

Wireworms

Wireworms are the larvae of click beetles
(Coleoptera: Elateridae)

Wireworms are yellow and/or light brown with a hard
shiny skin and 3 sets of legs near the head (Fig. 1)



Figure 1. Wireworm larvae collected from garden in early
May. Photo credit: Sebastian Ibarra

Wireworms can affect a wide variety of crops
including but not limited to potatoes, oats, wheat,
barley, corn, carrots, cabbage, clover, rutabagas,
lettuce, onions, peas, parsnips, beans

Wireworms can render root crops unmarketable and
cause crop stand injury in grains

Damage to seeds and seedling roots is caused in the
spring

Damage to root crops is usually caused in the fall

In PEI the main click beetle species of concern are:

Agriotes sputator (Fig. 2); *Agriotes obscurus*;
Agriotes lineatus; *Hypnoidus abbreviatus*;
Selatosomus pulcher; *Dalopius spp*

Wireworms pupate in the soil and emerge as adults
in the spring. They can take up to 5 years to pupate,
depending on the species



Figure 2. Photo of *Agriotes sputator* click beetle adults. Photo
credit: Sebastian Ibarra

There usually are several generations of wireworms
in an infested field. This means that there can be 1,
2, 3, and 4 year old wireworm larvae in one field at
any point in time

Click beetles mate after emergence in spring or
early summer, laying eggs soon thereafter. An adult
female can lay 100-200 eggs in the soil

**Click beetle monitoring is to be conducted from
mid-late April to early-mid July**

Vernon Pitfall traps (Fig. 3): traps baited with
female pheromone that attracts males of *Agriotes
sputator*. Two main monitoring strategies exist for
Vernon pitfall traps: Sentinel trapping [1
trap/field(s)] and field monitoring (8+ traps/ field).
Vernon pitfall traps are placed in the periphery of
the fields, preferentially in the headlands and/or in
grassed waterways/ berms. Vernon pitfall traps

should be used in conjunction with a field risk assessment. The field risk assessment takes into consideration: *i*) field cropping history, *ii*) wireworm presence in nearby fields, and *iii*) wireworm sampling (optional) or click beetle sampling (optional). Dr. Bob Vernon and Dr. Wim Van Herk, from Agriculture and Agri-Food Canada – Agassiz, BC, are currently conducting studies in PEI to determine the best protocol for implementing a click beetle monitoring program



Figure 3. Vernon pitfall trap for *Agriotes sputator* click beetle males placed in April and serviced weekly. Photo credit: Sebastian Ibarra

NELT trap (Fig. 4)- Light traps that attract multiple species of click beetles, both males and females. Eight or more traps can be placed around fields known to have wireworms, or in areas of interest. Traps are commercially available in PEI through Growing Forward Solutions, contact Ralph Yao



Figure 4. NELT trap for click beetle. Photo credit: Christine Noronha

Direct measurement of wireworms in the soil

Monitoring wireworms has one important caveat: if you find them, you know you will have a problem; but if you don't find them, you can't be sure you won't have a problem. A technique has been developed by AAFC (Todd Kabaluk) that has closely predicted wireworm damage to potato in the rotational crop one year in advance of planting to potatoes. A fact sheet explaining the details of this technique can be found on the website of the PEI Potato Agronomy website:

<http://peipotatoagronomy.com/topic-pests-diseases/>

The technique involves cultivating a ~2m strip across the rotational grass/forage crop in the spring one year before planting potato, keeping the strip lightly tilled or chem-fallowed until September. In September, bury a half-potato 15cm (6") deep (potatoes cut in half catch more wireworms) every 10m (33'), marking each placement with a flag. Dig up the potato after 2 weeks and assess the wireworm damage and number of wireworms.

While the above technique has been tested experimentally, many other techniques appear on the internet using a variety of baits. Spring baiting, although less reliable (more variable wireworm activity), is conducted when soil temperatures are above 5-10°C. Bait materials can include flour/potato/carrots/oats/wheat/rolled oats or anything that generates the attractant carbon dioxide. Fifteen to twenty baits should be placed per acre, checked every 4 -5 days.

Baiting can be achieved by:

Burying 1 cup of bait at a soil depth of 6 inches

Cover the bait with soil and mark bait location with a stake or flag

After 4-5 days, remove the baits and surrounding soil from the area, and count the wireworms

If a wireworm is observed in any of the baits, crop damage is possible

Note: wireworm baiting has a chance of yielding false negatives results – meaning that zero catches do not imply zero wireworm presence. Leaving the bait in the field for longer periods of time could have repellent effects, increasing the chance of false negatives

Cultural practices are the first line of defense:

Avoid growing susceptible crops (potatoes, grains) in fields with previous history of wireworm damage

Plow-down of green material can result in increased damage **in potatoes due to reduced effectiveness of granular insecticides such as Thimet**

Rotating with cereals will increase egg laying in that field. Assess the risk of click beetle wireworm presence in your fields (see above), and avoid planting cereal crops in fields at risk. Consider using NELT and/or Vernon pitfall traps in these fields to prevent mating and egg laying in spring and early summer (speculative)

In fields at risk, practice crop rotation strategies with the goal of mitigating wireworm damage. There is evidence to suggest that these practices can reduce the incidence of other disease such as potato common scab (*Streptomyces*) and/or canker/black scurf (*Rhizoctonia*). The following practices are encouraged in fields with history of wireworm damage:

Rotate with 2 crops/year for 2 years

Plant first rotation crop in early June; the second crop should go in by mid to late August. Ideal wireworm rotation crops are:

Brown Mustard (*Brassica juncea* var. Centennial). Recommended seeding rate is 10lb/ac or 11.2kg/ha

Buckwheat (var. Mancan). Recommended seeding rate is 40lb.ac or 44.8kg/ha

Note: Avoid brown mustard if your main cash crop is a member of the brassica family, i.e. canola, cabbage, etc.

In gardens: Consider the use of sacrificial crops to prevent damage to your crop: One week before planting your main crops, plant narrow, densely seeded wheat (wheat seeds almost touching) in rows spaced about 1 meter apart. Untreated seed will attract most wireworms away from the planted crop areas between. The rows of wheat can be replenished if wireworms are consuming them. Wheat can be cut to prevent it from growing too high at around 30 cm above ground

Apply insecticides only when necessary. Use insecticides as part of an integrated pest management program (coupled with cultural, mechanical, and/or biological tools). Make application decisions based on data gathered through monitoring. The sale, use, or application of a pesticide is regulated by the *Pesticides Control Act*, enforced by the Department of Communities, Land, and Environment. **Follow the pest control product label instructions.** Rotate insecticide products with different modes of action class (MoA) to reduce the chances of resistance development

The table below is not a comprehensible list and is only provided as a reference. Always read the product label; in case of disagreement between the table and the label, the label shall be considered correct

Products registered for use in potatoes:

Thimet 20G (Phorate; MoA: 1B). In furrow application

Pyrifos 15G (Chlorpyrifos; MoA: 1B). In furrow application –*Restrictions may apply if you intend to export tubers exposed to this active ingredient*

Titan (Clothianidin; MoA: 4A). Seed-piece treatment

Capture (Bifenthrin; MoA: 3A). In furrow application

Nipsit INSIDE 600 Insecticide (Clothianidin; Moa: 4A). Seed-piece treatment

Products registered for use in grain, oilseed, and pulses:

Alias 240SC (Imidacloprid; MoA: 4A). Registered for use in wheat, barley, oats, and corn

Cruiser 5FS (Thiamethoxam; MoA: 4A). Registered for use in wheat, barley, chickpeas, lentils, dry peas, and faba beans

Cruiser Maxx Beans + Vibrance 500FS (Thiamethoxam, Metalaxyl-M, Fludioxonil; Sedaxane; *Insecticide* MoA: 4A). Registered for use in soy beans and dry beans

Cruiser Maxx Vibrance Cereals (Thiamethoxam, Metalaxyl-M, Difenoconazole, Sedaxane; *Insecticide*

MoA: 4A). Registered for use in barley, wheat (spring and winter), and oats

Cruiser 5FC + Apron Maxx RTA + Vibrance 500FS (Thiamethoxam; Metalaxyl-M, Fludioxonil; Sedaxane; *Insecticide* MoA: 4A). Registered for use in chickpea, lentil, and dry peas

Cruiser Vibrance Quattro (Thiamethoxam, Metalaxyl-M, Difenoconazole, Sedaxane, Fludioxonil; *Insecticide* MoA: 4A). Registered for use in barley, wheat, and oats

Fortenza (Cyantraniliprole; MoA: 28). Registered for use in corn
Nipsit SUITE Cereals OF Seed Protectant (Clothianidin, Matconazole, Metalaxyl; *Insecticide* MoA: 4A). Registered for use in wheat

Nipsit INSIDE 600 Insecticide (Clothianidin; Moa: 4A) Registered for use in wheat

Stress shield 600/Sombrero (Imidacloprid; MoA: 4A). Registered for use in wheat, barley, oats, field beans, soybeans, field peas (only Stress Shield), faba beans (only Stress Shield), chickpeas (only Stress Shield), and lentils (only Stress Shield)