

## Plant Pathology Factsheet

### PHYTOPHTHORA ROOT AND STEM ROT OF SOYBEAN

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(Revised 3-03)

Phytophthora damping off and root rot (PDRR), caused by the soil-borne fungus *Phytophthora 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 seed and/or young seedlings. Severe stand loss (Figure 1) often necessitates replanting. Alternately, *P. sojae* can infect and kill established plants any time during the season. PDRR is most likely to be encountered in poorly drained soils with a high clay content. Other situations favoring PDRR are: soil compaction, “hard pans”, low lying areas, and fields subject to temporary flooding or ponding.

Work in Kentucky has shown that *P. sojae* is widely distributed in west Kentucky. However, most fields apparently escape infection because soil conditions are unfavorable to infection and/or disease development. *P. sojae* 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.

*P. sojae* can attack plants as long as soil temperatures are at least 50 degrees F. The threshold for rapid disease development, however, is 60 degrees F. An extended period (i.e., 7-14 days) where soil is saturated is a requirement for extensive PDRR to occur.



Figure 1. Stand loss caused by Phytophthora damping-off and root rot.

*P. sojae* is genetically highly variable. To date, over 70 races of *P. sojae* have been identified. These races represent a variety of 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; we also detected races 2, 13, 15, 24, and 26. All of the races found would be defeated by the commonly deployed PDRR resistance genes, Rps1-c and Rps1-k.

## SYMPTOMS

Infected, germinating seed rot before or shortly after emergence. Plants infected in the seedling stage



Figure 3. Diagnostic stem lesion associated with infection by *P. sojae*.

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 PDRR. Plants infected and killed at later developmental stages (Figure 4) exhibit the same symptoms as seedling plants, but death occurs at a slower rate.



Figure 2. Seedlings killed by *Phytophthora sojae*.



Figure 4. Adult plant killed by *P. sojae*.

The root rot phase of PDRR is not as readily discerned as the killing stem rot phase of the disease. Overall, root volume of diseased plants is reduced compared with healthy plants. Main and secondary root will appear brown in color and nodule formation will be dramatically reduced. Above ground, affected plants exhibit a light green coloration and will be stunted.

Which of the two phases of PDRR that develops is determined by the growing conditions, the race of *P. sojae*, the soybean variety grown, and the agronomic practices used.

## MANAGEMENT

PDRR is managed through variety selection, application of certain seed-or soil applied fungicides with certain varieties, and by improving soil drainage of fields, where possible. Employing specific cultural practices may also help limit damage caused by PDRR.

**Variety Selection and Seed Treatment Fungicides.** Most major seed companies sell soybean varieties which resist specific races of *P. sojae*. As stated earlier in this article, based on the races we most frequently encounter in Kentucky, there is a very good chance that most PDRR-resistant varieties sold here will perform well. However, without field specific information regarding which race of *P. sojae* is present, there is always the risk of crop failure. The point to remember is that PDRR-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”. Varieties with non-race resistance perform well against all races of *P. sojae*, but they are susceptible to infection in the seedling stages. This situation can be overcome by application of 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 PDRR on susceptible varieties.

**Cultural Practices.** Tiling poorly drained fields or otherwise managing surface water may help reduce PDRR by reducing the time soils are saturated following prolonged rain events. Avoid any farming practices that encourage soil compaction. Avoid early planting into cool, wet soils.