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Activity 11 Factsheet

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

Objectives

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.

Methodology

Sclerotinia stem rot, caused by the fungus Sclerotinia sclerotium 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 the country. This 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. The major focus was to screen the effectiveness of a combination of fungicide and marine bioproducts in the laboratory setting and in the greenhouse. In the second year, the focus was in the greenhouse. Six fungicides: Lance, Proline, Quadris, Quash, Vertisan and Serenade CPB (bio-fungicide) were tested in vitro (Year 1 only) and in the greenhouse.

Greenhouse trial (Years 1+2):

Canola plants were grown in pots filled with Promix in a greenhouse. Fungicides registered in Canada for use against stem rot were used in this experiment. Fungicides were mixed with marine bioproducts: seaweed extracts (commercial product from rockweed Ascophyllum nodosum), λ carrageenan, κ carrageenan and ι carrageenan were sprayed on 3-4-week-old canola plants. Marine bioproducts were mixed with the fungicides at a concentration of 1g / L. Sclerotinia was grown in potato dextrose agar plates (25° C for 3-4 days) and a 5mm plug was placed on leaves 24 hours after treatment. Three leaves in a plant were inoculated with the fungus, with four plants per treatment (2016 two leaves/plant, five plants/treatment). The treated plants were covered in plastic bags to maintain humidity to encourage infection. On the 3rd day post inoculation, plants were transferred to a humidity chamber and arranged in a completely randomized design. The size of leaf lesions was measured from 3 to 7 day days post inoculation (dpi). The lesions were measured using a digital calliper.

Antifungal assay (Year 1):

Fungicides and seaweed extracts/carrageenans were mixed with a half strength potato dextrose agar (PDA) medium and poured into 9cm diameter Petri dishes. Fungicides were added at a concentration of 0.1 or 0.2 µg/mL of active ingredient and 1 µg/mL was used as the positive control. Ascophyllum nodosum extract and carrageenans were added to media at a concentration of 1 g/L. A 2mm plug of

Sclerotinia was inoculated at the center of the plate and incubated at 25° C. The diameter of colony was measured daily up to four days or until the mycelium covered the entire plate.

Data collection

Greenhouse trial (Years 1+2):

The spread of disease increased from 3 to 7 dpi. Fungicide applied at the recommended dose was used as the positive control and resulted in the most effective reduction in disease spread. The best treatments were Proline (combined with seaweed extract), and Lance (combined with seaweed extract and ι carrageenan) followed by Quash (with ⌈-carrageenan). In 2016, the best treatment was Proline (combined with seaweed extract), which was over five times more efficient at reducing the lesion size than the negative control.

Antifungal assay (Year 1):

The diameter of mycelium on ½ strength PDA plates containing fungicide treatments was measured from 1 dpi. In control treatments, the mycelium covered the entire plate in 3 days. The positive controls (Fungicide at 1 µg/mL a.i.) were the most effective in reducing the fungi growth. The treatments with fungicides were better than the controls with no fungicides. Treatments with serenade (Bacillus subtilis a.i.) did not allow Sclerotinia to grow. Quash was the most effective among all fungicides in controlling the fungus growth and the most effective combination treatment was 0.2 µg/mL a.i. with λ carrageenan and κ carrageenan. Among treatments, higher concentration (0.2 µg/mL a.i.) was better in controlling the mycelium spread than lower concentration of the active ingredient present (0.1 µg/mL a.i.).

Results

The results are significant, as the marine bioproducts improved the activity of fungicide in reducing the stem rot disease and it was identified that the amount of fungicide used can be significantly reduced with combination treatments. Carrageenans and Ascophyllum nodosum extract improved the activity of fungicides in vitro. In the greenhouse experiment, Proline, Lance and Quash, when used at the recommended rate completely inhibited disease development. When marine bioproducts were mixed with fungicides at 10% of the recommended amount, there was a significant improvement in the activity of the fungicides. Seaweed extract when mixed with 10% of the recommended dose of Quadris improved the activity of fungicide by 50%. In the initial stage of the infection the combination treatment was comparable with that of 100% fungicide. Similarly, the activity of Lance improved when combined with seaweed extract of iota-carragennan. The activity of Proline was also improved by combining with seaweed extract. The results of the experiment were promising. However, further field trials are necessary to draw conclusions.

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