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Reduce clubroot spore load by 95%

CATEGORY disease | *February 11, 2020*

A ≥2 year break from clubroot-resistant canola resulted in a 95% decrease in clubroot resting spore concentrations. In the third year after the harvest of clubroot-resistant canola, resting spore concentrations were similar to those of host-free control plots.

Previous small plot research showed the value of extended canola rotations for reducing clubroot resting spore concentrations while increasing canola yield. Small plot research in Quebec found that after a ≥2-year break from canola, clubroot resting spore loads dropped by up to 90% from initial levels, resulting in yield gains of 32–76% (Peng et al., 2015). In a small plot trial in Alberta, canola yield was significantly higher by 19 bushels per acre with a three-year break between canola compared to a 2-year canola-barley rotation (Hwang et al., 2019).

The impact of growing clubroot-resistant canola cultivars on *Plasmodiophora brassicae* resting spore dynamics was also examined in this third study conducted under field conditions in commercial cropping systems in Alberta. The study also looked at what effect initial *P. brassicae* resting spore concentrations in the soil had on clubroot development in clubroot-resistant canola.

Monitoring of *P. brassicae* resting spore concentration in the soil was carried out in 17 fields across Alberta where clubroot had been detected previously. Soil sampling was conducted in the spring

close to seeding and after harvest at five to 12 fixed points within each field regardless of cultivated crop over 2 to 4 years. Each fixed point consisted of a 3 x 3 metre plot.

Over 8500 soil samples were collected and formed a total of 895 composite soil samples. Resting spore concentrations were measured by quantitative PCR analysis, with a subset of samples also evaluated in greenhouse bioassays with a susceptible host. During years when clubroot-resistant canola was grown in a field, post-harvest soil sampling was accompanied by clubroot incidence and severity ratings of 50 plants within a 1 square metre area at each fixed position.

The crop rotations assessed were those used by the commercial growers in their own management system. Two fields had clubroot-resistant canola grown 1-in-4 years, 4 fields had clubroot-resistant canola 1-in-3 years, 6 fields with clubroot-resistant canola in 2-of-4 years, 3 at 1-in-2 years, 1 at 2-in-3 years, and 1 at 3-in-4 years.

Two to 7 control plots that were kept free of plant growth were set up adjacent to each test plot.

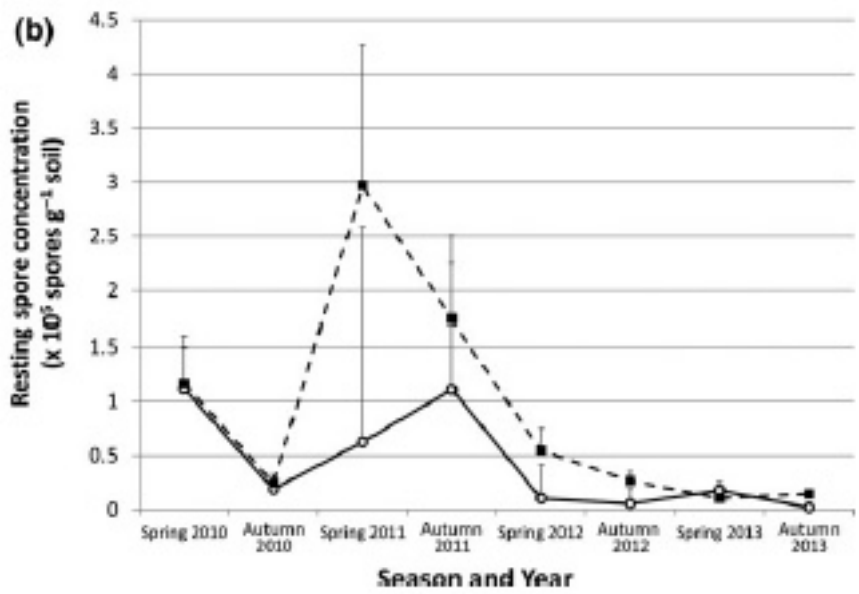
Resting spore concentrations decreased by 95%

Over the various rotations, resting spore concentrations peaked in the year following clubroot-resistant canola. For example, there was a 141% increase in average spore concentration following cultivation of clubroot-resistant canola, from 6.5×10^4 spores per g soil in spring of year 1 to 1.57×10^5 spores per g soil in spring of year 2. Conversely, control plots with no susceptible host saw a 160% decrease in average resting spore concentration.

The researchers thought this spike in spore concentration may have been caused by a lag in the release of new resting spores into the soil from the few galls that did develop on the clubroot-resistant canola, and the spores remaining in the galled root material until it decomposed or was incorporated into the soil the following year.

Although a few galls did develop on the clubroot-resistant canola, clubroot severity was very low. These mild symptoms, even in the presence of relatively high levels of *P. brassicae* inoculum, show the importance of using clubroot-resistant varieties as one of the tools to help manage the disease, along with extended crop rotations without clubroot hosts. The galls that formed likely were enriched with clubroot pathotypes that could break the resistance, further highlighting the need for proper rotation, since any resistant variety planted in the next season would have been exposed to higher levels of these pathotypes.

The concentration of *P. brassicae* resting spores in the soil in a 1-in-4 year clubroot-resistant canola rotation where clubroot-resistant canola was cultivated in year 1 of spring 2010.



Filled squares (dotted line) represent concentrations when clubroot-resistant canola was cultivated in year 1; open circles (solid line) represent control plots.

Source: Ernst et al. 2019.

Large declines in resting spore concentrations with at least a 2-year break from clubroot-resistant canola were observed. In the third year after the harvest of clubroot-resistant canola, resting spore concentrations were similar to those of host-free control plots. From a maximum average resting spore concentration of 2.97 x 10^5 spores per g soil observed in the spring after clubroot-resistant canola was grown, a ≥2-year break without Brassica cultivation resulted in a 95% decrease to 1.45 x 10^4 spores per g soil in the fall three years later.

The results show the importance of planting clubroot-resistant canola in rotations longer than 1-in-2 years; even a 2- year rotation away from a host can help prevent the excessive build-up of soil inoculum. By implementing longer rotations and having an awareness of clubroot severity or inoculum levels in their fields, producers may be able to prolong the effectiveness of clubroot-resistant varieties and contribute to more sustainable management of clubroot of canola.

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Ernst, T.W., Kher, S., Stanton, D., Rennie, D.C., Hwang, S.F. and Strelkov, S.E. (2019), *Plasmodiophora brassicae* resting spore dynamics in clubroot resistant canola (*Brassica napus*) cropping systems. Plant Pathol, 68: 399-408. doi:10.1111/ppa.12949