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Researching clubroot management practices

CATEGORY disease | *November 4, 2020*

Research conducted over the past decade set the foundation for today's clubroot management practices. This research covered the potential of biofungicides/fungicides, cultivar resistance, and crop rotation for management of clubroot disease caused by *Plasmodiophora brassicae*.

Synthetic fungicides ineffective

The fungicides Allegro and Omega (fluazinam) and Ranman (cyazofamid) were not effective when applied in-furrow at 500 L water/ha. Ranman was most effective on canola when incorporated into the soil prior to seeding, but was only effective at low to moderate inoculum pressures. Similarly, Allegro/Omega were effective only under low inoculum pressure.

Terraclor 75% WP (Pentachloronitrobenzene; PCNB), when incorporated into the soil before seeding, reduced clubroot severity more consistently than other fungicides in heavily infested fields. However Allegro, Omega and Ranman are too expensive to use commercially at the rates tested, and the use of PCNB is restricted due to health concerns

Fungicide seed treatments were also examined. Dynasty 100 FS (azoxystrobin), Nebijin SSC (flusulfamide), Vitavax RS (carbathiin + thiram), Prosper FX (carbathiin + trifloxystrobin + metalaxyl), and Helix Xtra (difencazole + metalaxyl + fludioxonil) reduced infection under controlled greenhouse conditions, but none of the treatments was effective in field trials. Seed treatments may have a role

only in reducing the risk of seed- borne dissemination of *P. brassicae* carried on seed produced in infested fields.

Biofungicides also ineffective

The biofungicides Serenade (*B. subtilis*) and Prestop (*Gliocladium catenulatum*) suppressed the disease on canola under greenhouse conditions. Granular and seed-treatment formulations were developed to facilitate the delivery of these biofungicides in field trials near Leduc and Edmonton. These biofungicides were not effective when applied in the seed furrow to high *P. brassicae* resting spore populations in the soil.

Biofungicides were also assessed as a seed dressing. Two seed treatment formulations of *B. subtilis* were evaluated in greenhouse studies. Serenade was applied encapsulated on the seed, and Kodiak (*B. subtilis*) was applied to canola seed with a commercial seed-treatment formulation, both to a susceptible canola cultivar. The seed treatments were moderately effective at the lower inoculum rate (10,000 spores/cc), but ineffective at the higher rate 100,000 spores/cc).

Biofungicide trials were also conducted on a 12-year crop-rotation study to assess the potential of Kodiak biofungicide seed treatment. The trial site was at AAFC Normandin, Quebec, with 3 crop rotations (continuous barley), 3-year break (canola– barley–field pea–barley), and 1-year break (canola– barley). The DSI on the susceptible canola cultivar in field trials exceeded 90% in the 1-year and 3-year breaks, and biofungicide seed treatments did not reduce clubroot severity.

In a greenhouse environment, the biofungicide Serenade was applied to susceptible (S), moderately resistant (MS) and resistant (R) canola cultivars exposed to an extremely high dose of *P. brassicae* inoculum (approximately 100 million resting spores/cc soil). There was a slight interaction between Serenade and cultivar resistance. The biofungicide substantially reduced clubroot severity on S and MR cultivars relative to non-treated controls. On the R cultivar, the symptom on non-treated plants was negligible under controlled conditions and application of the biofungicide did not reduce the disease level any further. On the MR cultivar, which showed a moderate level of clubbing, Serenade reduced the DSI to the level observed on the resistant cultivar

To validate these greenhouse results, field trials were carried out at three locations in 2010. The canola cultivars ‘45H26’ (S) and ‘45H29’ (R) were seeded in heavily infested fields near Leduc and Edmonton, Alberta and Normandin, Quebec. A granular formulation of Serenade was applied in-furrow with the susceptible and resistant cultivars. Synthetic fungicides fluazinam and cyazofamid were also compared as seed treatments.

The DSI ranged from 69% to 98% on the non-treated S cultivar. The DSI for the resistant cultivar '45H29' was consistently low (<15%), and the seed yield of the resistant cultivar was 73% to 81% higher than the S cultivar. None of the biofungicide or synthetic fungicide formulations reduced DSI on S or R cultivars in these field trials.

A two-year break and a resistant cultivar reduced spores by 90%

A study was carried out at the Normandin site to assess the impact of length of cropping rotation (0-, 1-, 2-, 3- or 4-year break from canola) on S, MS and R canola cultivars (Peng et al. 2015).

With the susceptible canola cultivar, a 2-year break reduced the disease impact on plant growth and development. However, despite the substantial inoculum reduction after 2 years, the levels were still too high to obtain commercially acceptable yields.

Resistant cultivars reduced clubroot severity and canola yield losses significantly. A 2-year break (3-year crop rotation) from canola reduced *P. brassicae* resting spore concentrations by 90% relative to growing continuous canola or a 1-year break in heavily infested field plots. In a resistant cultivar, >2-year breaks increased yields by up to 25% relative to continuous growing of canola, despite the similar DSI and crop impact ratings.

A 2-year interval between canola crops with non-hosts, together with use of resistant cultivars, is recommended to reduce the inoculum load of *P. brassicae* in soil and achieve maximum yields of canola.

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Gary Peng, Rachid Lahlali, Sheau-Fang Hwang, Denis Pageau, Russell K. Hynes, Mary Ruth McDonald, Bruce D. Gossen & Stephen E. Strelkov (2014) Crop rotation, cultivar resistance, and fungicides/biofungicides for managing clubroot (Plasmodiophora brassicae) on canola, Canadian Journal of Plant Pathology, 36:sup1, 99-112 http://dx.doi.org/10.1080/07060661.2013.860398