SoilWealth NURTURING CROPS

Integrated Crop Protection PROTECTING CROPS

BEET CYST NEMATODE ON VEGETABLES

(Source: adapted from Vivien Vanstone, Government of WA, Department of Agriculture and Food, Farmnote 153)

Beet cyst nematode (*Heterodera schachtii*) can cause considerable yield loss to cruciferous vegetable crops (such as the brassica crops cabbage, Chinese cabbage, cauliflower, Brussels sprouts, broccoli, turnip, radish and swede), as well as to beets (red and silver), rhubarb and spinach. The nematode severely damages root systems, especially during the summer months. Beet cyst nematode also infects many common weeds such as wild turnip, shepherd's purse, fat-hen and portulaca, where it can survive and infect the next vegetable crop planted.

CONTROL

Control strategy is based on an integrated approach, comprising proper cultivation hygiene, adequate timing of planting, weed control, crop rotation, trap cropping and chemical control. It is important to only use chemical control as a last resort. Chemicals are less and less effective due to enhanced biodegradation and pesticide resistance problems.

Enhanced or accelerated biodegradation (microbial degradation) of pesticides

Commonly describes the phenomenon of significant increase in the rate of degradation of a pesticide in soil following a previous, often repeated application of the same pesticide or another pesticide, usually of similar chemical structure. It is apparently caused by an adaptation of one or more species of microorganism in the soil to metabolise, thus inactivating the pesticide.

Pesticide resistance

Commonly describes the decreased susceptibility of a pest population (e.g. nematodes, insects, fungi or weeds) to a pesticide previously effective at controlling the pest. Pest species develop pesticide resistance via natural selection: the most resistant specimens survive, passing on their acquired resistance traits to their offspring.

Hygiene is important because nematodes spread in (or are introduced by) contaminated soil. Infected soil can be spread by people, crates, tools and machinery. Ensure that infected seedlings are not planted. This is important as they aid the introduction or spread of nematodes, re-infecting treated areas and causing damage. Seedlings are more prone to severe damage than older plants.

Nematode populations increase rapidly under successive host crops (including weeds), 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 help reduce nematode levels in soil. Three to four years of a non-host are required. Rotation is more useful for preventing population build-up than for reducing already high populations.

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

Cover crops must be non-hosts. Many biofumigation crops belong to the brassica family and can therefore harbour nematodes.

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

Plant crops when **soil temperatures** are lower (nematodes are less active and reproduce more slowly) in order to reduce damage.

When using **chemicals** for nematode control, follow the advice of your agronomist and read the label instructions carefully before use. Treat soil prior to planting. However, chemical control is not 100% effective, as protective nematode cysts can be widely distributed within the soil. Furthermore, chemicals can be subject to enhanced biodegradation, becoming less effective when the same chemical or chemicals with the same mode of action are applied repeatedly. There is also a risk of resistance build-up.

Hort Innovation ahr applied horticultural research RMCG

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SYMPTOMS

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 1)**. These are female nematodes, which mature and harden to produce a light-brown to reddish-brown cyst. 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.

Above-ground symptoms consist of reduced stand, poor growth, stunting, yellowing and wilting **(Figure 2)**. An infected crop contains smaller plants of reduced value and quality, since root damage interferes with water and nutrient uptake. Infected plants compete poorly with weeds. Entire fields can be infested, or localised infection can appear as circular or oval areas where plant population density and growth are poor. Over time, the smaller areas of infestation 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 occurs.

Figure 1. Female nematodes erupt from the roots, appearing as pin head sized white-yellow bodies which later harden to produce brown cysts (Bayer Crop Science, UK)

LIFE CYCLE

Each cyst contains several hundred eggs **(header image).** Combined with sufficient soil moisture, root exudates from growing host plants stimulate hatching 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 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.

Figure 2. Effect of beet cyst nematode on growth of cabbage (left) compared to healthy cabbage (right) (Robert Ingram, DAFF)

Header image of nematode cyst containing several hundred eggs (Ulrich Zunke, University of Hamburg,Mactode Publications)