

# Phytophthora Root and Stem Rot of Soybeans

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## What is Phytophthora root and stem rot of soybeans?

It is a disease caused by the soil-borne fungus, *Phytophthora megasperma* var. *sojae*. Because the fungus persists in soil for several years, do *not* grow susceptible soybeans in affected fields. The disease is important economically because it reduces yields by killing or stunting plants.

## What are the disease symptoms?

Disease symptoms appear in all stages of plant growth. When conditions are favorable for the rapid growth of soybeans, disease symptoms may be delayed; but when plants are under stress, wilting and dying of the leaves often occurs suddenly.

Seeds and germinated seeds often rot before emergence, thereby reducing stands (Fig. 1). Young plants, after emergence, are very susceptible to root and stem rot and they often wilt and die. Older plants may be stunted and gradually die throughout the season (Fig. 2).

The first symptom is a yellowing of the lower leaves, followed by a yellowing and/or wilting of the entire plant. Leaves commonly remain attached for a week or more on dead plants.

When the diseased plants are carefully removed from the soil, the lateral and branch roots of infected plants are generally rotted and the rotted taproots are dark brown. The fungus characteristically moves up from the soil line into the stem (Fig. 3), often as high as 10 to 12 inches above the ground (Fig. 4), and turns the stem brown.



Fig. 1. A young soybean stand severely reduced by Phytophthora root rot. Missing and dead plants will result in reduced yields.



Fig. 2. Older soybean plants killed by Phytophthora root rot. Note how the dead leaves remain attached to the plant. Some plants (yellow leaves) are in less severe stages of disease development.

## How does the fungal pathogen survive and infect plants?

*Phytophthora megasperma* var. *sojae* survives as spores (called oospores) in the crop residue of infected plants. The oospores germinate in wet soil and usually form another structure called a sporangium. The sporangia release small swimming spores, called zoospores, which are attracted to soybean roots. After infection has occurred, new sporangia and zoospores are formed on the surface of the roots for initiating new infections.

## What environmental conditions favor the fungus and the disease?

Periods of high soil moisture,

rainfall or ponded water favor the disease because the zoospores swim through the soil in free water. Conditions favorable for infection occur most often on heavy, compacted clay soils with poor drainage. The optimum soil temperatures for infection are 81 to 91 °F for seedlings and young plants, and 77 to 86 °F for older plants. Infection can occur at soil temperatures as low as 50 °F. Disease development is slower and a lower percentage of plants become infected at lower soil temperatures.

When a soybean variety is listed as resistant to Phytophthora root rot

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Fig. 3. An early symptom of *Phytophthora* root rot is a browning of the stem, beginning at the soil line, as the fungus moves up the plant.



Fig. 4. Characteristic symptoms of stem rot caused by *Phytophthora megasperma* var. *sojae*. Browning may extend as high as 10 to 12 inches above the ground.

#### does that mean it is always resistant?

At least fifteen races of *Phytophthora megasperma* var. *sojae* are known, of which races 1, 3, and 7 are predominant in Michigan; race 4 has been found infrequently. Soybean varieties differ in their reaction to races of the fungus. A variety resistant to race 1 can be susceptible to races 3, 4, or 7. Table 1 lists several commonly grown and new soybean varieties and their reactions to the predominant races of *P. megasperma* var. *sojae* found in Michigan.

#### How can *Phytophthora* root rot be controlled?

Cultural practices that reduce soil compaction, increase soil aeration and improve soil structure are among the best ways to control *Phy-*

*tophthora* root rot. Avoid planting in low lying areas and in poorly drained soils. Where the disease has previously occurred, do *not* plant susceptible varieties. Following soybeans with soybeans increases the chances of *Phytophthora* root rot becoming a problem. *Phytophthora* root rot is less likely to occur where soybeans are rotated with corn or small grains.

Generally, varieties that are commonly grown in Michigan and have resistance to *Phytophthora* root rot are resistant only to race 1 of *Phytophthora megasperma* var. *sojae*.

Table 1. Reaction of several soybean varieties to the races of *Phytophthora megasperma* var. *sojae* occurring in Michigan.

| Soybean Variety        | Races of the Fungus |   |   |   |
|------------------------|---------------------|---|---|---|
|                        | 1                   | 3 | 4 | 7 |
| Amsoy 71               | R <sup>1</sup>      | S | S | S |
| Beeson                 | R                   | S | S | S |
| Beeson 80 <sup>3</sup> | R                   | R | S | R |
| Coles                  | S <sup>2</sup>      | S | S | S |
| Corsoy                 | S                   | S | S | S |
| Corsoy 79 <sup>3</sup> | R                   | R | S | R |
| Evans                  | R                   | S | S | S |
| Harcor                 | R                   | S | S | S |
| Hark                   | S                   | S | S | S |
| Harosoy 63             | R                   | S | S | S |
| Hodgson 78             | R                   | S | S | S |
| Nebsoy                 | R                   | S | S | S |
| SRF 150 P              | R                   | S | S | S |
| SRF 200                | R                   | S | S | S |
| Steele                 | R                   | S | S | S |
| Wells II               | R                   | R | S | R |
| Vickery <sup>3</sup>   | R                   | R | S | R |

<sup>1</sup>R = resistant

<sup>2</sup>S = susceptible

<sup>3</sup>Certified seed should be available in 1981 or 1982.

Some varieties that lack race specific resistance, however, may have field or general resistance to all races of the fungus, although this form of resistance is not complete. New soybean varieties are available with resistance to more than one race and which are adapted to Michigan. More varieties will become available in the near future. Your county extension agent or seed dealer can provide information on varieties and their *Phytophthora* resistance.

Other root diseases of soybean that occur in Michigan are black root rot, *Rhizoctonia* root rot, charcoal rot and *Fusarium* root rot. The accurate diagnosis of a root rot may require consultation with a county agent or even the Plant Disease Diagnostic Laboratory on the Michigan State University campus.

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