

MANAGEMENT PRACTICES AND CROP ROTATION FOR CONTROL OF EUROPEAN WIREWORMS IN CANADA

Interim Research Report E2009-24

BACKGROUND

Significant losses in crop yield, quality, and marketability have been attributed to wireworms, a pest of growing concern and widening distribution across Canada. While the Atlantic provinces harbour native wireworm species, three species introduced to North America from European ship ballast cause the lion's share of damage. These three species, *Agriotes lineatus*, *A. obscurus*, and *A. sputator*, have a short lived adult phase, commonly known as click beetles, that seldom cause substantial crop damage. The destructive larvae of these species persist in the soil for several years, feeding on the roots of host plants and causing significant reductions in the yield and quality of economically important crops.



Larval wireworm feeding on a carrot (J. MacKenzie)

WHAT WAS DONE

In 2008, the Organic Agriculture Centre of Canada continued working toward the development of cultural management strategies targeted at the larval wireworm and adult click beetle. Damage to crops as a result of wireworm feeding may be mitigated by deterring egg laying in crop fields or reducing viability of eggs and young wireworms, developing methods to deter feeding on cash crops, and using unattractive or ill-suited plants in a crop rotation.

Crop Rotation for Wireworm Control: Rotational crops may be used to create an inhospitable soil environment for wireworms.

A 3-year crop rotation trial was established at the Brookside NS research site in 2007, with the second year of cover crops planted in 2008. The trial includes crops which may have a detrimental effect on wireworm populations, such as glucosinolate-releasing brown mustard, quick growing and often tilled buckwheat, flax with possibly poor nutritional quality for the wireworm, deep rooted and soil drying alfalfa, and a control of barley underseeded to clover. In 2009, these plots will be planted with carrots or potatoes for evaluation of crop damage.

Wireworm populations in the plots seeded with the various crops were monitored throughout the 2007 and 2008 growing seasons. No significant differences in wireworm abundance due to the crop planted have been detected. There is, however, an emerging trend towards high wireworm populations the barley underseeded to clover plots and lower levels in the flax and brown mustard plots.



Installing traps for wireworm monitoring in an alfalfa plot of the crop rotation trial (J. MacKenzie)

Development of a Push-Pull-Immobilize Strategy: Evaluations are being made of a push-pull-immobilize strategy, based on pushing

wireworms away from a cash crop using feeding deterrents, pulling wireworms from the cash crop using attractive bait crops, and immobilizing wireworms through the use of harmful seed or soil treatments.

Push Strategy: The push strategy aims to create a crop that is not attractive to wireworm. Plant-derived feeding deterrents, which may be applied as seed treatments or to growing plants, are currently being evaluated. Alternatively, less attractive varieties or cultivars of a given cash crop could be employed. However, an evaluation of four carrot varieties, including a commonly used processing variety, Chantenay, Scarlet Nantes, and Yaya revealed no significant differences in the relative attractiveness of these varieties.

Pull Strategy: In order to serve as an effective bait, a crop must be more attractive to wireworms than the cash crop it is protecting. Potential bait crops, including wheat, red-skinned potato, corn and dandelion have been evaluated in the lab, with results suggest that germinating wheat is more attractive to wireworms than carrot, and may thus serve as an effective trap crop (Figure 1). Red-skinned potato, dandelion, and corn did not prove to be sufficiently attractive to wireworms to merit use as trap crops in carrot production.

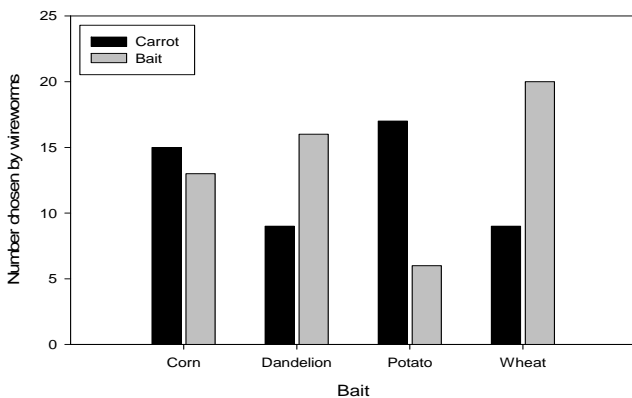


Figure 1. Number of wireworms choosing carrots or various baits in a laboratory trial of the 'pull' strategy.

The effectiveness of the wheat pull strategy was tested in a field trial in 2008. Wheat was densely seeded between carrot rows in August and September in an effort to lure the wireworms away from the maturing carrots until harvest. Results to date are inconclusive, with no significant reductions in wireworm damage in carrot rows adjacent to wheat rows but a trend toward such a reduction.

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Wheat planted between carrot rows before harvest as an in-field test of the "pull" strategy (J. MacKenzie)

Immobilize Strategy: The potential for organic soil amendments, such as diatomaceous earth, neem oil, and wood ash, to immobilize or control wireworms is currently under evaluation in laboratory conditions.

THE BOTTOM LINE...

Wireworms are a damaging crop pest with few management techniques currently available for organic producers. Research is currently underway to evaluate the use of crop rotation and a push-pull-immobilize strategy for wireworm management.

CREDITS

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