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Introduction

It is easy to find soybean diseases in Oklahoma. The major diseases of soybeans in Oklahoma are caused by fungi, bacteria, and nematodes that attack seed, seedlings, roots, foliage, pods, and stems. Conditions favorable for disease development can result in stand loss, reduction in seed quality, and occasionally yield losses. Severity of disease development and need for control are influenced by varietal selection and environmental conditions. Correct identification and early detection are critical in the proper management of soybean diseases. This fact sheet is intended to aid Oklahoma soybean producers in recognizing common soybean diseases that attack seedlings and roots. Diseases of soybeans that attack the leaves, pods, and stems are described in OSU Extension Facts No. 7662.

Seedling Diseases

Seedling diseases are caused by a group of fungi, acting independently or together, that cause similar symptoms on young plants. These diseases are classified as being either pre-emergence or post-emergence. Seedlings that become diseased prior to emerging through the soil surface are described as having pre-emergence seedling disease. Seedlings that become infected after emerging through the soil surface are described as having a post-emergence seedling disease. Fungi associated with seedling diseases include Fusarium, Phomopsis, Phytophthora, Pythium, and Rhizoctonia. These fungi are common wherever soybeans are grown and are capable of attacking soybean seedlings either pre- or post-emergence. They are primarily seedborne and soilborne pathogens.

Seedling diseases are usually associated with factors that cause stress to the young, developing soybean plant. Factors such as cool and wet soils, poor seed quality, improper planting depths, and herbicide injury can all play a major role in predisposing seedlings to invasion of the seedling disease fungi.

Dark brown or reddish lesions on the lower stem or main root are symptoms of seedling diseases (Figure 1). Often, the infected stems develop a watery lesion at the soil line, and the seedling breaks over at the lesion just prior to its death. Fields infected with significant amounts of seedling disease will have thin stands and uneven growth of seedlings. Infection by the disease-causing pathogens may occur before or during germination, or after emergence before the first set of trifoliate leaves develop.

Seedling diseases can be reduced by delaying planting until soil temperatures increase above 68°F and by planting high quality seed. A fungicide seed treatment can reduce seedling diseases and improve stand, especially in early planted soybeans. Seed treatments are relatively inexpensive and in most cases ensure a good start. However, seed treatments will not make up for poor quality seed (less than 85% germination). (Contact your local OSU County Extension Agriculture Agent for a current list of soybean fungicide seed treatments.)

Root and Lower Stem Diseases

Phytophthora Root Rot (Phytophthora megasperma var. sojae)

Phytophthora root rot is a soilborne disease that primarily occurs on soybeans that are growing in poorly drained soils with a high clay content. General symptoms include wilting of the plant, yellowing of leaves, and the development of large, water-soaked lesions on the lower stem and roots (Figure 2). Leaves on older plants first turn yellow between the veins, followed by a general wilting and death of the plant. The dead leaves generally remain attached to the plant.
Control of Phytophthora root rot is obtained by planting resistant varieties. There are many races of the pathogen, but varieties with resistance to all races are available. Low, poorly drained fields with clay-type soils should be avoided when planting susceptible varieties.

Southern Stem Blight (*Sclerotium rolfsii*)

Southern stem blight occurs on a wide range of host plants, including soybeans. Soybean losses due to southern stem blight are generally restricted to scattered, localized areas of dead plants that usually appear during the mid to latter part of the growing season.

The typical symptoms of southern stem blight infections are wilting and dying of plants generally in groups ranging from two to 20 plants. The key symptom for southern stem blight is the appearance of white, cottony mold growing on the main stem at the soil surface (Figure 3). Small, dense, brown structures (sclerotia), approximately the size of mustard seed, typically can be seen in association with the white mold. Sclerotia are the major survival structures for this pathogen.

Control of southern stem blight is obtained through crop rotation with grass crops such as corn and grain sorghum or with cotton. Deep plowing to bury the sclerotia and infected crop debris also provides some control of this disease. Avoid planting soybeans following crops which have had a significant problem with southern stem blight during the previous growing season (e.g., peanuts).

Charcoal Rot (*Macrophomina phaseolina*)

Charcoal rot is a prevalent disease throughout the soybean growing areas of Oklahoma. Yield losses due to charcoal rot are difficult to measure because the disease is closely associated with moisture stress and nutrient deficiencies. High plant populations, soil compaction, and nematode infestations also increase the incidence of charcoal rot.

Symptoms appear in hot, dry weather usually after the plants have initiated flowering and have begun setting pods. Leaves of infected plants turn yellow, and entire plants wilt and die with the leaves remaining attached. Wilting plants often occur in circular patches in low areas of a field. The most reliable diagnostic symptom is the development of tiny black specks (sclerotia) just beneath the epidermis, or bark, of the tap root and lower stem (Figure 4). The small sclerotia resemble a sprinkling of powdered charcoal in the diseased tissue, hence the name charcoal rot.

Since this disease is associated with stressed plants, incidence of charcoal rot can be reduced through proper fertilization, weed control, and irrigation. Crop rotation with poor hosts, such as cotton or small grains, for one to two years, can help in minimizing yield loss due to charcoal rot. There are no known resistant varieties; however, varieties that do not bloom and set pods during the normally dry months of July and August are more likely to escape infection by charcoal rot. There are no known chemical controls.

Nematodes

There are several different species of nematodes that feed on soybeans, but only two are known to be of consequence on Oklahoma soybeans. Root-knot (R-K) and soybean cyst nematodes (SCN) have been detected in Oklahoma soybean fields. Of these, the soybean cyst is the more common and is considered to be more damaging to soybean yields.
Above ground symptoms of nematodes, either R-K or SCN, are not specific. Sometimes nematode-infested plants are yellow and stunted (Figure 5). Stunted plants are often clumped within a row, which causes an uneven or wavy appearance to the rows. However, the amount of yellowing and stunting can vary dramatically between and within infected fields. Sometimes, there are no visual symptoms at all, or symptoms of other plant stresses such as drought or nutrient deficiency may be very pronounced.

The presence of R-K or SCN can frequently be diagnosed in the field. Root-knot nematode causes the roots to produce characteristic swellings or galls (Figure 6) which are easily distinguishable from nitrogen-fixing nodules (Figure 6a).

Female soybean cyst nematode can often be observed in the field as white to yellow cysts attached to the roots (Figure 7). Although visible to the naked eye, the female cysts are very small and can easily be missed. The most reliable method of detection is to submit a soil and root sample to the OSU Plant Disease Diagnostic Laboratory. (Contact your local OSU County Extension Agriculture Agent for information on sampling for nematodes.)

Control of both root-knot and soybean cyst nematodes is most effectively obtained through a "nematode management program." The goal of the management program is to reduce nematode populations below damaging levels and to prevent the development of races or strains of SCN capable of damaging resistant varieties. The use of crop rotations combined

![Figure 6. Root knot.](image1)

![Figure 6a. Nitrogen nodules.](image2)

![Figure 7. Soybean cyst nematodes.](image3)

Above ground symptoms reflect injury caused by root-feeding nematodes. A. root-knot nematode: female (stained red) feeding in root tissue; B. nematode eggs; C. head region of nematode with stylet protruding (arrow); D. soybean cyst nematode (yellow and brown cyst stages adhering to root segment); E. Reniform nematode: (female with head embedded in root).

Figure 5. Nematodes.
with the use of soybean varieties resistant to SCN and/or R-K generally provides control of these pests. It must be emphasized that the effectiveness of resistant varieties decreases over time if they are continually grown in nematode infested fields. (Contact your local OSU County Extension Agriculture Agent for a current list of soybean varieties resistant to SCN and R-K.)

Growers who have fields with a history of nematode problems need to develop a management strategy that includes crop rotation and rotation of nematode resistant and susceptible varieties. A minimum four-year rotation is recommended.

Year 1: Nonhost crop
Year 2: SCN resistant variety
Year 3: Nonhost crop
Year 4: SCN susceptible variety

**Nonhost Crops for SCN**
- alfalfa
- canola
- corn
- cotton
- forage grasses
- rye
- wheat
- melons
- oats
- peanuts
- red clover
- rice
- sorghum

**Nonhost Crops for Root-Knot**
- wheat
- corn
- oats
- rye

For fields infested with R-K nematode, a similar rotation should be followed with R-K resistant or susceptible varieties inserted in the rotation in place of the SCN varieties.

Nematicides (chemicals that kill nematodes) have also been used to manage nematode populations. However, because of the narrow profit margin for soybeans, the cost of application is often prohibitive. Therefore, control centers around non-chemical methods such as crop rotation, resistant varieties, deep tillage, and fallow plowing, which will reduce the severity and incidence of nematode infestations.

**Disease Management Principles**

A basic strategy for control of soybean diseases is prevention. The following suggestions are offered in an attempt to provide soybean producers some basic components that will aid in the prevention of soybean diseases.

- Plant high quality, preferably certified seed.
- Apply fungicide seed treatment.
- Use proper seed bed preparation, planting depth, and seeding rates.
- Practice crop rotation with non-legume crops.
- Use deep plowing to bury plant debris.
- Plant disease and nematode resistant varieties.
- Apply foliar fungicides to maintain seed quality.
- Practice good management of fertility, weeds, and insects.

Integrating the above principles, as they apply, into a soybean production program will help prevent diseases from becoming a limiting factor.

**References**


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