

## Beet cyst nematode on vegetables

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The beet cyst nematode (*Heterodera schachtii*) can cause considerable yield loss to cruciferous vegetable crops (cabbage, Chinese cabbage, cauliflower, Brussels sprouts, broccoli, turnip, radish and Swede), as well as to beets (red and silver), rhubarb and spinach, by severely damaging the root systems, especially during the summer months. This nematode also infects many common weeds such as wild turnip, shepherd's purse, fat-hen and portulaca.

### Symptoms

Entire fields can be infested, or localised infection can appear as circular or oval areas where plant stand and growth are poor. Over time, the smaller areas of infestation will enlarge and spread.

Beet cyst nematode can infect plants of all ages. Seedling attack can result in severe injury or even plant death. When older plants are attacked, less damage will occur.

Above-ground symptoms consist of reduced stand, poor growth, stunting, yellowing and wilting (Figure 1). An infected crop contains smaller plants of reduced value and quality, since root damage interferes with water and nutrient uptake. Infected plants will compete poorly with weeds.



Figure 1: Effect of beet cyst nematode on growth of cabbage (Robert Ingram, DAFF)

Roots attacked by beet cyst nematode appear "bearded" or "whiskered" due to the excessive development of

fibrous roots. Root vegetables will have smaller storage roots which may have abnormal swellings.

The most evident sign of beet cyst nematode is the appearance of glistening white-yellow bodies about the size of a pin head attached to the fibrous roots (Figure 2). These are the female nematodes, which mature and harden to produce a light-brown to reddish-brown cyst.



Figure 2: Female nematodes erupt from the roots, appearing as pin head sized white-yellow bodies which later harden to produce brown cysts (INRA, National Institute for Agricultural Research, France)

### Life cycle

Each cyst contains several hundred eggs (Figure 3). Combined with sufficient soil moisture, root exudates from growing host plants stimulate hatch of juvenile nematodes. The juveniles are attracted to the roots, infecting near the tips, causing roots to branch profusely. The juveniles feed on the roots and develop into adults. When mature, the males emerge from the roots, while the females remain sedentary. Females become lemon-shaped, protrude from the root surface, and can be seen as small white-yellow dots about the size of a pin head. The female dies and her body (containing many eggs) hardens to form a cyst, which detaches from the roots to remain in the soil.

Development from root penetration to the mature cyst takes about 4-8 weeks, depending on temperature. Optimum temperature for growth and reproduction is 21-27°C. Several cycles may occur during the growth of

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Figure 3: Nematode cysts contain several hundred eggs (Ulrich Zunke, University of Hamburg, Mactode Publications)

the host plant, and greater damage will occur in summer. As many as five generations per season are possible in warmer climates, when plants are re-invaded by freshly hatched juveniles within one growing season.

Cysts can remain viable in the soil for several years, even in the absence of a host plant. Although some eggs will hatch each season, not all eggs in a cyst will hatch at the same time, and hatching can continue over several years.

### Control

Nematodes can be spread in, or introduced by, contaminated soil, crates, tools and machinery. It is also important to ensure that infected seedlings are not planted, as they will suffer severe damage as well as aiding the introduction or spread of nematodes, and re-infecting treated areas.

Nematicides (e.g. Nematicur®) are used for pre-planting soil treatment. However, chemical control is not 100% effective, as the protective nematode cysts can be widely distributed within the soil. Furthermore, these chemicals can be subject to enhanced biodegradation (i.e. development of soil organisms that degrade the nematicide) and become less effective when the same chemical is applied repeatedly. Nematicides are particularly toxic, so need to be used with care, adhering to withholding periods and according to registered usage for each crop.

Nematode populations can increase rapidly under successive host crops, so that an initially low population can increase to high levels by the end of a growing season.

Rotation with a non-host crop (e.g. legumes, corn, cereal, onion, potato) can aid in reducing nematode levels in soil. Three to four years are required, and rotation is more useful in preventing population build-up than in reducing already high populations.

Weeds can provide a reservoir of infection, contributing to build-up and carry-over of nematodes. Fallow also needs to be weed-free to be effective.

Trap cropping involves the growth of a susceptible crop to stimulate hatching and root penetration by juvenile nematodes. The crop must then be destroyed before the nematodes are able to complete a full life cycle within the roots. This can be incorporated with green manuring of suitable crops. Trap cropping is more effective in warmer than in cooler climates.

Planting crops when soil temperatures are lower (and nematodes are less active and reproduce more slowly) can reduce damage. Seedlings are more prone to severe damage than older plants.

AGWEST Plant Laboratories can test soil and/or plant roots for nematodes. To obtain submission forms and full sampling instructions contact (08) 9368 3721 or (08) 9368 3333.