

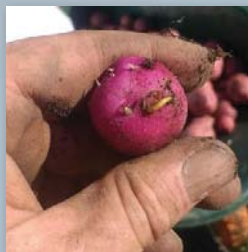


Lindsay Dodds

Kwantlen Polytechnic University Department of Sustainable Agriculture and Food Systems

INTRODUCTION

- Wireworms:
 - Polyphagous soil-dwelling larvae of click beetles (Coleoptera: Elateridae)
 - Cause significant damage to agricultural crops including cereals, legumes and potato
 - Transition through as many as 13 larval instars over 2-5 years, terminating as short-lived adults
- Wireworm damage to potato
 - Thirty-nine species known to attack potatoes
 - *Agriotes*, *Conodenis*, *Ctenicera*, *Liminius*, and *Melanotus* include most significant wireworm pests of potato
 - Tubers with as little as two feeding holes may be unmarketable
- *Metarhizium brunneum*
 - Entomopathogenic fungus occurring naturally in local soils
 - Isolate LRC112, obtained from an infected wireworm cadaver near Agassiz, BC, infects wireworms under field conditions in Canada
 - Can cause 90-100% mortality of *A. lineatus*, three weeks after inoculation
 - Mass-produced for use in field and laboratory trials
 - Previously tested for wireworm control with varying success
 - Biocontrol efficacy influenced by environmental factors such as temperature, soil moisture, and nutrient availability
 - Best results when soil temperature is at least 18°C at planting (June in south coastal British Columbia for deep seed crops like potato)
- Attract-and-kill strategy
 - Carbon dioxide attracts wireworm
 - Combining *M. brunneum* treatment with a carbon dioxide source may lure wireworms to the infective biocontrol
 - Seed potatoes emit carbon dioxide
 - Cut seed pieces emit more carbon dioxide than whole seed pieces



OBJECTIVE

- Whole or cut seed potatoes were tested, with or without *M. brunneum*, to determine if the attract-and-kill strategy would protect an organic potato crop from wireworm damage without reducing yield.

METHODS

- Study location: KPU Orchard, Richmond, B.C., Canada
 - Partnership between Kwantlen Polytechnic University, and Agriculture and Agri-Food Canada
 - Certified organic by BC Association for Regenerative Agriculture
- Preparation for planting:
 - Abundance and diversity of endemic wireworms sampled using pheromone and CO₂-baited pitfall traps
 - 130 seed tubers cut in half and left to suberize to reduce opportunity for disease infection
 - Sprouts from cut and whole seed potatoes removed to ensure consistent growth stage between treatments
 - *M. brunneum* (AAFC, Agassiz, BC) mass-produced and blended with dry rice
- Experimental design: Randomized complete block factorial with 4 treatments and 6 replicates
 - Treatments (4):
 - Seed factor: Whole or half seed pieces
 - Biocontrol factor: *M. brunneum* or untreated control
 - Plots (24):
 - Dimensions: 2.25 x 4 m
 - Center row treated, with buffer rows at each plot edge
 - Potato culture:
 - Planting: June 20, 2018
 - 30 cm between plants, 1.25 m between rows
 - Drip irrigation applied along each row
 - Hilled at planting and 42 days after planting
 - Tops mowed 10 days before harvest
 - Tractor-driven potato harvester
 - Harvest: October 11, 2018
 - Data collection:
 - Potato yield, potato count, number of wireworm feeding holes per tuber
 - Data analysis:
 - ANOVA in R statistical software



RESULTS

- Whole seed pieces produced a higher yield than half seed pieces ($p=0.01$) (Fig. 1). No significant influence of biocontrol on yield was detected.
- An interaction was observed between seed and biocontrol effects on wireworm damage ($p=0.03$). *M. brunneum* application reduced the number of holes per tuber in potatoes grown from half seed pieces, but not in potatoes grown from whole seed pieces (Fig. 2).

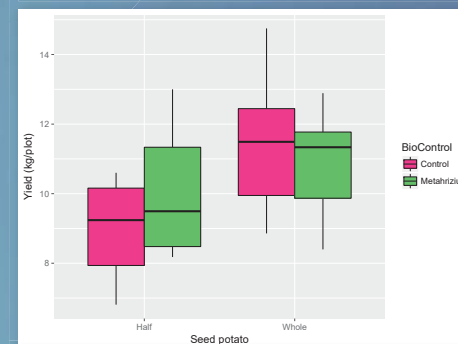


Fig 1. Yield of potatoes according to seed potato type and biocontrol.

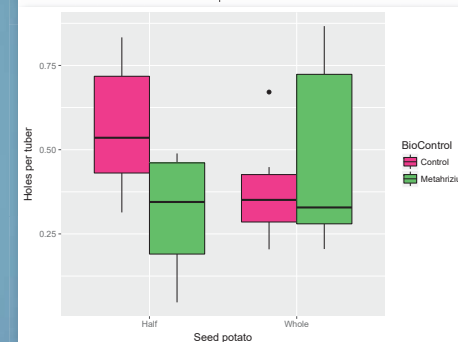


Fig 2. Wireworm damage according to seed potato type and biocontrol.

CONCLUSION

M. brunneum reduced wireworm damage to potatoes grown from half seed pieces, but not to potatoes grown from whole seed pieces. Potatoes grown from whole seed pieces had a higher yield and no more damage than potatoes grown from half seed pieces with *M. brunneum*.

The observation is consistent with the hypothesis that cut seed pieces attract wireworm larvae that can be killed by *M. brunneum*. *M. brunneum* compensated for the extra feeding damage associated with using cut seed pieces, but did not offer any additional benefit over using whole seed pieces.

ACKNOWLEDGMENTS

Mike Bomford and Todd Kabaluk provided help, support, and guidance. Rebecca Harbut assisted with design, squaring, and plot measurement. Arcadio Guzman, Piper Kenney and Torin Boyle helped with planting, weeding, and harvest.