ATTACK OF THE RAVENOUS ROOT PESTS

CURRENTLY PLAYING AT A FARM NEAR YOU

By Av Singh

Theatrical Trailer: **Just below the soil surface, root vegetables are soaking up the goodness from their surroundings and transforming themselves into vibrantly-coloured masses of fleshy tissue packed with flavour and dense in nutrients. Suddenly, as we pull up our harvest, we are shocked to realize someone has beaten us to the punch—our root crops have been decimated by pests.**

Maybe, in reality, the events are not as dramatic, but each year pests create significant losses for organic farmers and gardeners by affecting the yield, quality and particularly the marketability of root crops. Insects can leave visible damage on the crops and also create portals for pathogens to enter the roots and cause disease. This article will highlight common problems and propose general practices to combat not only the symptom (insect infestation) but to address the *root* cause.

Colorado potato beetle larvae on damaged leaves.

Supporting cast and usual suspects

Technically, 'root vegetables' refer only to those plants that have roots that are harvestable, such as beets, carrots, horseradish, radishes, rutabagas, parsnips, turnips, Jerusalem artichokes and sweetpotatoes. However, other categories of underground vegetables including bulbs (onion, garlic), corms (celeriac), rhizomes (ginger) and tubers (potatoes) face similar concerns from root pests. For simplicity, we'll consider anything edible underground to be a root crop.

Similarly, root insects are often generalized as root weevils, root maggots, wireworms, cutworms, etc., despite being several distinct species. The following are common descriptions of the root crop pests, but the key factor to remember is that despite these being the 'stars' of the show, there are innumerable extras that have integral roles.

Root maggots

Many species of the root maggot exist; for example the onion maggot only affects members of the Allium family (including garlic, onions, shallots), and similarly the cabbage maggot damages almost all members of the Crucifer family (including radishes, turnips, rutabagas).

Affected plants lack vigour and may be stunted or yellowed. Often the clearest sign of root maggot damage is the wilting of plants during the heat of the day.

Root maggots are particularly destructive in early plantings. They attack succulent roots and often

leave them tunnelled, yellow and rotting. The damage to the roots creates entry points for disease infection and plants often succumb to root rot.

In the spring or early summer, the adults emerge from their overwintering cocoons in the soil. They look similar to the common housefly but are smaller. The flies soon mate and deposit up to 200 eggs at the base of a host plant. The eggs hatch within days. Larvae feed for up to three weeks, pupate and the cycle starts all over again. There can be several generations per growing season.

Wireworms

As of recently, the wireworm has become the dominant threat to a wide range of root crops including potatoes, rutabagas, carrots, turnips, beets, onions and parsnips, despite their preferred food source being sod and cereal grains. It is not advisable to plant host crops the first year after breaking sod.

The adult wireworm (known as the click beetle) is a dark brown beetle about 2 cm (¾ in.) in length. The adults overwinter beneath the soil surface and emerge in the spring. They feed on floral nectar and do no agricultural damage. The adults begin laying eggs in June and the entire process of laying and hatching is staggered throughout the summer resulting in a constant presence of wireworms. Moreover, the larval stage of many species of wireworm can last more than four years, with larvae rising and descending in the soil profile depending on moisture and temperature. The majority of damage by the larvae occurs in early spring or in early fall when soil temperatures are cool.

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Carrot rust fly

The carrot rust fly lays its eggs at the base of growing carrots (and other members of the Umbelliferae family including parsnips). The larvae chew and tunnel their way through the crop leaving not only unsightly grooves but ample area for disease infection. Damage to early seedlings often results in stunted or twisted carrots. The effects are not only cosmetic; damage can change the flavour.

Adult flies, with their yellow legs, shiny black bodies and yellowish-red heads, appear in late May and begin laying eggs in late June. Larvae hatch within two weeks and the month-long consumption of roots begins. A new generation will appear in August and another in September. Carrot rust fly will not fly long distances and can be controlled through crop rotation.

Baited breath...for the wireworm

Red-skinned potatoes are like ice cream for wireworms. To lure wireworms away from crops, bury cut potatoes between crop rows. Flag these, dig them up later, and destroy them with soapy water or fire. Read more about wireworms on page 63.

The plot: action and adventure

All too often organic farmers and gardeners are pulled into the drama of a pest infestation which invariably leads to an action adventure (possibly even a horror) situation as a one-on-one combat approach takes place. If farmers and gardeners take such an aggressive approach, unlike Hollywood, the bad guys will eventually win. Alternatively, farmers and gardeners must draw upon a series of techniques and practices that serve as small parts of a whole system (more about this below). The following methods are somewhat generic and must be tweaked to cater to specific crops, pests and regions.

Crop rotation

The cornerstone to any organic system, crop rotation becomes increasingly important to address pests such as wireworms and carrot rust fly.

Biodiverse soil

Soils rich in diverse microorganisms, especially nematodes, will help manage many insects in the larval stage. Applying compost is a good method of inoculating soils with nematodes, but nematodes are also commercially available and can be introduced.

Farmscaping

Gardens and farms should not be viewed as distinct from nature, rather, they should be viewed as part of nature. Mimicking nature by allowing for a diversity of species, including weeds, creates niches for beneficial insects such as parasitic wasps (great for maggot management) as well as

creating an alternative food source for pests. Visit www.cog.ca/documents/Farmscaping.pdf for more information.

Cultural practices

Growers have long employed practices that have minimized pest damage and they include:

1) Early cultivation to increase soil temperature and increase soil moisture loss to inhibit wireworm;

2) Delayed planting to miss the first and often most destructive generation of insects;

3) Use of floating row covers to deter adult flies, moths, and beetles from laying their eggs;

4) Use of attractant crops or lures to entice insects away from the cultivated crop;

5) Use of repellent crops to keep insects at bay; and

6) Soil fertility management (i.e. matching nutrient supply to crop demand) to ensure that plants are not exuding excess nutrients which can attract insects.

The big picture: getting to the *root* cause

In viewing the farm as a whole, the over-abundance of a particular insect should be seen as a messenger relaying information about an imbalance within the system and not as the cause of the problem. For example, the carrot rust fly is a scavenger of surplus nutrients. If the fertility within your farm system is out of balance, the rust fly will help you manage it…but with less than desired outcomes.

Here lies the root cause of many of the problems facing farmers and gardeners—how do we create a balanced system? No easy answer, in fact Mother Nature doesn't seem to provide us with clear examples. However, a first step in working towards a balanced system is differentiating between maximizing and optimizing, in terms of productivity. Although the two words are often synonymous, they should be seen as two very distinct paths.

In maximizing productivity, the adage 'by any means necessary' may be applied and higher yields of the desired crop are generated. But at what cost? In maximizing productivity, organic farms or gardens are often weed-free, excessive in nutrients and the farmer or gardener is at the ready with additional inputs to troubleshoot the next collapse within the system.

Alternatively, a strategy based on optimization should be viewed as taking on the motto 'the process is as important as the product,' which arguably will generate a lower-yielding cash crop, but requires less trouble-shooting inputs. The inherent difference between the systems is that an optimizing strategy is based on the integrity of a system as a whole in which synergies are fostered (i.e. weed refugia as a feed source for pests as well as a host for beneficials) and the roles of all actors are valued.

The sequel

Unfortunately, nature is no simple recipe and organic agricultural systems are dynamic. As such, pest infestations will occur when there is, for example, a cool, wet spring, or when the carrots didn't germinate so potatoes were planted in the same spot two years in a row. Flourishing pest populations are a part of nature. However, in an organic system employing an optimizing (rather than maximizing) strategy, the organic systems will be more robust and resilient with the ability to self-correct and self-regulate imbalances.

Further reading

The ACORN Growers' Database has detailed information on pests and organic control methods at www.acornorganic.org/cgi-bin/organopedia/indexdisplay?4.

ATTRA, the U.S. National Sustainable Agriculture Information Site, has on-line fact sheets and brochures about various pests and how to control them organically at http://attra.org/pest.html.

Giving soil a boost

A commercially available soil inoculant to increase beneficial nematode numbers has shown promise (at least anecdotally) in managing root pests. The nematodes *Steinernema carpocapsae* and *Heterorhabditis megidis* may provide moderate control of cabbage root maggot and potatoes, respectively. On the horizon, the fungus *Metarhizum anisopliae* may be another biological control agent against wireworms.

Av Singh, PhD, PAg, is the Organic and Rural Infrastructure Specialist with AgraPoint in Nova Scotia and is available at 902-896-0277 or a.singh@agrapoint.ca. Av is a former board member of Canadian Organic Growers (COG).