

Charcoal Rot of Soybeans

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Figure 1. Wilted plants in a charcoal rot infected field.

Charcoal rot, caused by the soilborne fungus *Macrophomina phaseolina*, is the most damaging soybean disease in Kansas. Although the disease can occur anywhere, it is especially severe in the southeast and east central regions of the state. In the past, disease incidence has reached 100 percent in some fields. Statewide, losses have occasionally approached an estimated 10 percent of the total crop.

The causal fungus is a weak parasite of soybeans, attacking young plants when their growth is retarded by unfavorable weather conditions. The signs of charcoal rot typically appear after midsummer when hot, dry weather slows plant growth. The disease may even appear on irrigated soybeans if water is withheld to promote maturity.

The fungus survives from season to season as small, hard black structures known as sclerotia. Sclerotia produced in soybean root and stem tissues may survive in crop debris for years. Besides soybean, the charcoal rot fungus can attack a number of other crop plant types, including corn, sorghum and various weed species.

SYMPTOMS

Charcoal rot symptoms generally begin to appear after mid-season. During periods of hot, dry weather, leaves turn yellow and wilt, but remain attached to the plant (Figure 1). After flowering, light gray to silvery stem lesions (Figure 2) may extend from the soil line upward.



Figure 2. Stem lesions may appear after flowering.

The best diagnostic symptom is found when the epidermis is peeled away from the stem. Numerous small, black bodies (sclerotia, **Figure 3**) give infected tissue a grayish-black color (**Figure 4**) resembling a sprinkling of finely powdered charcoal, hence the name 'charcoal rot.' The woody portion of the root and base of the stem may show black streaks when they are split open (**Figure 5**).

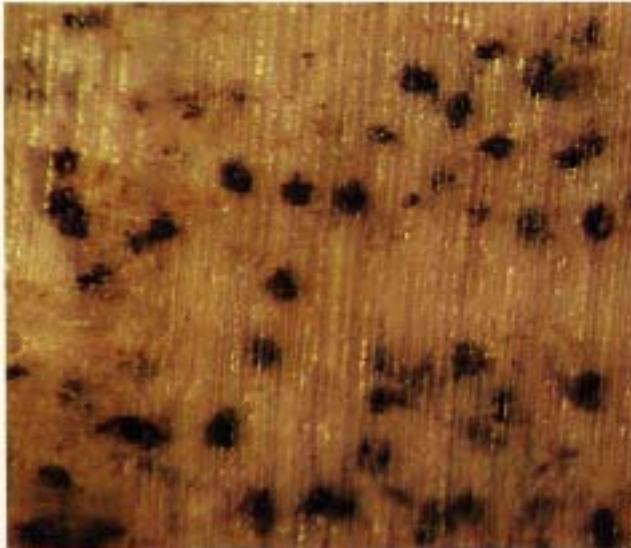


Figure 3. The small black fruiting structures (sclerotia) found in the stem tissue are a key diagnostic for charcoal rot.



Figure 4. Numerous sclerotia give the appearance of "powdered charcoal"

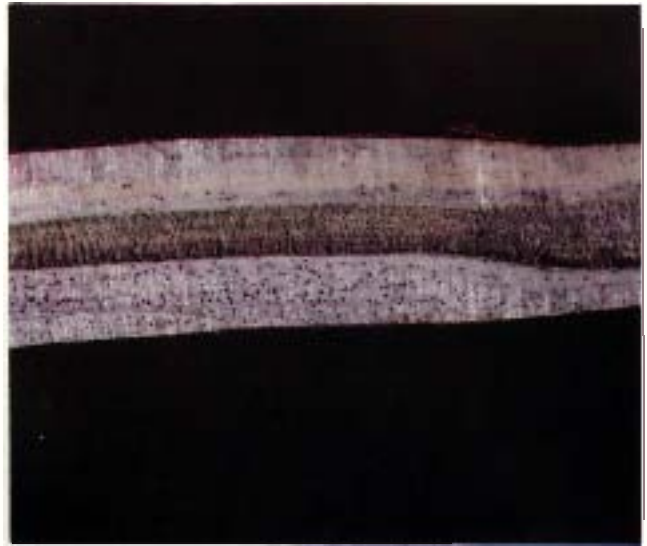


Figure 5. Black streaking may be present in root and basal stem tissues when split open.

CONTROL

Charcoal rot is usually most severe in older plants which have been subjected to stressful environmental conditions such as high temperature, drought, or poor fertility. A disease management program to minimize yield losses should include cultural practices which reduce these stresses.

For many field crop diseases, resistant cultivars are the most practical means of control. Resistance to the charcoal rot fungus, however, has been difficult to identify. Still, certain soybean cultivars appear to "resist" invasion by the fungus. These cultivars are usually the adapted, full-season cultivars for the region (e.g. Group 5 cultivars for east central and southeast Kansas) which may escape stressful conditions by flowering and filling pods later in the season than earlier maturing cultivars.

Fertility can also influence charcoal rot development. Plants under stress from too low or too high a level of nutrients are more likely to be attacked by the charcoal rot fungus than are those planted into soils with well balanced fertility.

Practices which reduce water stress should also be used. Irrigation, where available, can be used to avoid drought stress. Since irrigation is not available to many growers, other water management procedures which can be used include planting at the proper seeding rate and maintaining good weed control.

No chemicals are currently available for charcoal rot control. Planting high quality seed, free from other pathogens, into warm, dry soils, will produce vigorous seedlings and plants that tend to escape charcoal rot fungus infection. Seed treatment may aid in achieving this goal.