for the retention of shriveled, brown, dead leaflets, the foliar symptoms look much like those caused by sudden death syndrome (Figure 1). Splitting the stems of infected plants longitudinally reveals a dark, chocolate-brown discoloration of the pith (Figure 2). However, this discoloration alone is not diagnostic of brown stem rot because other pathogens (such as tobacco mosaic virus) may cause similar symptoms under similar conditions. By contrast, in plants that have sudden death syndrome with the same leaf symptoms, the cortex of the stem remains normal white to pale-green.

Photo provided by Dean Malvick, University of Minnesota

Figure 2. *The split soybean stem on the left shows the dark, chocolate-brown pith that often indicates brown stem rot.*

Causal Agent

Brown stem rot is caused by *Phialophora gregata,* sometimes called *Cephalosporium gregata* or *Cadophora gregata*. This soilborne fungus grows slowly and variably in artificial media and requires that its natural substrate, soybean stubble, be embedded in the growth medium for it to sporulate. The fungus occurs in two distinct types: the more damaging type (genotype A) causes stem and leaf symptoms; the second type (genotype B) typically causes only stem symptoms.

Disease Cycle

The pathogen survives in crop debris in the soil and infects soybean seedlings early in the growing season. The pathogen sporulates profusely in soil, but it is not clear whether these spores or mycelium growing from underground debris from a previous soybean crop infect young plants. The pathogen infects the plant through lateral roots or the taproot.

Once in the plant, the fungus grows mainly within the stem in the conductive tissue. Disease symptoms develop more rapidly as the plant ages. Plant damage is thought to be mainly the result of toxins the fungus produces. These toxins cause the stem's internal browning, leaf death, and may ultimately result in the death of the entire plant.

Cool weather during pod fill favors brown stem rot. University of Wisconsin researchers have cautioned that the risk for brown stem rot is higher when the soil pH is less than 6.5.

In recent years the disease has been considered a minor problem in Indiana. In a recent survey with several soybean indicator lines for the pathogen near West Lafayette, Indiana, 24 of 54 stem samples were positive for the fungus. Of these samples, 92 percent were the more damaging genotype A, while 8 percent of the samples had both genotypes.

Management

Brown stem rot may cause yield loss without producing striking symptoms. Plants infected with strains that only cause stem symptoms suffer less yield loss than those infected with strains that also cause leaf-symptoms. But yields still may decline when only stem symptoms are present, especially when soybean is grown in monoculture. Management strategies involve adopting best management practices. As with any soilborne disease, it is important to keep good field notes to identify problem areas and to determine if the affected areas are becoming larger over the years.

Planting

Planting at the optimal time (early May for most of Indiana) creates the highest yield potential. Although later planting reduces the risk of brown stem rot, it also will reduce the crop's yield potential. Row width has little effect on brown stem rot severity.

Tillage

Conventional tillage, which buries soybean residue and promotes its decomposition, reduces brown stem rot risk in subsequent soybean crops. The fungus does not survive well in the soil once soybean residue has decomposed. The fact that many growers are practicing intermittent tillage (reduced tillage or no-till when a soybean crop is planted after corn, followed by more intensive tillage when a corn crop is planted after soybean) may be one reason why brown stem rot is not a major problem in the Corn Belt, but additional research is necessary to confirm this.

Rotation

Crop rotation with corn or small grains reduces brown stem rot. In fields where the disease has become severe, two or three years out of soybean will be necessary to reduce the fungus population to manageable levels.

Resistant Soybean Varieties

Some soybean varieties are resistant to brown stem rot. Cultivars with this resistance should be used only when high disease pressure is anticipated in an infested field.

Chemical and Biological Control

Foliar fungicides have no effect on brown stem rot. Likewise, seed treatment fungicides will have no effect because protecting the seedling will not be sufficient to inhibit infection after these materials have dissipated.

Recent research from Wisconsin indicates that maintaining a soil pH at 7 will reduce the risk of brown stem rot.

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