

# Phytophthora Root Rot (PRR)

Phytophthora root rot (PRR) is a soil-borne root and stem disease of soybeans caused by *Phytophthora sojae*. Unlike other root rot pathogens, *P. sojae* may infect soybeans at any growth stage. *P. sojae* is an oomycete pathogen, also called a water mould, that may remain dormant in the soil for several years. Infection of plants takes place via zoospores, which are attracted to root exudates and swim to their host through water in the soil.

## SYMPTOMS

Early-season signs of infection appear similar to other root rots. Pre- and post-emergent damping off, stunted growth and small, wilted plants are common symptoms.

Later in the season, plants infected with PRR will have a brown lesion that extends upwards from the soil line. The inside of the stem will also have brown discoloration.

Plants will yellow, wilt and leaves will remain attached to the stem. Roots will be rotten with limited nodulation and plants will pull easily from the ground. If the roots are healthy, it may be another stem disease like northern stem canker or pod/stem blight.



**Brown lesions extend up the stem from the soil. Plants wilt and leaves remain attached to the plant.**



## SCOUTING

PRR may affect soybeans at any growth stage. Heavy, compacted and saturated soils are conducive to infection. Fields at greatest risk for PRR development generally have tight soybean rotations, more soybean field history and poor drainage areas.

Scout field approaches, drains and low-lying areas of the field. Warm soil and periodic rains will increase the likelihood of infection.

In August, look for wilted plants with brown stem lesions that extends from the soil line. Plants may be in patches or randomly occurring here and there in high-risk areas. Northern stem canker (NSC) also produces brown lesions at the nodes and may be easily confused with PRR, however, roots will be rotted with PRR whereas they will be healthy with other stem diseases.

**Northern stem canker (NSC) is commonly confused with PRR. NSC lesions may span multiple nodes, but often roots will be healthy and plants won't pull easily from the ground. PRR lesions will extend upwards from the soil. Roots will be rotted, and plants will pull easily from the ground.**



## VARIETY RESISTANCE

**Major gene resistance (Rps genes)** provides season-long resistance to specific races or pathotypes of PRR. Rps genes currently used in commercial soybean varieties are Rps 1a, 1c, 1k, 3a, and 6. These are reported in MPSG's Pulse & Soybean Variety Guide and Seed Manitoba. In the 2023 regional variety trials, 80% of varieties contained Rps 1c, 31% Rps 1k, 10% Rps 3a and 1% Rps 6.

Multiple pathotypes of Phytophthora exist in a given field, meaning we need to know which are present in the field to select a variety with the appropriate corresponding resistance genes. No single Rps gene has been shown to provide resistance to all *P. sojae* pathotypes and new pathotypes able to overcome Rps genes continue to emerge.

Monitor the performance of soybean varieties grown in your fields. If plants with PRR are found, make note and select a variety with different Rps genes the next time soybeans are planted in that field.

A commercial soil test was recently developed to identify pathotypes of *P. sojae* in a given field. Available through AYOS in Quebec, soils may be collected, kept cool and shipped to their lab for PRR testing.

**Partial resistance, also called field tolerance**, is not pathotype-specific and is controlled by multiple minor genes. With partial resistance, the plant is better able to resist Phytophthora root infection and lesions develop slower, resulting in less severe symptoms. This resistance is expressed after VC (unifoliate stage) and should be used in combination with an effective seed treatment in high-risk scenarios for PRR development.

Seed companies report PRR partial resistance of their varieties in their respective seed guides. Rating scales vary among companies, making direct comparison of varieties from different companies challenging. There is a need for independent testing of soybean variety PRR partial resistance. MPSG has been exploring a hydroponic assessment of PRR partial resistance to determine if it may be a tool to inform variety selection. A new research project, co-led by Dr. Yong Min Kim and Dr. Owen Walley, has begun to explore PRR partial resistance further in the field at AAFC-Brandon, AAFC-Morden and AAFC-Harrow.

## SURVEILLANCE OF PRR IN MANITOBA

Soybean fields are surveyed annually for root, foliar and stem diseases through a collaborative effort by Agriculture and Agri-Food Canada, Manitoba Pulse & Soybean Growers and Manitoba Agriculture.

In 2023, soils were collected from this survey and analyzed to identify pathotypes of *P. sojae* living in the soil. Previous surveys isolated *P. sojae* from infected plants to identify common pathotypes in Manitoba. Now, with the ability to determine the *P. sojae* pathotypes present in the soil, we can better assess the infection potential of a field's soil and use that to better inform variety selection by choosing appropriate Rps resistance genes.

In 2023, 84% of soybean fields had *P. sojae* present in the soil and the potential to infect soybeans. In fields with more soybean history and frequency in the rotation, more *P. sojae* pathotypes were found to be present.

Similar to findings from previous surveys, Rps 1a may be considered ineffective as the *P. sojae* pathotypes present can frequently overcome that resistance gene. Recent surveillance efforts also indicate that Rps 1c and 1k are also commonly defeated by the PRR pathotypes present in our soils. Rps 3a and 6 are less available in soybean varieties but have the greatest likelihood of offering protection against the *P. sojae* pathotypes present in Manitoba soils.