

Workshop Title: Wireworm Management in Horticulture Crops

Speaker: Dr Christine Norohna, Agriculture and Agri-Food Canada

Executive Summary:

Dr. Christine Norohna reviewed research on wireworm, starting with the description of wireworm, how the population increases and the methods used in their research in reducing wireworm damage. Great results have been seen with the use of brown mustard (*brassica juncea* var. Centennial) and buckwheat (var. Mancan). In addition, there has been ongoing research in the area of using *Metarhizium* and pheromones that shows promise for commercial use. The presentation concludes with strategies to reduce your wireworm damage.

Detailed Notes:

Wireworms have really been challenging us. What are wireworms?

- Larvae of click beetles.
- Several species cause crop damage.
- An emerging pest worldwide.
- Affect a wide variety of crops. Potatoes, corn, cabbage, carrots to name a few. Biggest problem are the root crops as they become unmarketable.
- Can render root crops unmarketable.
- Very limited means of control.

Lifecycle - They pupate in the soil and emerge as adults in the spring. Their lifecycle is five years. Spring-early summer adults (click beetles) lay 100-200 eggs in the soil. Feed on the seedling roots and in the fall on the tubers or root crops. They hibernate in the soil in the fall, returning to the surface in the spring. The population continues to increase over the years based on their five-year life cycle.

Why is the damage worse in one year more than another? In newly infested fields where the adult comes in and lays eggs, you won't see damage that year, but once you have adults and second year larvae you will notice some damage, but not too much. In the third year, you have more larvae and therefore more damage.

There are 48 species of click beetles in PEI, 98 in NB and 101 in NS. European species (e.g. *Agriotes sputator*, *Agriotes obscurus* and *Agriotes lineatus*) have five-year lifecycle and are the ones normally found in our region. There are other species (e.g. *Hypnoidus abbreviatus*) as well.

Where do they prefer to lay their eggs?

- Undisturbed fields with green plant material are preferred

- sod fields
- under-seeded fields
- pasture fields
- adults will also lay eggs in bare soil though egg survival may be compromised

When to bait?

Wireworm have an aggregated distribution in the field. So you may find patchy distribution. Don't put the baits out too early. Too late in the fall they have already hibernated and you don't think you have wireworms. Bait in September or end of May or June to see wireworm issues in your fields.

Monitoring click beetles

Wireworm population have been closely monitored in PEI using pheromones (this only tracks males.)

Survey of click beetles species across PEI

Starting to see increasing population in PEI and across the country. Prairies have different species and they are increasing too.

Impact on agriculture

- Once infected, agriculture land will remain infected until adequate control measures to eliminate the larvae are implemented.
- If wireworms are not controlled, the land may become an important source of adult beetle that will infest other fields.
- Because of the wide host range, good agricultural land may become unsuitable for crop production.

Why difficult to control?

- Five-year life cycle
- Soil-dwelling – how deep are they?
- Difficult to monitor
- Several generations
- Damage occurs in the spring and fall
- Feed on a wide variety of crop species – oats, wheat, barley, clover, corn, carrots, lettuce, onions, peas, potatoes, parsnips, cabbage, beans, rutabagas, etc.

Wireworms attack germinating seeds in the spring. As the plant grows, it releases CO₂ and that is how they find their crop.

Plough-down of green material can result in increased damage as beetles can eat ploughed down material and don't need to come to the surface. Worms then come up and feed on your tubers. Don't plant a valuable crop after plough-down or you will have damage (in range of 12 holes per tuber).

Study on rotation crops

- Brown mustard
- Buckwheat
- Barley/clover

Grown for two years. Grew in spring, disked in and then fall crop. Fields used were heavily populated with wireworm. Found that brown mustard, buckwheat reduced the damage. Cabbage growers don't want to follow with mustard so can use buckwheat.

Why does brown mustard work?

- Because the plant tissue has allyl-glucosinolate
- When plant material starts to breakdown, an enzyme myronase reacts with the tissue to produce Isothiocyanates, which acts as a fumigant and kills disease organism in them.
- 2-phenylethyl in its roots which is toxic to insects. Brown mustard has high levels.

Buckwheat

- organic matter
- phosphorus
- but don't know why it has an impact on wireworm

Crop rotation

- brown mustard brassicae var. *juncea*
- buckwheat – var. *mancan*
- 2 crops/year for 2 years
- have to fertilize it
- Plant in early June
- Disk the crop in late July before seeds mature
- After two to three weeks harrow the field to level it
- Depending on the seeder you may need to roll it before planting, mainly because you don't want the mustard seed planted too deep
- Do not need to add fertilizer for the second planting
- The second crop should go in by mid-late August
- Wireworms come to the surface to feed by mid-late September
- You want the crop established and producing the chemicals
- This second crop does not need to be disked as it will act as ground cover and will not produce seeds
- Treat the brown mustard and buckwheat like a crop.

Using the Brown Mustard as Nurse Crop

Brown mustard was planted in the potato rows at five different seeding dates throughout the summer. July 14, July 30th, August 13, August 20th and August 28th planted the mustard between rows.

Pleased with the results – half the holes from what we had with no mustard. Review more for correct dates. Mustard and barley work together well.

Potato Variety Trial

- Twenty varieties and six replicates per variety
- Mean number of blemishes (holes + scars) in different potato varieties grown without an insecticide application to protect against wireworm damage

Can Metarhizium control wireworms by controlling click beetles?

(in the years leading up to planting potatoes)

First of all, is Metarhizium (Fungus) even pathogenic to the adult beetles? Tests in the lab say yes. Use of spore granules, spore spray, and spore dust in arenas and added the beetles. Granules worked well but dust/spray not as well. Need a certain dose to make them sick. Can we control the adults, then get rid of eggs and the result larvae.

The Concept – Attracting Beetles to Bands of Biocontrols using Pheromone Granules – mixed granules with pheromone attract males and pick up the spores and then off to mate they transmit to the females. If you had the pheromone at higher rate metarhizium almost all are killed. Work still at research stage, not at commercial stage. Another year to make commercial, but it is looking promising.

Strategies to reduce damage

1. Find out if you have wireworms in your field
2. If you work up a long-term sod field do not plant a valuable crop the first year.
3. Plant brown mustard or buckwheat as a rotation crop as outlined above.
4. Try not to plant a preferred host such as grain every year.
5. For root crops harvest early before wireworms come up to the surface to feed in the fall.