Clubroot spore load reduced by 90% with a two-year canola break

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A break from susceptible canola of at least 2 years resulted in more than 90% reduction in clubroot pathogen resting spores compared to continuous canola or a 1-year break. Clubroot resistant varieties grown with a 2- to 4-year break yielded 32 to 76% higher than continuous canola.

Resting spores of clubroot (*Plasmodiophora brassicae*) can survive in the soil for up to 20 years. However, the impact of a 2- to 5-year crop rotation on spore load and disease impact was unknown. Researchers at Agriculture and Agri-Food Canada, University of Alberta and Alberta Agriculture and Forestry conducted a two-year study to quantify the effect of crop rotation on the amount of clubroot inoculum in a heavily infested field. Additionally, they also assessed the impact of crop rotation on clubroot severity and yield of canola hybrids with different levels of resistance to clubroot.
A 3-hectare field on an AAFC research farm at Normandin, Quebec was used for the study, where severe clubroot had been observed since the early 1990s. The field had been used for a crop rotation study for the previous 9 years and allowed the researchers to avoid the costly and time-consuming task of setting up the trial from scratch.

In the first year of rotational trials, susceptible (45H26), moderately susceptible (InVigor 5030) and resistant (45H29) canola hybrids were seeded into plots with a 0- to 4-year break from a susceptible canola crop. Estimates of clubroot resting spores were derived from quantitative PCR (qPCR) analysis. Canola emergence at 1-, 2- and 3-weeks after seeding, clubroot severity and canola yield were also measured.

**Susceptible and moderately susceptible hybrids devastated**

The mean resting spore concentration was not significantly different in soil samples that had been in a 0- or 1-year break from susceptible canola. Resting spore populations were reduced by more than 90% with a ≥ 2-year break relative to continuous or 1-year break, and then did not decline with longer rotations. The researchers thought that the population might stabilize after the initial sharp decline. Immature and non-viable resting spores released from infected canola roots might degrade rapidly once in the soil, whereas mature resting spores are more robust and remain after the initial decline.

Susceptible and moderately susceptible hybrids were either completely wiped out or severely stunted in the continuous and 1-year rotations. For rotations greater than 2 years, the level of inoculum remaining in the soil was still high enough to produce moderate to severe disease in the susceptible and moderately susceptible hybrids. While yield did increase for the susceptible and moderately susceptible hybrids in longer rotations, they were still very poor – less than 3.5 bu/ac (200 kg/ha) for the susceptible and 7 bu/ac (400 kg/ha) for the moderately susceptible hybrids. This compared to yield of around 41 bu/ac (2300 kg/ha) for the resistant variety with a 2- to 4-year break.
Resistant varieties yielded significantly higher with at least a 2-year break.

Because of the devastation of the susceptible and moderately susceptible hybrids, only resistant hybrids were planted in the second year of rotational trials. Hybrids compared included 74-54RR, L135C and VT-ABL1483.

Clubroot incidence and severity were generally low on each hybrid, with the disease severity index ranging from 4 to 10% in continuous canola and a 1-year break, and 0 to 1.3% in 2- to 4-year breaks.
Yield following a 2- to 4-year break ranged from 34 to 42 bu/ac (1910 to 2370 kg/ha), which was 43% to 76% higher than continuous or a 1-year rotational break. The higher yield may be resulted from the reduced clubroot pathogen inoculum in the soil, as well as other benefits associated with longer crop rotation.

Comparison of the yield of three resistant canola cultivars produced following a 0- to 4-year break from susceptible canola

![Comparison of yield](image)

Source: Peng et al. 2015

The research demonstrated, for the first time, that most clubroot resting spores disintegrate within the first two years in the soil. Additionally, growing a clubroot-resistant hybrid substantially increased yield and reduced the resting spores going back into the soil compared to a susceptible hybrid. These findings highlight the value of using clubroot-resistant hybrids in combination with a greater than 2-year break from canola to help minimize the impacts of clubroot and to help slow the spread of the disease.
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