Effect of *Metarhizium brunneum* Application Method on Wireworm Damage to Potato

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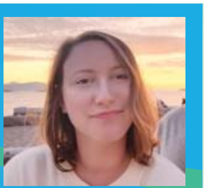

INTRODUCTION

Wireworms reduce marketable potato yield by tunneling into tubers.

Wireworm lifecycle in potato. Image: Kazakova Maryia

Wireworms (Coleoptera: Elateridae)

- Thirty-nine known species damage tuber crops. Species differ in their susceptibility to pathogens and level of damage to crops.
- *Agriotes obscurus* is a predominant wireworm pest in Canada. It can live for 2-5 years as a soil dwelling larva before becoming an adult click beetle and living aboveground briefly to feed and reproduce.

Metarhizium brunneum

- Entomopathogenic fungus found in soils everywhere
- Germinating conidia penetrate the waxy cuticle of soil-dwelling insects
- The fungus grows throughout the insect body, killing its host in a week or more.
- Isolate MetLRC112, obtained from an infected wireworm cadaver near Agassiz, BC, is being mass-produced and tested as a potential biocontrol of wireworm pests in field agriculture.

Attract-and-kill Method

- A carbon dioxide source, such as decomposing rolled oats, is used to attract wireworms to cultured *M. brunneum* conidia
- Spot treatment beneath potato seed pieces has been effective, but labor requirements may be an obstacle to large-scale success
- Potential alternative application methods requiring less precision include banding strips along crop rows and untargeted broadcast application

Experimental site preparation, June 20

Spot treatment with *M. brunneum* and rolled oats, June 20

OBJECTIVES

- Determine if *M. brunneum* reduces wireworm damage to potato
- Compare the effectiveness of different *M. brunneum* distribution methods on the proportion of marketable potatoes.

MATERIALS AND METHODS

Location: KPU Orchard, Richmond, BC

Experimental Design

- Randomized complete block design with four treatments and seven replicates (28 plots)
- Three rows of six potato plants per plot (18 plants in 3 x 3 m plot)
- One meter buffer, planted to buckwheat, between replicates
- Potatoes planted on 20 June and harvested on 8 October

Banded treatment application before potato planting, June 20

Treatments

1. **Control**: No added source of CO_2 or *M. brunneum*
2. **Spot Treatment**: 34 g *M. brunneum* formulation blended with 71 g rolled oats divided into 18 equal portions, placed below each seed piece in plot at planting.
3. **Banded Strip**: 34 g *M. brunneum* formulation blended with 71 g rolled oats and divide into three equal portions, banded along the bottom of each planting trench in plot before planting.
4. **Broadcast**: 34 g *M. brunneum* formulation blended with 425 g of dry rice spread evenly over plot before planting.

Experimental block of potatoes with buckwheat buffer between blocks, July 29

Data Collection

- Data collected from center row of each plot
- Potatoes washed after harvest and stored at 4º C
- Potato weight, count, and wireworm damage (holes per potato and per plot) recorded

Statistical Analysis:

Data were tested for normality (Shapiro-Wilk) and subjected to ANOVA to test for treatment effects. All statistical testing was conducted using the jamovi interface for R ($\alpha = 0.05$).

Potato harvest, October 8

RESULTS

Neither *M. brunneum* nor application method affected potato yield or wireworm damage rates (Figs 1-3). A strong edge effect was observed, with lower yields along the eastern edge of the experimental site (Fig. 4).

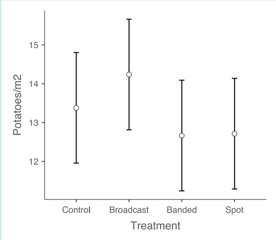

Figure 1. Potato count by treatment. Error bars denote standard error of the mean.

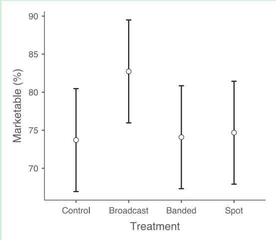

Figure 2. Proportion of potatoes that were marketable by treatment. Error bars denote standard error of the mean.

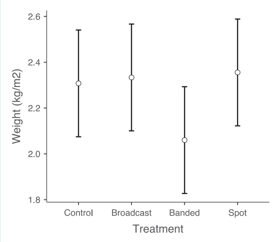

Figure 3. Potato weight by treatment. Error bars denote standard error of the mean.

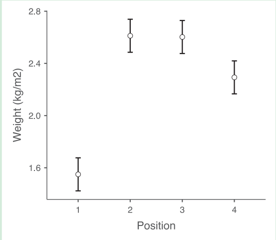

Figure 4. Potato weight by plot position within each replicate, ranging from east (1) to west (4). Error bars denote standard error of the mean.

DISCUSSION

More variability was observed within treatments than between treatments, possibly obscuring treatment effects. The experimental site showed a strong edge effect, with lower yields in plots on the eastern edge (Fig. 4), but blocking was conducted from north to south.

Non-treatment sources of variation that could not be blocked out may have included differences in initial wireworm populations, soil fertility, soil moisture, or soil temperature.

CONCLUSION

This experiment found no evidence that *M. brunneum* reduces wireworm damage or improves potato yield. No differences were observed between *M. brunneum* application methods.

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