

MONITORING AS A TOOL FOR MANAGING ROOT-KNOT NEMATODE IN VEGETABLE CROPS

Monitoring plays a vital role in managing plant diseases, insect pests and plant-parasitic nematodes. When crops are checked regularly, growers can locate pest or disease infestations and identify areas where control measures are required. This fact sheet focuses on root-knot nematode and explains how monitoring can be used to reduce losses on vegetable crops.

Why is monitoring important?

Root-knot nematode is a serious pest of vegetable crops and the only way to minimise losses is to ensure that the crop is planted into soils where the nematode population density is very low. A range of management practices are available to achieve this but growers can only use them effectively if they know how many nematodes are present in their fields.

Step 1: Diagnosis of nematode damage at harvest

The best way to commence a monitoring program is to check the crop prior to or immediately after harvest. Roots are removed and checked for galling and areas of the field where low, medium, and high levels of galling are observed, or where galling is absent, are recorded. If this is done in a systematic manner, a field map can be produced that indicates areas where the nematode is causing little or no damage and identifies 'hot spots' where control measures may be needed in future.

Once the severity and extent of nematode damage in a particular field is known, management strategies are developed. In fields where no damage is apparent, the previous nematode control program can be maintained. However, if crop losses have occurred, other control options must be considered (e.g. a longer rotation break, a different cover crop, better weed control, or application of a nematicide).



Severe galling on small swollen roots and fine roots of sweetpotato at harvest. Such symptoms indicate that numbers of root-knot nematode in this field are very high and steps must be undertaken to markedly reduce the nematode population before the next crop is planted.

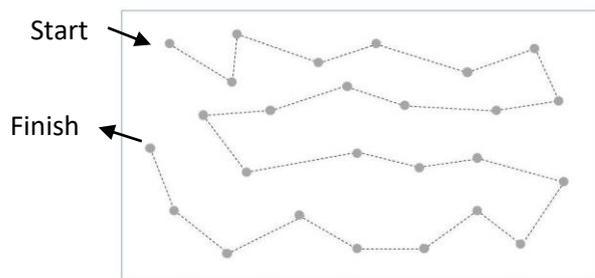
Step 2: Soil sampling

When checking the crop at harvest, a soil sample should be collected to quantify the nematode population, identify the root-knot nematode species, and check whether other plant-parasitic nematodes are present at damaging levels.

Assessing the nematode population prior to planting is even more important because the results can be used to predict the risk of nematode injury to the next crop. Pre-plant tests also indicate the effectiveness of the rotation and other practices used since the previous crop. Species identification is important when crops that are damaged by only one species are being planted (e.g. capsicum, which is only damaged by *M. incognita*), or when checking for newly introduced species such as *M. enterolobii*.

How should soil samples be collected? A cylindrical sampling tube 20-25 mm in diameter is ideal but a spade or auger may be used. The important point is that a representative sample is collected from random points across a field. This can be achieved by walking in a 'W' pattern and collecting a small volume

of soil (a handful, or about 100 mL) at regular intervals to a depth of about 20 cm. Because nematodes are irregularly distributed, soil must be collected from at least 30 sampling points per hectare. The soil is then bulked, mixed carefully, and a 500 g sample sent to a laboratory for analysis.



Where there are differences in soil type or previous cropping history within a field, a separate composite sample should be obtained from each area and tested separately, as nematode numbers may vary markedly in these areas.

As most traditional extraction methods rely on nematodes being active and mobile, care should be taken to ensure that samples are handled with care and not heated to temperatures above 35°C. Samples must be packed carefully so that the soil is not disturbed in transit and should be dispatched to the diagnostic laboratory by express delivery on the day they are collected.

Step 3: Nematode analysis

Nematode populations have traditionally been quantified by extracting nematodes from soil and counting them under a microscope. Some state governments and commercial laboratories offer such a service but it must be done by professionals with the skills required to correctly identify nematodes. The soil nematode community can also be assessed using DNA techniques, but regardless of the extraction and quantification method used, it is important to ensure that samples are forwarded to a laboratory that is capable of reliably detecting very low populations of root-knot nematode.

Step 4: Interpretation of results

There is no simple way to interpret the results of nematode analyses because the number of nematodes that will cause damage is influenced by factors such as soil type, soil moisture content, temperature, and the biological status of the soil. Thus, when growers commence a nematode monitoring program, the results should be interpreted with caution. It may take several years to gain a good understanding of the number of nematodes that will cause damage in the environmental conditions on a particular farm.

Some vegetable crops are very susceptible to root-knot nematode and pre-plant population densities as low as 1 nematode/200 g soil may cause damage in some situations. Consequently, if any root-knot nematodes are detected in a sample, the grower must consider whether it is worthwhile changing to a more tolerant crop, planting a resistant variety, or applying a nematicide. There is always a risk of making the wrong decision, but that risk is lessened if the grower is prepared to set up some field trials and learn from the results. If strips comparing untreated v. nematicide, or a susceptible variety v. a resistant variety are set up in fields where the pre-plant nematode count is known, the grower can use the results to make rational decisions on whether a given number of nematodes are likely to cause economic losses.

One situation that sometimes arises is that root-knot nematode is not detected in a sample. However, extraction methods are never 100% efficient and the damage threshold for crops such as carrot, potato and sweetpotato is very low, and so a zero count should be treated cautiously. A grower can only be confident that the count is zero if the following criteria can be met: 1) root-knot nematode problems have never been observed in the field previously; 2) galls caused by the nematode were not present on the roots of the previous crop; 3) the soil type is not ideally suited to root-knot nematode; 4) the sample was collected in the correct manner and dispatched appropriately; and 5) the laboratory which provided the nematode count has the expertise required to detect very low populations of root-knot nematode.