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UNIVERSITY OF WISCONSIN-MADISON

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Phytophthora Root and Stem Rot

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What is Phytophthora root and stem rot? Phytophthora root and stem rot (PRSR) is a common disease of soybean that can ultimately cause death of soybeans at any stage of development. The disease can cause stand losses and severe yield reductions in susceptible soybean varieties. In Wisconsin, PRSR of soybean is becoming increasingly important due to expansion of soybean acreage, increased frequency of planting of soybeans in given fields, and substantial variability in the organism that causes the disease.



Post-emergence damping-off of soybean seedlings due to Phytophthora root and stem rot. (Photo courtesy of Craig Grau)

What does Phytophthora root and stem rot look like?

Watch for symptoms of PRSR in fields or areas of fields with poor drainage (e.g., low-lying areas or areas with soil compaction problems). In addition, watch for the disease in well-drained fields when soils are saturated due to heavy rain or excessive irrigation. Symptomatic plants often occur in patches.

Symptoms of PRSR can vary depending on the age of affected plants. Early stages of PRSR can lead to seed rot or death of seedlings prior to emergence (called pre-emergence damping-off). Once plants emerge, PRSR can lead to yellowing, wilting, and death of seedlings (called post-emergence damping-off). Infected seedlings can be pulled easily from the ground because of damage to developing roots. Symptoms of PRSR in older plants (particularly those infected before flowering) include root decay, browning and water-soaking of stems extending six to 12 inches above the soil line,

yellowing of leaves, wilting, and eventual death, with leaves on dead plants remaining attached. Stem lesions of PRSR are typically brown, long, narrow, and sunken. When infections remain confined primarily in roots, above-ground symptoms may be more subtle, and can include a lighter green color, stunting and uneven growth. Death due to PRSR tends to occur more rapidly in younger plants than older plants.

Symptoms of PRSR can be similar to symptoms of other soybean diseases, particularly Pythium root rot (PRR) and stem canker. PRR causes root symptoms similar to those caused by PRSR but typically not the expansive stem lesions seen with PRSR. Stem canker, like PRSR, causes stem lesions, but stem canker lesions tend to be larger (eventually girdling stems), and become darker brown with age than those caused by PRSR. Also, older stem canker lesions will have numerous black, pimple-like spots (actually reproductive structures of the fungus that causes the disease). Such spots will not be present in lesions of plants suffering from PRSR.

Where does Phytophthora root and stem rot come from? PRSR is caused by the water mold *Phytophthora sojae*, a soilborne organism that survives via specialized, thick-walled spores called oospores. Oospores are produced in infected soybean plants, and can survive for many years in the soil after soybean residues decompose. Oospores germinate when soil moisture is high. *P. sojae* tends to be most active when temperatures are between



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58 and 77°F, in contrast to *Pythium* species (the causes of Pythium root rot), which tend to be active over a wider temperature range (50 to 95°F).

How can I save a soybean crop with Phytophthora root and stem rot? Once soybean plants become infected by *P. sojae*, there is no cure. Therefore, management of PRSR relies on preventing infections from occurring.



Brown stem discoloration and plant death (with leaves remaining attached) is typical of Phytophthora root and stem rot. (Photo courtesy of Craig Grau)

How can I avoid problems with Phytophthora root and stem rot in the future? Use PRSR-resistant varieties as a primary means of disease management.

Both race-specific resistance [complete resistance to a specific variant of the pathogen (called a race)] and field resistance (partial resistance to many races) are available in soybean varieties marketed in Wisconsin. When choosing a race-specific variety, be sure to know which race(s) of the pathogen is/are prevalent in your area and match race-specific resistance genes with the predominant race(s). The performance of race-specific resistant varieties can change over time. Therefore, monitor the performance of race-specific resistant varieties very closely, and base future selection of race-specific resistant varieties on the performance (or lack thereof) of recently planted varieties. Field (partial) resistance to PRSR is present at differing levels in most soybean varieties marketed in Wisconsin.

While field resistance can be useful in managing PRSR, this type of resistance is not particularly effective during early growth stages or under high disease pressure (e.g., when *P. sojae* levels are high in soil or when soil conditions are excessively wet). In addition to using resistant varieties, consider using seed treatments containing metalaxyl or mefenoxam. These active ingredients have been shown to be effective in providing early protection of soybean seeds and seedlings against *P. sojae*. Also, improve soil drainage to promote drier soils that are less favorable for *P. sojae* growth and reproduction. Crop rotation will not eliminate PRSR or eradicate *P. sojae* but should be used to prevent the rapid build-up of high levels of the pathogen that can reduce the effectiveness of field resistance.

For more information on Phytophthora root and stem rot of soybean:

Contact the University of Wisconsin Plant Disease Diagnostics Clinic (PDDC) at (608) 262-2863 or pddc@wisc.edu.