Latest Research Results

organic SCIENCE CLUSTER 3

Managing wireworms in vegetable crops

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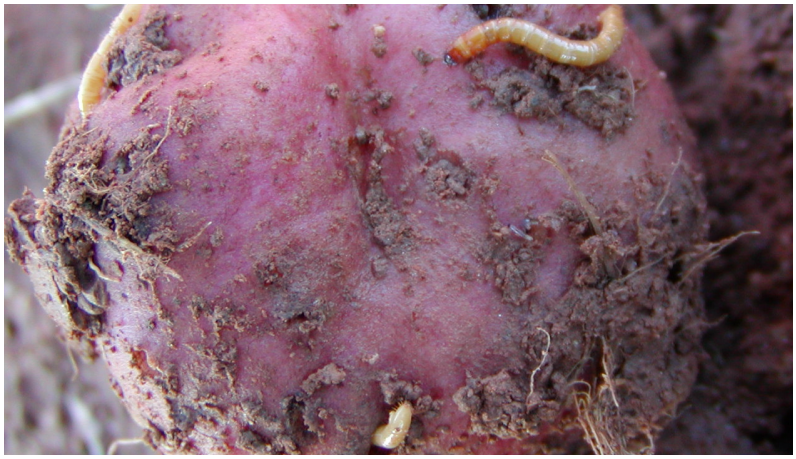
Wireworms are a subterranean and seriously pestilent larvae of agricultural crops. As there are no pest control products available to organic farmers, they lack effective controls for wireworms. Small-scale vegetable producers in BC report large crop losses or the inability to grow marketable produce due to wireworm damage, resulting in economic losses. Because of the damage wireworms do to crops, there is reduced availability of organic produce. Wireworm infested land means farmers are wary of opening up new land for production, thereby constraining the expansion of the organic industry.

Through field research, we sought to develop new methods for managing wireworms at levels that enable an abundance of organic food production. The methods that were researched were those represented by integrated pest management principles: pest prediction, cultural management, mechanical control, and biological control. Our goal was to determine the efficacy of selected methods within these principles and assess them for implementation into farming practices.

We found that:

- Mass trapping male click beetles with pheromone-baited traps, and disorienting male beetles with pheromone-treated granules, decreased the number of new wireworms, but not as much as was expected. This is likely a matter of fine-tuning factors such as the amount of pheromone on the granules, frequency of granule applications, and potency of the lures used in the traps.

- The sex pheromones of some native wireworm species are relatively easy to identify and produce (e.g. *Agriotes mancus*), while those of others (e.g. Limonius spp., A. ferrugineipennis) have very different structures and were new to science. These



newly discovered pheromones allow us to extend the pheromone-based monitoring and management tactics that are being developed for *A. obscurus* and A. *lineatus* to other growing regions (i.e. Ontario, Prairie provinces, BC Interior).

- Delaying seeding of annual crops in the spring (e.g. corn) led to decreased seedling mortality due to wireworms, but made the seedlings more vulnerable to damage from other soil insects (e.g. western corn rootworm larvae).

- Cultivating the field during periods of peak wireworm activity decreased wireworm numbers, however it could negatively impact soil structure and increase soil erosion.

- Frass of black soldier fly larvae (commercially mass-produced for pet and livestock feed), when applied with a wireworm attractant prior to planting, can significantly increase the marketable yield of seeded crops – in our case, Hakurei turnip and carrot. The frass is commercially available as an organic fertilizer. Similarly, a unique strain of the insect fungal pathogen *Metarhizium brunnem* (LRC112), applied similarly to the frass, had the same effect of significantly increasing marketable yield.

- The penetration of ground-resting fruit such as melons, peppers, cucurbits, and tomatoes by wireworms can be significantly reduced by underlaying the crop with a minimum of 4 mil plastic mulch, or entirely prevented by using woven fabric mulch.

While establishing wireworm management techniques that can be applied now, our research has identified further areas where advances would heighten the ability of organic growers to manage this pest:

- Targeting wireworm adults – click beetles – with entomopathogens, pheromones, and mass-trapping to reduce the input of new larvae into agricultural soil.

- Extending wireworm control, through the adult beetles, to refugia i.e. the semi-wild areas that border cropland. Controlling wireworms in this area would prevent the beetles' migration from refugia into crop land, thereby reducing their continual input into field soil.

- Combining different non-chemical control tactics, e.g. pheromones with entomopathogens, to increase the efficacy of the latter.

- Extending the pheromone-based mass trapping and monitoring tactics to other areas of Canada, which have different pest species, for which pheromones have recently been discovered.

- Using pheromone-baited traps to determine the risk of wireworm injury to fields, and to time the application of control tactics.

- Experimenting with drone technology to access refugia, as identified above

- Develop novel end-use product formulations for existing organic-certified active ingredients.

For more information visit the OSC3 Activity 21 webpage and/or DAL.CA/OACC/OSCIII & https://organicfederation.ca/organic-science-clusters/

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