Advancing the Fight Against Root Rot in Peas & Lentils

New research is shedding light on how genetic resistance and management strategies might work together to deliver an effective one-two punch in the fight against root rot in pea and lentil.

An Agriculture and Agri-Food Canada (AAFC) project called *Understanding Field Pea Breeding Initiatives, Physiology, and Agronomy to Mitigate Yield Loss by Root Rot* set out to evaluate how well pea lines developed in the United States (U.S.) with partial resistance to *Aphanomyces* or Fusarium root rot performed under Canadian conditions.

"What we found is lines that are resistant to one pathogen were not resistant to the other," says lead investigator and AAFC plant pathologist Dr. Syama Chatterton.

That makes the task more challenging for breeders trying to develop pea and lentil lines with greater resistance to both pathogens in one plant. More challenging—but not impossible.

The varieties that demonstrated greater resistance have been singled out for in-depth analysis of the traits that might contribute to their disease resistance. While the analysis is still in progress, Dr. Chatterton believes it will lead to varieties with stronger genetic resistance in the years ahead.

Genetic resistance cannot do the job alone. Root rot is notoriously difficult to manage because it is caused by multiple pathogens that can survive in the soil for a long time.

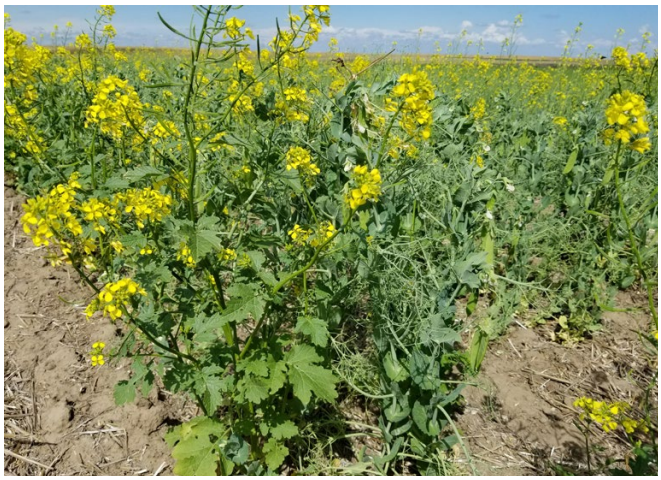
"It takes all the tools in the toolbox to fight something that complex. Partially resistant cultivars of field peas and lentils are a good start, but once we have them, we need solid agronomic practices that maximize their effectiveness in the field and safeguard the levels of resistance we have developed so far."

A second stage of the project looked exclusively at field peas to assess the impact of intercropping and crop rotation on test crops grown at six sites in Alberta, Saskatchewan, and Manitoba.

From these studies, researchers learned that intercropping pea with canola, mustard, or oats did not reduce pea root rot disease severity—but did often result in higher pea yields compared to the pea monocrop. However, this did not occur at all sites, and or in all years, especially during dry years.

"We would like to test if intercropping will slow down the buildup of pathogens in the soil, but that is more difficult to research," says Dr. Chatterton.

Plants from field, showing Aphanomyces, honey-brown root discolouration, loss of lateral roots, and pinching/browning of epicotyl.
Source: Dr. Syama Chatterton



Mustard-pea intercrop. Brassica's are not hosts to pea and lentil root rot pathogens.
Source: Dr. Syama Chatterton

Pea/oat intercrop did not favour pea under drought conditions.

Source: Dr. Syama Chatterton

A pea line that shows some partial resistance to Aphanomyces euteiches (left) but not to Fusarium avenaceum (Fus).

Source: Dr. Syama Chatterton

Stunting and yellowing and low yield under high disease pressure.

Source: Dr. Syama Chatterton

Dr. Chatterton and her team also conducted a crop rotation study to find out whether a root rot tolerant pulse crop was a safe option for growers hoping to maintain a pulse within their cropping system. They found that soybean, faba bean, and chickpea were not colonized by *Aphanomyces euteiches*, but could be infected by some Fusarium species.

Including these pulse crops in a rotation with pea did not increase pea root rot severity, however, and in some cases provided a yield boost to the subsequent pea crop, to Dr. Chatterton's surprise.

"Whether this is due to a residual nitrogen effect or to a reduction in pathogen inoculum is something we look forward to exploring in future research."

Another major finding confirms that extended rotations from pea are necessary to reduce root rot effects.

"At most sites, root rot severity and yield did not improve after a six-year break, which is the longest interval we were able to achieve with the study design."

Root rot severity and yields were usually the worst in the wet years, highlighting that mid-June rainfalls are the biggest drivers of pea root rot.

Dr. Chatterton says she knows the frustrations of pulse growers dealing with pea and lentil root rot, and stresses that more and more experts across a range of fields, from genetics and precision agriculture to soil health, are joining the fight.

"Results from the in-depth analysis of the partially resistant plant material we collected will open up whole new avenues for research as we try to tease apart what makes a plant resistant, and why plants are resistant to one root rot disease and not the other. I always get excited that the next line of research may lead to a breakthrough in figuring out this pathogen complex. For now, we are figuring it out in small increments."

Project
Breeding, physiology andagronomy to mitigate yield loss caused by rootrots of pea

Industry Funder
Alberta Pulse Growers, Saskatchewan Pulse Growers, Manitoba Pulse and Soybean Growers

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$1,698,236.20

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