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Plant Pathology Fact Sheet

Phytophthora Root and Stem Rot of Soybean

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IMPORTANCE

Phytophthora root and stem rot (PRSR), caused by *Phythophthora sojae*, is infrequently encountered in Kentucky. However, where it does occur, the disease can be quite destructive. Soon after planting, *P. sojae* can cause damping-off of germinating seeds and/or young seedlings. Severe stand loss (FIGURE 1) often necessitates replanting. Alternately, this pathogen can infect and kill established plants of susceptible soybean varieties any time during the season. Varieties that have some resistance to *P. sojae* may be stunted, but rarely die. PRSR is primarily a problem in poorly drained fields (due to high clay content, "hard pan," and/or soil compaction) or areas of fields that are prone to flooding.

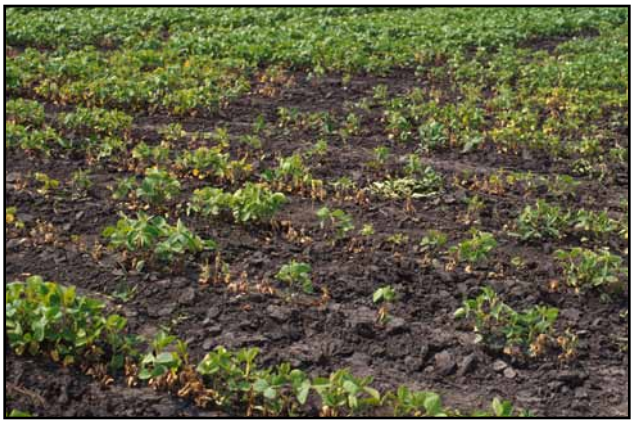

FIGURE 1. SEVERE SOYBEAN STAND LOSS DUE TO PHYTOPHTHORA ROOT AND STEM ROT.

SYMPTOMS

Damping-off and stem rot phases

Infected germinating seeds rot before or shortly after emergence. Plants infected in the seedling stage rapidly wilt, turn yellow, and die (FIGURE 2). Dead leaves characteristically remain attached to the plant. Stems of killed plants exhibit a dark, red-brown stem lesion starting at the soil line and extending up to the second or third node (FIGURE 3). This stem lesion is a key diagnostic feature of the killing stem rot phase of PRSR. Plants infected and killed at later developmental stages (FIGURE 4) exhibit the same symptoms as seedling plants, but death generally occurs at a slower rate.

Root rot phase

The root rot phase of PRSR is not as readily discerned as the killing stem rot

CLOCKWISE: **FIGURE 2**. PHYTOPHTORA ROOT AND STEM ROT SYMPTOMS ON SOYBEAN SEEDLINGS. **FIGURE 3**. THIS REDDISH-BROWN STEM LESION IS DIAGNOSTIC FOR THE STEM ROT PHASE. **FIGURE 4**. DISEASE SYMPTOMS ON PLANTS INFECTED AT A LATER STAGE OF DEVELOPMENT.

phase of the disease. Overall, root volume of diseased plants is reduced compared with healthy plants. Main and secondary roots appear brown in color and nodule formation is dramatically reduced. Above ground, affected plants exhibit a light green coloration, may wilt during the heat of day, and will be stunted. Root rot can be caused by many different soil pathogens; therefore, proper diagnosis is very important.

CAUSE AND DISEASE DEVELOPMENT

Phytophthora sojae is a soil-borne fungus-like organism that survives in soil or crop debris as durable, long-lived resting structures called oospores. Oospores can remain viable for many years; thus, for all practical purposes, once a field is infested with *P. sojae*, it will always be infested. This organism is widely distributed in West Kentucky; however, most fields apparently escape infection because soil conditions are unfavorable to infection and/or disease development.

Oospores produce mobile spores (zoospores) that are capable of traveling through water. This organism can also be dispersed on soil particles and via rain splash. *P. sojae* can infect plants as long as soil temperatures are at least 50° F. The threshold for rapid disease development, however, is 60° F. An extended period (i.e., 7 to 14 days) where soil is saturated is a requirement for extensive PRSR to occur.

P. sojae is genetically highly variable. To date, over 70 races of *the pathogen* have been identified each representing different combinations of known *P. sojae* virulence genes. A limited survey conducted in Kentucky during 1994 found that the predominant race here is race 1; races 2,

13, 15, 24, and 26 have also been detected. All of the races found would be defeated by the commonly deployed PRSR resistance genes, Rps1-c and Rps1-k.

Disease Management

PRSR is managed through variety selection, seed treatment fungicides, and improved soil drainage. Employing specific cultural practices may also help limit damage caused by this disease.

Variety Selection

Most major seed companies sell soybean varieties resistant to specific races (sometimes called pathotypes) of *P sojae*. Based on the races we most frequently encounter in Kentucky, there is a very good chance that most PRSR-resistant varieties sold here will perform well. However, without field specific information regarding which race is actually present, there is always the risk of crop failure. The point to remember is that PRSR-resistant varieties only resist certain races, but are completely susceptible to all others. One way to combat this situation is to plant varieties that have non-race-specific resistance. Some literature refers to these varieties as having "field resistance," "partial resistance," "rate-reducing resistance," or "tolerance."

Seed Treatment Fungicides

While varieties with non-race resistance perform well against all races of *P. sojae*, these varieties are susceptible to infection in the seedling stages. This situation can be overcome by mefenoxam or metalaxyl seed treatments. These seed treatment fungicides protect germinating seed and young seedlings until non-specific resistance becomes established. Seed treatment fungicides will not control PRSR on susceptible varieties.

Cultural Practices

- Tiling or ripping poorly drained fields or otherwise managing surface water may help reduce PRSR by reducing the time soils are saturated after prolonged rain events.
- Avoid any farming practices that encourage soil compaction.
- Avoid early planting into cool, wet soils.
- Planting soybean after soybean may result in increased PRSR; however, rotating fields to other crops will not help much in reducing pathogen levels due to the longevity of oospores contaminating the soil.

Additional Resource

The following University of Kentucky publication is available at County Extension Offices, as well as on the Internet.

- Kentucky Plant Disease Management Guide for Soybeans, PPA-10b (1995) http://www.ca.uky.edu/agc/pubs/ppa/ppa10b/ppa10b.pdf

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Photos by Don Hershman, UK