VEGE*notes*

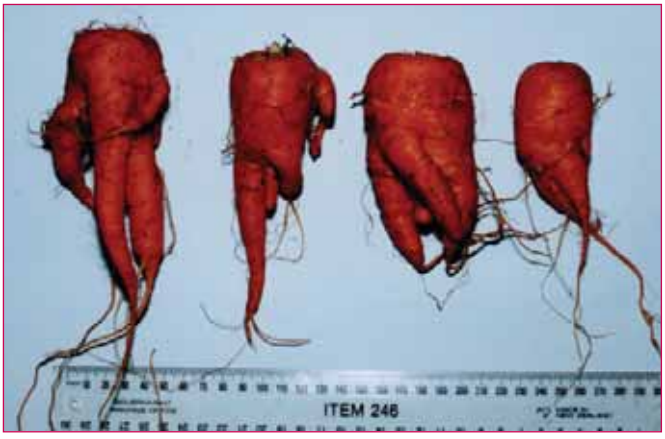
Your levy @ work

Nematode control in carrots

In Australia there are 330,000 tonnes of carrots produced annually, from approximately 7500 ha, with a farm gate value of A$150 M. Some species of plant-parasitic nematodes are a significant constraint to carrot production.

What is a nematode?

Nematodes, or 'eelworms', are small (invisible to the human eye) worm-like organisms that live in soil and feed on plant cells. They have a simple lifecycle; hatching from an egg as a worm-like organism that feeds and moults as it grows to become an egg-laying adult. This process takes about one month, and while most nematode species are important to soil ecology (e.g. feeding on fungi and bacteria), some plant-parasitic species are harmful to vegetable crops.



Nematode feeding can cause distortion of carrot shape including; galling, forking, hairiness, and thumb-like branch roots.

Nematodes harmful to carrots

Root knot nematode (RKN) (*Meloidogyne spp.*) is the most damaging to many crops in Australia. The main species affecting carrots in Australia are *M. javanica*, *M. hapla* and, to a lesser extent, *M. fallax*.

RKN can cause seedling death, stunting of young plants, branching of tap roots and galling in older plants, which reduces quality and yield. RKN is particularly damaging due to its high reproduction rate, which allows populations to build up rapidly.

Lesion nematode (*Pratylenchus spp.*), and other nematodes such as *Hemicyliophora saueri* and *Neodolichodorus australis,* can also cause crop losses when present in high numbers.

Control of nematodes

Nematode control in Australia is heavily reliant on general soil fumigants (e.g. metham sodium, 1,3, dichloropropene (1,3 D) or 1,3 D/chloropicrin mixtures) and non-fumigant nematicides (e.g. fenamiphos). These can be effective when applied according to label recommendations and with proper soil preparation. However, they should be used as part of an integrated program, e.g. along with soil testing. Nematicides should be used judiciously as they tend to be costly, highly toxic and potentially environmentally harmful. Additionaly, continual use of the same chemical can lead to microorganism build-up that can rapidly render them ineffective – a process known as 'enhanced microbial degradation'.

The Bottom line

- **Know your enemy and conduct a soil test.**
- **Sample intensively to get a representative count.**
- **Use nematicides in conjunction with a soil test.**
- **Plan rotations with crops that are poor nematode hosts or with biofumigant crops.**

Soil testing gives an indication of the risk of planting a particular field and the necessity for chemical treatment. Samples are taken with a trowel or soil corer, at an intensity of around 50/ha, to a depth of 20-30 cm across the field. Samples are bulked, gently crumbled, mixed well and 0.5 kg is sent to the laboratory. Samples should be kept cool (10°C) and sent soon after collection; testing relies on nematodes migrating out of soil prior to counting - those that die in transit are not counted! Samples are often collected prior to planting however, a sample taken prior to harvest of the previous crop in the rotation (soil is undisturbed and nematode numbers at their peak) can provide more accurate results. Test results need to be compared with local information on how many nematodes constitute a crop risk (i.e. the damage threshold. Nematode numbers higher than the threshold cause yield losses suffecient to warrant the costs of control).

Root knot on a carrot in WA. Courtesy E. Davison

The RKN threshold is often a single RKN, as soil tests often underestimate nematode numbers and carrots are particularly susceptible to RKN. However, for lesion nematode, the threshold may be 200-400 per 400 ml or grams of soil; thresholds can vary widely between geographical areas. As nematodes often have a patchy distribution, it may be possible to split the field into sections and send a sample from each; increased testing costs may be offset by the need to treat only those sections with high nematode numbers.

Rotations and break crops are best chosen with accurate soil counts of particular nematode species. For example, RKN *M. hapla* and *M. fallax* both cause damage to carrot crops.

Grass or cereal crops are often used to control *M. hapla*, but they can be hosts of *M. fallax*. Consult your local agronomist or Department of Primary Industries on suitable rotation or break crops. Biofumigant brassicas and mustards have been shown to be effective against nematodes if sufficient biomass is grown and incorporated into soil.

Some biofumigants host nematodes, and unless a good kill is obtained following incorporation, nematode populations may increase. Planting biofumigants in autumn and incorporating in early spring, prior to increased soil temperatures and nematode activity, reduces nematode build up under the biofumigant.

Fallow periods of more than six months can reduce populations of some nematodes, but may not reduce numbers below damage thresholds. It is important to maintain a bare fallow, as weeds can act as hosts and allow nematode numbers to increase.

Planting in late autumn or early spring can allow crops to become established when soil temperatures are cool and less conducive to invasion and reproduction of nematodes.

Future

Carrot varieties resistant to RKN are being developed overseas, however it may be some time before they are available. DNA based techniques of quantifying nematodes in soil and identifying specific species are likely to become important. This technology is available to cereal growers and may be available to vegetable growers in the future.

Further Information

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