Canadian Agronomist

DIGGING INTO RESEARCH

Aphanomyces euteiches oospore soil thresholds levels

CATEGORY **disease** | *June 27, 2023*

Aphanomyces root rot severity increased when oospore levels rose above 100 oospores per gram of soil. Below this level, Aphanomyces root rot did not develop in most soil types.

Aphanomyces root rot, caused by the oomycete pathogen *Aphanomyces euteiches*, was first confirmed in Saskatchewan and Alberta in 2012 and 2013. Surveys from 2014 to 2017 found the pathogen was widespread across the Prairies. The current recommendation for pulse growers is that if a field has a history of root rots, susceptible crops should not be grown for 6 to 8 years.

This research study had several objectives that would aid in the creation of a rapid assessment test that could help pulse growers assess their root rot risk, and guide field selection for susceptible pulse crops. These objectives were to relate oospore levels in autoclaved and non-autoclaved soils to Aphanomyces root rot severity for three Prairie soil types in western Canada, and to determine the relationship of measured DNA quantity of A. *euteiches* using droplet digital PCR or quantitative PCR to the initial oospore inoculum dose in soils.

Soil samples were collected from fields without a history of pulse production in Alberta and Saskatchewan in the fall of 2015 and 2016 from the Brown, Dark Brown, and Black soil zones. One sample was collected from a field in each soil zone in each province in each year for a total of 12 samples. One-half of the samples were autoclaved to remove any soil-borne pathogens.

The samples were inoculated with an equal amount of 4 different *A. euteiches* isolates at oospore concentration levels of 0, 1, 10, 100, 500, and 1,000 oospores/g soil.

For each treatment, 5 plants of CDC Meadow field pea were planted in pots and grown in a greenhouse. All pots were watered to runoff each day to ensure disease development. After 5 weeks, the pea roots were washed, and each plant rated for disease on an Aphanomyces root rot scale, based on percentage discoloration of the roots, 1 (1%–25% root discoloration); 2 (26%–50%); 3 (51%–75%); 4 (6%–100%); and 5 = dead plant. These ratings were converted to a Disease Severity Index (DSI) of 0 to 1, with 1 representing the maximum severity level.

Soil threshold levels identified

Generally, Aphanomyces root rot did not develop at oospore levels below 100/g soil on most soil types. Above 100/g the DSI increased, and the researchers concluded that 100 oospores/g soil is the threshold level for disease development.

Aphanomyces root rot severity was significantly higher in non-autoclaved treatment on most soils, indicating that other pathogens, such as *Fusarium* spp., can also play a role in disease development and severity.

PCR testing found a significant linear relationship between oospore inoculum concentration and DNA concentrations measured from the soil samples, but was affected by soil properties. Further research is currently underway to understand what factors affect DNA quantification accuracy by testing a much larger set of soils from across the Prairies.

The results provide the first steps in using DNA quantification to estimate oospore concentrations in the soil with the ultimate goal of developing a root rot risk assessment system for the Prairies based on soil oospore threshold levels.

Funding was provided by the Alberta Pulse Growers and the Saskatchewan Pulse Growers Associations.

Chatterton S, Schwinghamer TD, Page´ A, Davidson RB, Harding MW and Banniza S (2023) Inoculum dose–disease response relationships for the pea root rot pathogen, *Aphanomyces euteiches*, are dependent on soil type and other pathogens. Front. Plant Sci. 14:1115420.

Open Access: https://doi.org/10.3389/fpls.2023.1115420

Photos by Syama Chatterton