Activity 11

The effect of fungicides, biological agents, marine bioproducts and combination treatments for the control of Sclerotinia stem rot and black leg of canola in Eastern Canada

Annual Report – March 31, 2016

Overall Objective

The main objective of this activity is to evaluate fungicides, biological agents, marine bioproducts and combination treatments for the control of Sclerotinia stem rot and black leg of canola in Eastern Canada. It is expected that the research will lead to the development of an effective method to manage stem rot and black leg of canola by a combination of fungicide, biological agents and marine bioproducts.

Audience

The audience is crop producers, specifically those who grow or who have an interest in growing canola.

Performance Measures

New/Improved Practices

One new/improved practice was developed – a combination of fungicide and marine bioproducts to increase efficiency of fungicides.

Highlights

Canola is an important edible oilseed crop and the seeds contain 44% oil. Sclerotinia stem rot, caused by necrotrophic fungus *Sclerotinia sclerotiorum* (Lib.) de Bary is a major destructive disease of canola. This project activity investigated the effect of fungicides (registered for use in canola) in combination with marine bioproducts derived from seaweed to control or reduce the disease severity of *Sclerotinia* on canola. This was the second year of this activity. The major focus was to screen the effectiveness of the combination of fungicide and marine bioproducts in the greenhouse.

Six fungicides: Lance, Proline, Quadris, Quash, Vertisan and Serenade CPB (Bio-fungicide) were tested in the greenhouse. When marine bioproducts were mixed with fungicides at 10% of the recommended level, there was a significant improvement in the activity of the fungicides.

The results are significant, as the marine bioproducts improve the activity of fungicide in reducing the stem rot disease and more importantly the amount of fungicide used can be significantly reduced with combination treatments.

Outcomes

Canola is an important edible oilseed crop in Canada. Sclerotinia stem rot, caused by phytopathogenic fungi *Sclerotinia sclerotiorum* (Lib.) de Bary is a major destructive disease of canola. The risk of damage to crops is greater in Eastern Canada due to weather conditions in this part of country. This project investigates the effect of fungicides (registered for use in canola) in combination of marine bioproducts derived from seaweed to control or reduce the disease severity of *Sclerotinia* on canola.

Materials and methods

Greenhouse trial:

Canola plants were grown in pots filled with Promix in a greenhouse. Fungicides registered in Canada for use against stem rot (Table 1.) were used in this experiment. Fungicides were mixed with marine bioproducts: seaweed extracts (a commercial product prepared from rockweed *Ascophylum nodosum*), λ- carrageenan, κ- carrageenan, ι- carrageenan and were sprayed on three-week-old canola plants. Marine bioproducts were mixed with the fungicides at a concentration of 1 g/ L.

Sclerotinia was grown in potato dextrose agar plates (25° C for 4 days) and 5 mm inoculation plug was placed on leaves at 24 h after treatment. Two leaves per plant were inoculated with the fungus and there were five plants per treatment. The treated plants were covered in plastic bags to maintain humidity to encourage infection. On 3 days post inoculation (dpi), plants were transferred to a humidity chamber and arranged in a completely randomized design. The size of the lesion was measured from 3 to 6 dpi. The lesion was measured using a digital vernier caliper.

Table 1. Fungicides used in the experiment.

Serial No.	Fungicide	Application per acre	Active ingredient	Content a. i. (active ingredient)
1	Lance	142 g	Boscalid	70 %
2	Proline	126 – 147 mL	Prothioconazole	480 g/ L
3	Quadris	280 to 400 mL	Azoxystrobinn	250 g/ L
4	Quash	113 g	Metconazole	50 %
5	Vertisan	500 – 600 mL	Penthiopyrad	200 g/ L
6	Serenade CPB	0.4 – 1.6 L	*Bacillus subtilis* culture	1.34 %

Results and Discussion

The spread of disease increased from 3 to 6 dpi. Fungicide applied at the recommended dose was used as the positive control. These treatments resulted in the most effective reduction in disease spread. The best treatment was Proline.

Vertisan treatment:

On 3 dpi, the combination treatment of 10 % fungicide with SWE had the least disease spread followed by treatment with λ- carrageenan. The disease control was effective as compared with the control SWE treatment (Fig 1).

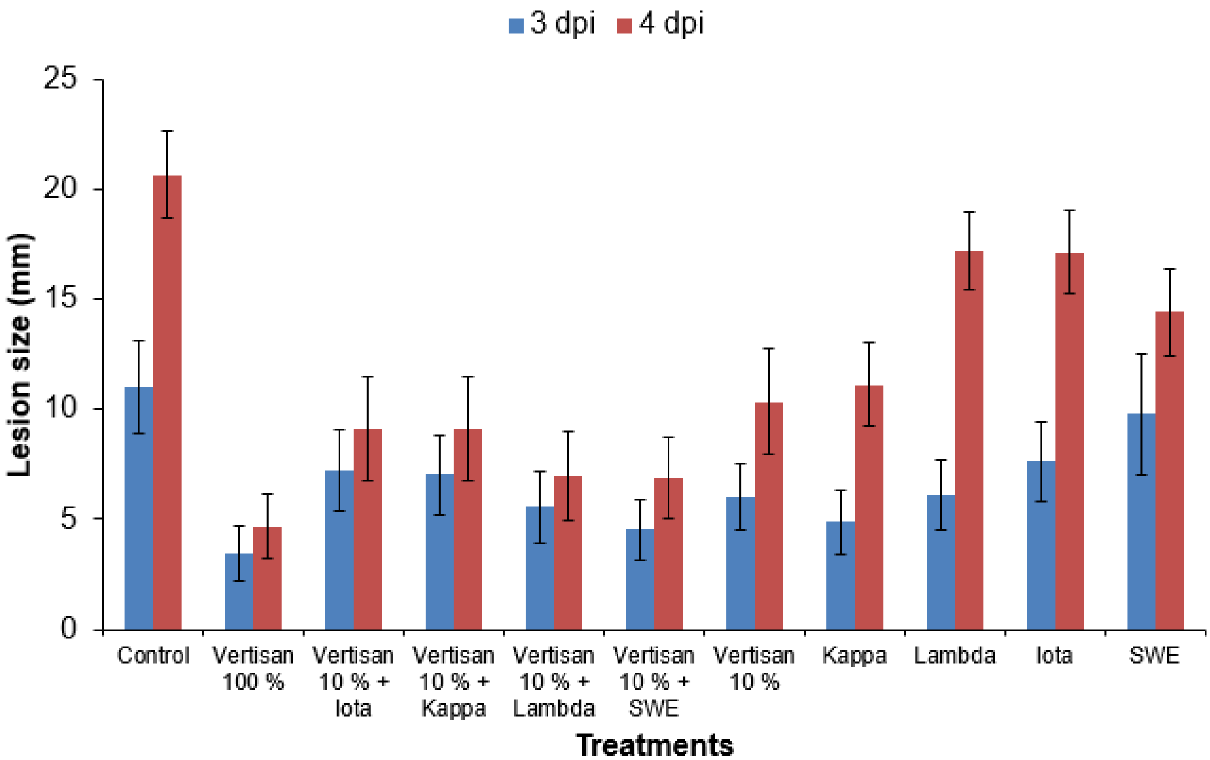

Fig 1. Size of leaf lesion (mm) on canola leaves inoculated with *Sclerotinia* with respect to Vertisan treatments (Iota-- ι- carrageenan, Kappa-- κ- carrageenan, Lambda-- λ- carrageenan, SWE—seaweed extract from *Ascophyllum nodosum*). Values represent mean ± standard error, n = 20.

Quadris treatment:

Fungicide (10 %) in combination with marine bioproducts were more effective than fungicide alone in controlling the disease spread. On 3 dpi, fungicide (10 %) with SWE was five times less as compared to fungicide 10 % alone, followed by fungicide in combination with λ- carrageenan (Fig 2). The combination with ι- carrageenan had the least disease spread and it is comparable to that of the negative control.

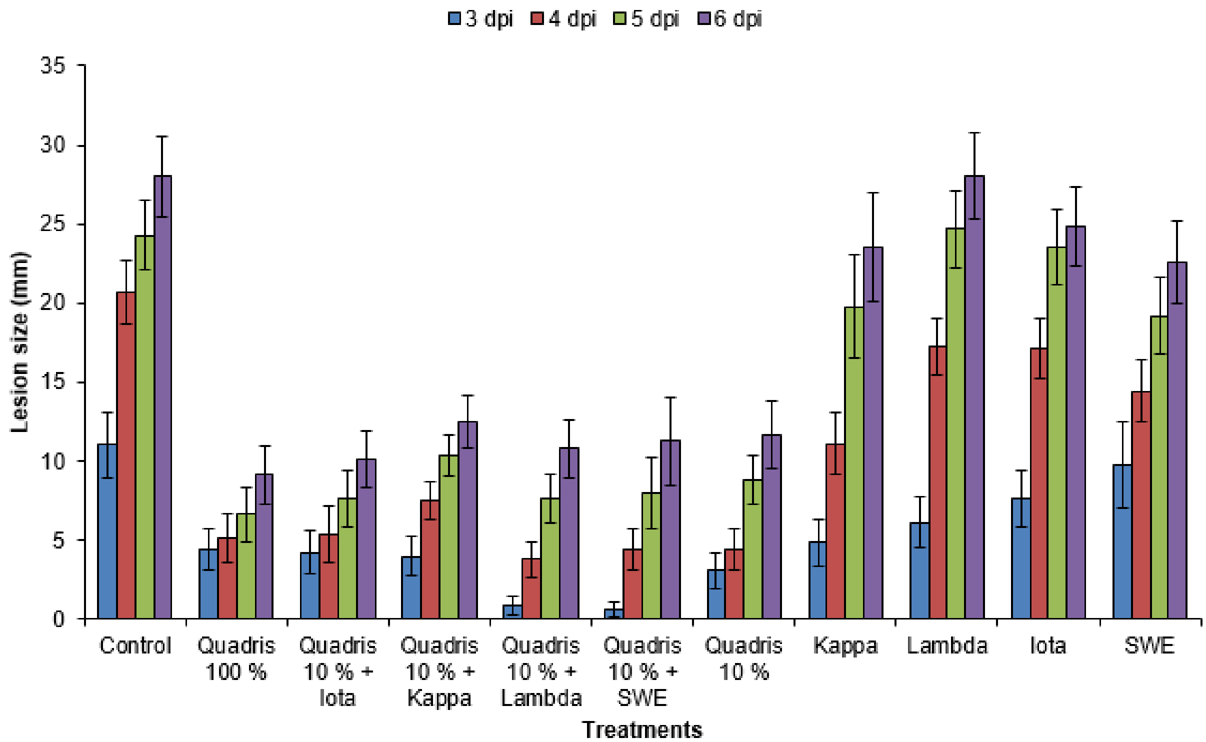

Fig 2. Size of leaf lesion (mm) on canola leaves inoculated with *Sclerotinia* with respect to Quadris treatments (Iota-- ι- carrageenan, Kappa-- κ- carrageenan, Lambda-- λ- carrageenan, SWE—seaweed extract from *Ascophyllum nodosum*). Values represent mean ± standard error, n = 20.

Quash treatment:

Fungicide combined with ι-carrageenan was the most effective in reducing spread of lesions, in comparison to control iota (Fig 3).

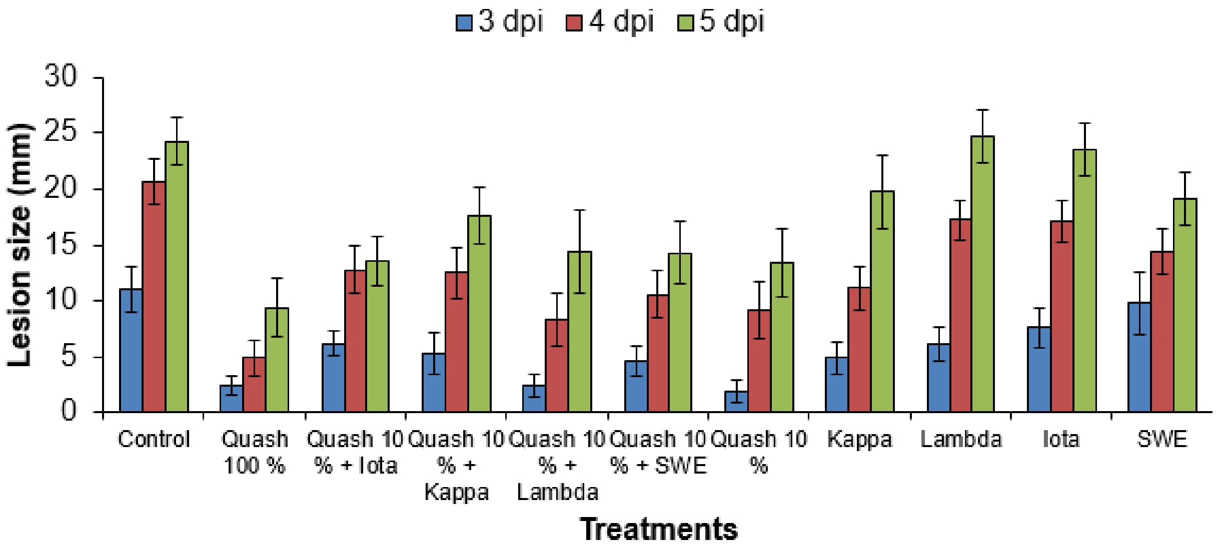

Fig 3. Size of leaf lesion (mm) on canola leaves inoculated with *Sclerotinia* with respect to Quash treatments (Iota-- ι- carrageenan, Kappa-- κ- carrageenan, Lambda-- λ- carrageenan, SWE—seaweed extract from *Ascophyllum nodosum*). Values represent mean ± standard error, n = 20.

Lance treatment:

Lance combined with ι- carrageenan resulted in 50 % reduction in lesion spread than the negative control (Fig 4).

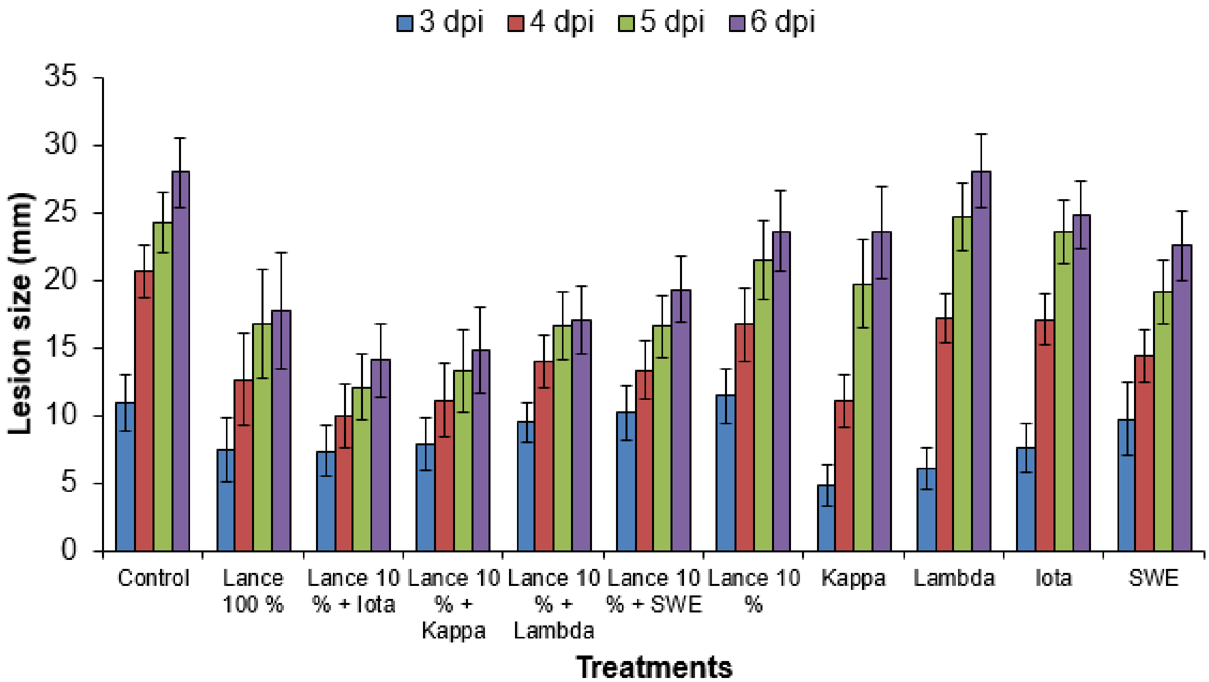

Fig 4. Size of leaf lesion (mm) on canola leaves inoculated with *Sclerotinia* with respect to Lance treatments (Iota-- ι- carrageenan, Kappa-- κ- carrageenan, Lambda-- λ- carrageenan, SWE—seaweed extract from *Ascophyllum nodosum*). Values represent mean ± standard error, n = 20.

Proline treatment:

Seaweed extract combined with the fungicide showed best management of disease followed by κ-carrageenan (Fig 5). Fungicide with SWE was >5 times efficient in reducing the lesion size than negative control. The combination treatments were more effective than the controls.

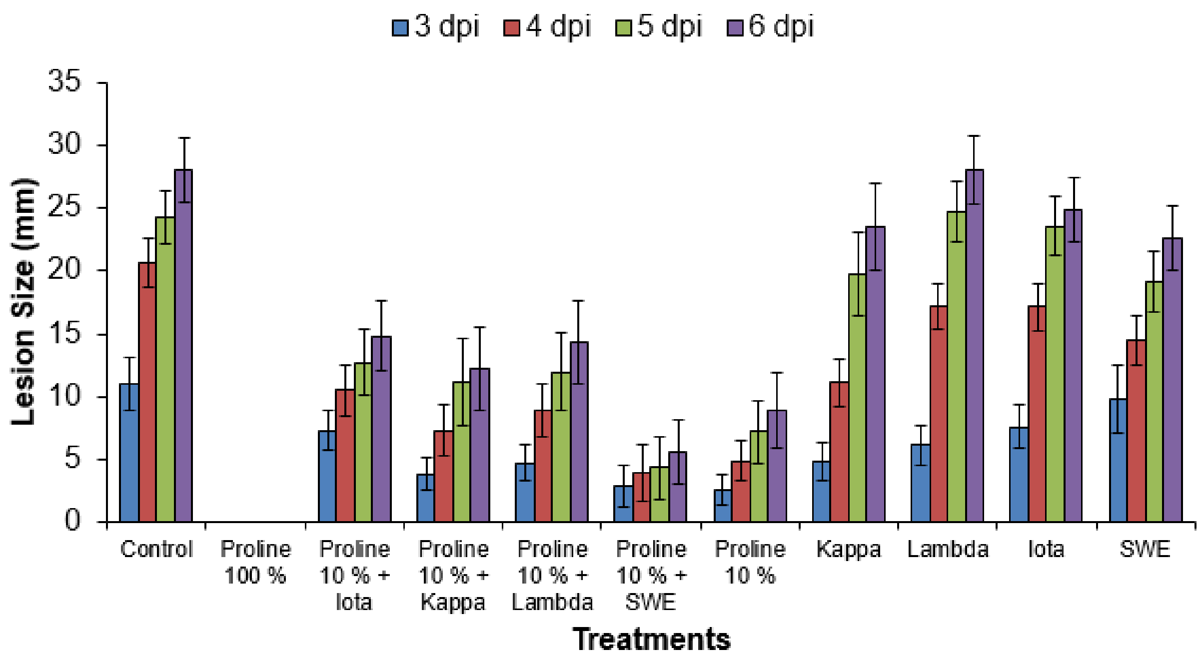

Fig 5. Size of leaf lesion (mm) on canola leaves inoculated with *Sclerotinia* with respect to Proline treatments (Iota-- ι- carrageenan, Kappa-- κ- carrageenan, Lambda-- λ- carrageenan, SWE—seaweed extract from *Ascophyllum nodosum*). Values represent mean ± standard error, n = 20.

Serenade treatment:

Bio-fungicide combined with ι-carrageenan performed the best among treatments in controlling the disease (Fig 6).

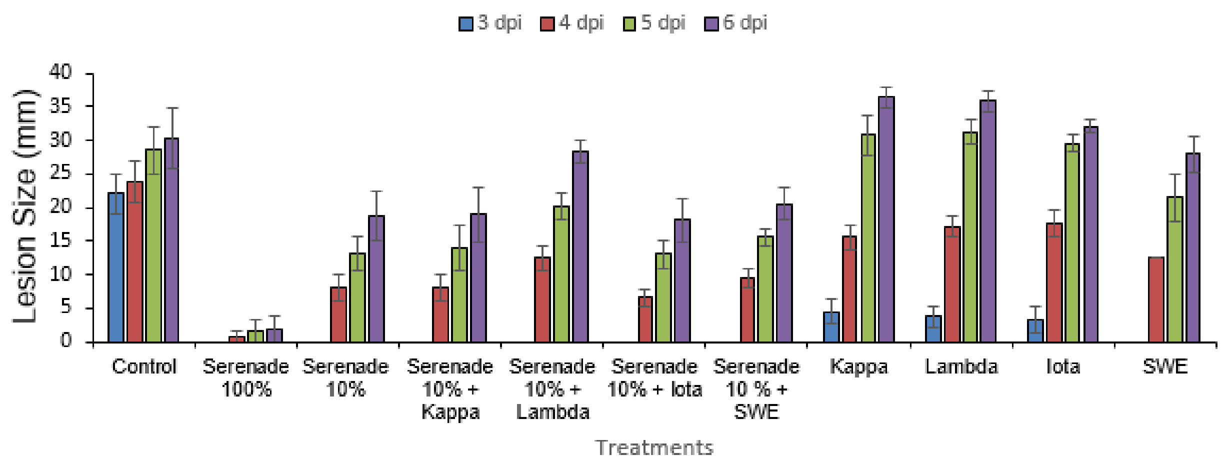

Fig 5. Size of leaf lesion (mm) on canola leaves inoculated with *Sclerotinia* with respect to Serenade treatments (Iota-- ι- carrageenan, Kappa-- κ- carrageenan, Lambda-- λ- carrageenan, SWE—seaweed extract from *Ascophyllum nodosum*). Values represent mean ± standard error, n = 10.

Future Work

The results of the experiment were promising. However, further field trials are necessary to draw conclusions. Two marine bioproducts were identified (lamda- caragennans and Ascophyllum nodosum extract) that improved the activity of fungicides. Current trials were in greenhouses, recommendations cannot be made unless field trials are implemented in the future.