PEST ADVISORY LEAFLET NO. 05

Plant Protection Service
Secretariat of the Pacific Community

Revised 2003

Burrowing and Lesion Nematodes of Banana

The burrowing nematode, *Radopholus similis*, is the most important nematode pest of bananas in the South Pacific. It was first found on banana plants from Fiji in 1891. It probably now occurs in the SPC Region wherever bananas are grown, having been distributed in infested planting material. The disease caused by this nematode is variously known as *Radopholus* root rot, blackhead, toppling disease or decline. (See section on site selection and land preparation for host range of *R. similis*.)

Pratylenchus coffeae and other *Pratylenchus* species (lesion nematodes) cause symptoms in bananas similar to those of *R. similis*. In some areas they can be as damaging. The host range of *P. coffeae* includes over 250 plant species.

Nematodes of lesser importance, but which are also commonly found within the region, include *Meloidogyne* spp. (root-knot nematodes), *Rotylenchulus sp*. and *Helicotylenchus* spp. (spiral nematodes). These are not dealt with in this leaflet, but various methods for controlling burrowing nematodes will also help to control other banana nematodes.

Figure 1: Lesions on banana roots caused by nematodes

LIFE CYCLE

Burrowing nematodes feed and reproduce within living corms and roots. They can also be found in the soil. As they burrow into the roots, the tissues behind their advance become necrotic and this is helped by the invasion of other rot-causing organisms. Eggs are laid in the corms and roots. Approximately two weeks are required for the life cycle to be completed. Female nematodes live two or three months and lay more than 100 eggs each. When roots die the nematodes enter the soil in search of healthy roots. Nematode survival in the soil in the absence of suitable hosts varies considerably, but probably does not exceed one year.

The lesion nematodes also invade and feed on root and corm tissues of bananas. Their life cycle usually takes less than 20 days when temperatures range from 25°C - 30°C. *P. coffeae* has been shown to multiply on bananas and plantains that are resistant or tolerant to attack by *R. similis*.

DISEASE SYMPTOMS AND CROP LOSSES

Nematode activity within the root cortex causes reddish-brown to black, elongated lesions which are readily seen when the roots are split open. Roots eventually blacken and die. Rots may extend 2 cm or more into the corms, causing the condition known as “blackhead”. Attacks by nematodes, combined with the effects of secondary rot organisms, destroy or weaken much of the root system. Infested plants lack vigour and fruiting is poor. Such plants are readily blown over and the roots are exposed.

When burrowing nematodes are controlled, plant density is higher, bunch weight and frequency of fruiting are increased and the need for replanting reduced. Yield increases of 30-60% are often recorded.

CONTROL

An effective and economical nematode pest management programme requires the integration of a range of methods, adjusted to local conditions and continually monitored so that modifications are made as needed. There are also effective methods for controlling nematodes in established plantings, but these are costly and require special safety precautions.

1. Cultural Control

Nematode-free planting material

The use of nematode-free planting material on uninfested land is most important.

Paring or trimming

Select suckers which will weigh at least 3/4 kg after trimming. Trim the corm tissue until all black or discoloured spots have been removed, leaving only clean white tissues. Remove at least one ring of leaves. Wash corms in running water, and allow them to dry before planting. Ensure that no trimmings are taken into the area to be planted. This paring procedure is very simple and should be followed whenever bananas are planted. Experience has shown that paring alone may not give complete nematode control. Therefore, in commercial plantations hot water treatment of the trimmed suckers is recommended.

Hot water treatment

Submerge trimmed suckers for 20-25 minutes in water at 53-54°C. Specially constructed treatment tanks heated with bottled gas may be used. Strict control of temperature and time is essential and careful supervision by agriculture staff is recommended. Under-treating may not kill the nematodes and over-treating may kill the plants. After treatment, spread the suckers on a clean surface to dry and then plant as soon as possible.

Resistant cultivars

Bananas and plantains resistant to *R. similis* such as 'Goldfinger (FHIA-01)' have been developed and are available through the SPC Regional Germplasm Centre. Breeding for resistance to *R. similis* and *P. coffeae* is ongoing in various parts of the world.

Prevention of spread

Because nematodes are readily transported in soil on shoes and tools, care should be taken to ensure that equipment is cleaned before being used on uninfested fields. Movement of animals from infested to uninfested fields should also be minimised. Manure used on fields should be well composted to kill any nematodes present.

Site selection and land preparation

Elimination of *R. similis* and *P. coffeae* from infested fields prior to planting is near to impossible but numbers can be reduced by having a fallow period greater than a year.

Land where bananas are to be planted should be kept free of crops susceptible to the burrowing nematode for at least one year. Crops known or suspected to be hosts for burrowing nematodes include: *Abelmoschus manihot* (bele or aibika); *Cajanus cajan* (pigeon pea); *Colocasia esculenta* (taro); *Dioscorea alata* (yam); *Ipomoea batatas* (sweet potato); *Piper methysticum* (kava); *Saccharum edule* (duruka or pit pit); *S. officinarum* (sugar cane); *Sorghum sudanese* (Sudan grass); *Vigna unguiculata* subspecies *unguiculata* (cowpea); *Zea mays* (maize) and *Zingiber officinale* (ginger).

Crop rotation, cover crops and soil amendments

Crop rotation with non-hosts can be effective for *R. similis* but not necessarily for *P. coffeae* because of its wide host range. Plants useful for rotation are brassicas (canola and mustards), *Crotalaria spectabilis* (crotolaria) and Sudan grass. These can be ploughed into the field where the chemicals released from the decaying plant matter acts as a nematicide.

The planting of selected cover crops, such as *Panicum maximum* var. trichoglume (green panic) or a mixture of this and *Macroptilium atropurpureum* (siratro) has been shown to suppress populations of burrowing and root-knot nematodes and is recommended for the fallow between banana crops.

Marigolds can act as a nematicide. Nematodes are attracted to marigold roots, but are killed once they feed on the living roots. To fully benefit from their effect a cover crop of marigolds should be planted for one season. Planting a few marigolds around will not be effective.

Incorporating chitin-containing materials into the soil, such as crushed shells of crabs and prawns, can reduce nematode levels. There are microorganisms in the soil that feed on chitin and chitin-containing nematode eggs and nematodes. Increasing the chitin levels in the soil increases the numbers of these fungi. Once the crushed shells are used up, the fungi begin to attack the nematodes. Fallow fields kept weed-free for 1 – 2 years can also dramatically reduce the number of nematodes. When land is no longer to be used for banana production the old banana mats should be killed and the stumps removed so that nematodes do not continue to feed and reproduce.

Soil solarisation

For small fields, covering them for 6 – 8 weeks with plastic after tilling and watering raises the soil temperature and sterilises it. If chicken manure or brassica residues are incorporated before sterilisation, this shortens the time necessary to one month.

2. Chemical Control

In recent years a number of non-volatile organophosphate and oxime carbamate nematicides have been evaluated for use on bananas. Of these fenamiphos (Nemacur), ethroprophos (Mocap), and isazophos (Miral) are widely used in commercial plantations in major banana exporting countries. These nematicides are generally available in granular formulations and should be used according to the specific recommendations of the manufacturers as given on the labels. Normal doses are in the region of 1.5-2.5 g active ingredient per plant or 25 g/m^2. Application should be done seven days prior to planting.

Planting material can be treated with a liquid nematicide as follows:
Pare the planting material to remove all dead tissue. Immerse planting material in Nemacur dip solution for 10 minutes. Allow to drain and dry. Wear elbow-length PVC gloves when

dipping and when handling dipped material.

When replanting old banana land or land which was infested with burrowing and lesion nematodes, granular nematicides should be sprinkled in the planting holes. Post-planting applications should be made after 8-12 weeks and subsequently every 4-6 months by sprinkling the granules over an area of approximately 1 m^2 around the young plants.

In established plantings, nematicides can be sprinkled on the soil around the banana mats after clearing away trash and weeds. The granules should be distributed to give protection to the young sucker which has been selected for the next crop.

Applications should be made when rainfall is expected or prior to irrigation. The chemicals are effective only when the active ingredients are carried to the root zones. All nematicides are highly toxic and care must be exercised to avoid direct skin contact and to prevent damage to wildlife. Also they should not be used when domestic animals graze through the plantation.

Hand-held shakers made from containers with holes punched in the lids, and callibrated to the appropriate dosage, are useful applicators. Because of their toxicity, nematicides should only be used by trained persons, and instructions on pesticide labels should be strictly adhered to.

Another nematicide that is now being used effectively to control *R. similis* and other nematodes associated with bananas in several commercial banana growing countries in the South Pacific region is oxamyl (Vydate).

Vydate is systemic and like most nematicides it is highly toxic and should be administered only by trained persons and according to instructions and precautionary measures as specified on the label. Because it is used undiluted in the control of banana nematodes it should be administered at all times using a specially designed spotgun applicator which is supplied free with the chemical. The hose of the spotgun is attached to a specially made lid that should fit safely on to the chemical container making it safer for users. With the spotgun the chemical is shot close to the base of the sucker or pseudostem where it can then be absorbed by the roots and translocated to other parts of the plant. In Australia the rate used is 7.5 – 10ml whilst in South Pacific islands the rate used is 5 ml per sucker or pseudostem per application. This can be repeated at two to three months depending on the nematode status of the field. In cases of heavy infestation the rate can be increased and the application interval shortened. The chemical is most effective when the soil is adequately moist.

Figure 2: Advanced rotting leading to toppling disease caused by nematodes.

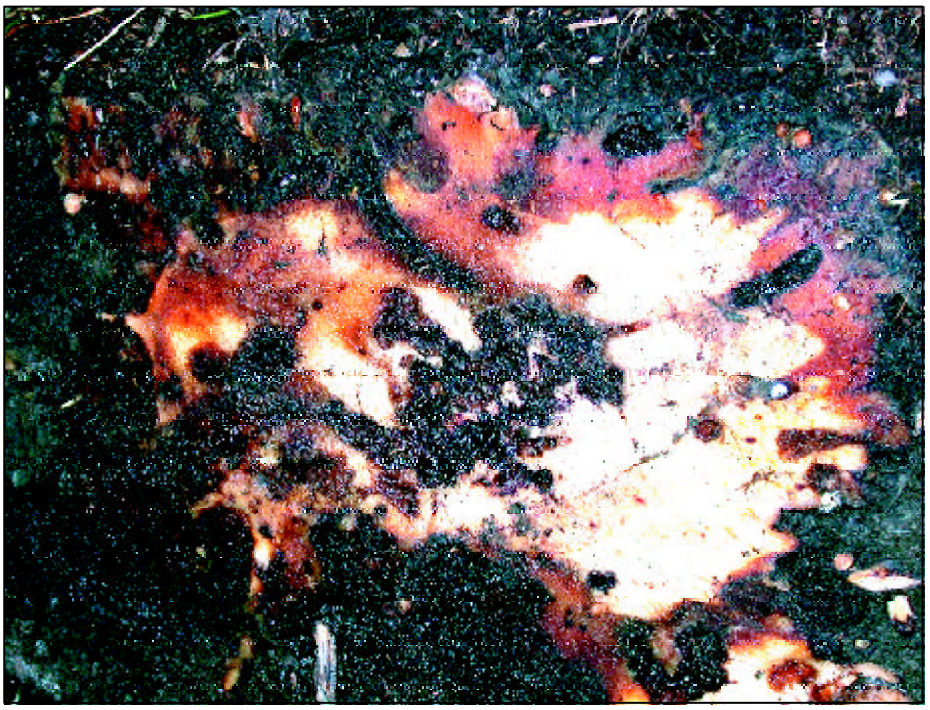

Figure 3: Typical symptoms of nematodes: reddish discolouration at base of banana.

This second edition was written by G.V.H. Jackson, T. K. Ruabete and J.G. Wright. The photographs were supplied by Tony Pattison, Senior Nematologist, QDPI-Centre for West Tropics Agriculture, Australia and J.G. Wright, SPC Plant Pathologist. This leaflet was originally prepared by M.F. Kirby.

Original text: English

Printed with financial assistance from the European Union.

Published by the Secretariat of the Pacific Community. Further copies of this leaflet may be obtained from the Secretariat of the Pacific Community, Plant Protection Service, Private Mail Bag, Suva, Fiji Islands or from our Website, **www.spc.int/pps** or E-mail us at **pps@spc.int**; or from the Secretariat of the Pacific Community, BP D5, 98848 Nouméa Cedex, New Caledonia.

Secretariat of the Pacific Community Cataloguing-in-publication data

Jackson, G.V.H,

Burrowing and lesion nematodes of bananas / by G.V.H. Jackson, T. K Ruabete and J.G. Wright. —2nd edn.

(Pest Advisory Leaflet /Secretariat of Pacific Community; 5)

1. Radopholus similis - Oceania. 2. Pratylenchus – Oceania 3. Nematodes - Oceania

634.772 AACR2
Agdex 231/637
ISBN 982-203-958-1
ISSN 1017-6276