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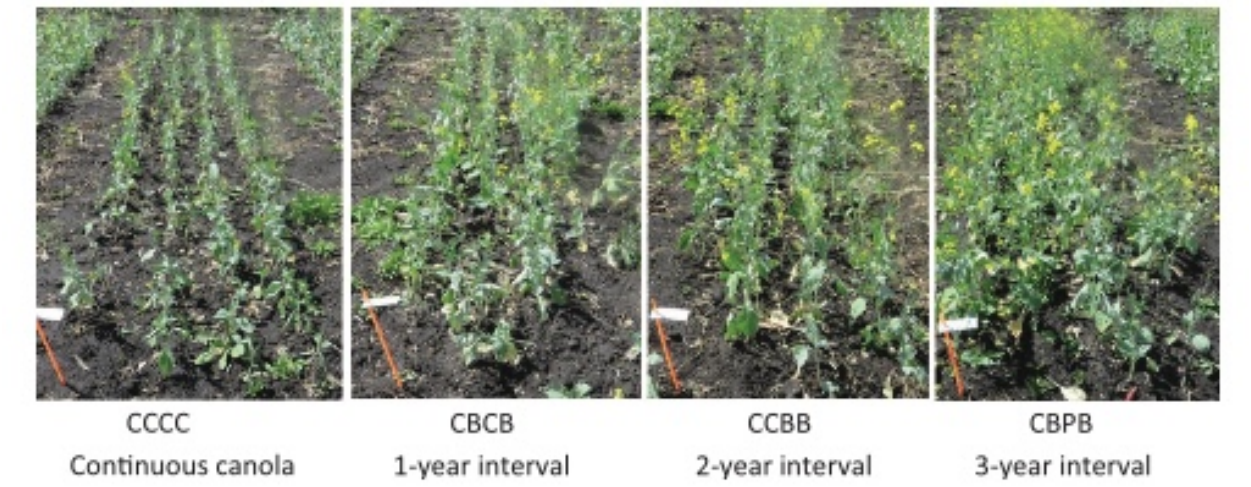
DIGGING INTO RESEARCH



Three-year break increased canola yield by 18 bushels per acre

CATEGORY disease | ***January 16, 2020***

Canola yield with a three-year break between canola crops was significantly higher than a tighter canola-barley rotation by 18 bushels per acre. Growing clubroot resistant canola in a tight rotation was not a strategy that could be implemented to keep clubroot spore populations low, and that strategy could actually speed resistance breakdown.

Clubroot, caused by *Plasmodiophora brassicae* Woronin, is a threat to canola production. The objective of this research was to study the impact of clubroot-resistant canola in rotation with non-host crops on clubroot development, severity, yield, and *P. brassicae* resting spore populations.

Rotation of resistant varieties helped but not enough

The field trial was conducted at the Alberta Agriculture and Forestry clubroot nursery, Henwood, in northeast Edmonton, Alberta from 2013 to 2016. The concentration of resting spores was estimated to be approximately 100,000,000 spores/g of dry soil.

The experiment consisted of 12 rotation sequences planted over a 4-year period. Four canola varieties resistant to clubroot pathotype 3 were grown in the 4-year rotations in various sequences. For example, one variety was continuously grown over 4 years, or alternating with another variety, or each variety was grown only once over the 4 years.

In 2017, each plot was seeded to the susceptible canola cultivar '45H26' on May 31 to assess clubroot severity. Before seeding the final crop, soil samples were collected to determine the spore load in the soil using the qPCR method.

A fallow treatment that was kept free of vegetation for 4 years, and a non-host treatment planted to Harrington barley was grown over the 4 years, and were used as controls.

The same rotation sequences were tested in micro-plot experiments repeated at two sites about 500 m apart at the clubroot nursery. Each micro-plot consisted of a 38-L Roughneck Storage tub filled with 30 L of a 1:1 mix of *P. brassicae* infested soil collected from the clubroot nursery plot and Sunshine Mix No. 4 potting soil, resulting in a *P. brassicae* resting spore concentration of 50,000,000 spores/g of soil.

Under micro-plot conditions, susceptible 45H26 did not show clubroot development when grown following 4 years of either continuous barley or fallow. However, clubroot severity on the susceptible canola planted after any of the 9 continuous rotations of clubroot resistant canola ranged from 6% to 64%. This indicated that growing clubroot resistant canola in a continuous rotation is not a strategy to keep clubroot spore populations low.

Small galls were also observed on more than 10% of the resistant plants and, as a probable consequence, the researchers recommended that using resistant varieties in a continuous canola rotation should not be considered a substitute for non-host crops or fallow. Additionally, the resting spores produced on clubroot-resistant canola in these continuous rotations likely consist of *P. brassicae* pathotypes capable of overcoming resistance, so would represent an additional long-term management concern.

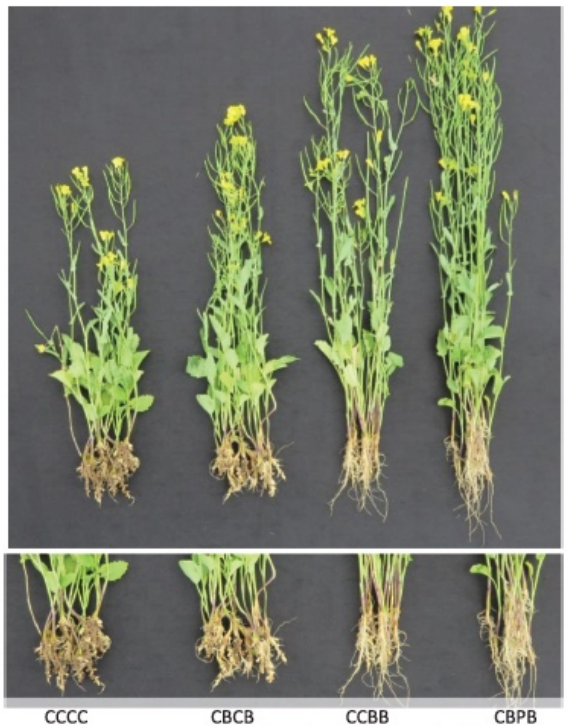
In the field trials, clubroot severity was also lower in the rotations with clubroot-resistant canola varieties, barley, or fallow compared to the continuous susceptible canola sequence. However, the effect of rotation sequences on yield was not significant.

Rotations with non-host crops

To determine the effects of including non-host barley or pea crops in rotation on *P. brassicae* spore populations and clubroot severity, susceptible 45H26 was grown in field soils containing approximately 100,000,000 resting spores/g of soil immediately adjacent to the first site, followed by four cropping sequences:

(1) continuous susceptible canola,
(2) alternating susceptible canola and Harrington barley,
(3) 2 years of susceptible canola followed by 2 years of barley,
(4) 3 years of non-host (barley or pea) followed by susceptible canola.

Seed yield for the barley-pea-barley-canola rotation was significantly higher than the other rotations. For example, the 3-year non-host rotation yielded 20 bushels per acre compared to 1.7 bushels per acre for the canola-barley rotation. Certainly, yields were much lower than the 10-year average for western Canada (46 bu/ac), most likely because of the use of a rototiller for plot preparation, but the results highlight the benefits of a three-year break in canola production.



Gall weight and clubroot severity were also significantly lower with the 3-year barley-pea-barley rotation compared to continuous canola or canola-barley rotation. The DNA concentration of P. *brassicae* was reduced following a 2- or 3-year non-host interval compared with the continuous susceptible canola or the 1-year non-host canola-barley rotation. For example, clubroot DNA concentration was 99% lower in the 3-year non-host rotation compared to the canola-barley rotation.

This research supports the conclusions from a field study in Quebec that a 2-yr break between canola crops reduced resting spore density by 90% compared with continuous production of a susceptible canola cultivar (Peng et al. 2015). The results also are consistent with a study by Ernst et al. (2019), which demonstrated that a ≥2-yr break from canola resulted in significant declines in *P. brassicae* resting spore loads in commercial cropping systems in Alberta.

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