



AVRDC - The World Vegetable Center

Fact Sheet

Tomato Diseases

Root-Knot Nematode

Meloidogyne incognita, *M. javanica*, and *M. hapla*
(listed in order of importance)

Found worldwide, particularly in warm climates



Symptoms

Nematodes live in the soil and feed on root juices of plants, causing small swellings known as root knots or galls. The female deposits eggs in or on the roots, or in decaying root debris. The juveniles hatch from the eggs and move toward root tips or minor wounds. They feed on root tissue.

All stages of plant growth are attacked. Aboveground symptoms often develop slowly over time and may go unnoticed until plants are well developed. Symptoms consist of stunting, yellowing and a general unthrifty appearance of plants. Infested plants may wilt or die in hot, dry weather.

Belowground, the roots will have obvious galls or knot-like swellings. These swellings prevent movement of water and nutrients to the rest of the plant resulting in stunted plant growth.

Plants affected by root-knot nematodes are more easily infected by soil-borne diseases caused by *Ralstonia solanacearum* (bacterial wilt), *Sclerotium rolfsii* (southern blight) *Fusarium*, *Pythium*, or *Rhizoctonia*. This secondary infection may lead to extensive discoloration of internal stem and root tissue, and rapid plant death.

How to Identify Root-Knot Nematode Damage



Nematodes are microscopic and cannot be seen with the naked eye.



To identify, dig up stunted plants and look for swollen "knots" on roots, which are created by the nematodes.



Conditions for Disease Development

Nematodes have a very wide host range including many crops and weeds. They are found in many soil types but greatest damage occurs in warm, sandy soils.

Nematodes can survive as dormant eggs a few months until environmental conditions are suitable for hatching to occur. They are generally intolerant of flooded soil conditions. The eggs and juveniles survive in intact plant roots and are released into the soil as the plant disintegrates. Nematodes are active throughout the year in warm, moist soils.

Nematodes are spread by using or moving infested soil or by transplanting infested seedlings. Infested soil may also be spread by irrigation water, by running water from one sloped, affected portion of a field to another portion of a field, on farm machinery or implements, and on workers' shoes.

Control

Use resistant varieties. Check with your local extension agent to determine which tomato varieties are suitable for your region since some nematode populations may overcome resistance.

Rotate the tomato crop (susceptible) with other crops such as grasses or brassicas (tolerant), followed by onion (resistant) and then dry fallow during hot, dry weather if possible.

Repeated plowing of the soil at the end of the growing season during hot, dry weather of the fallow period exposes nematodes to desiccation and death. This practice may be sufficient to increase yield of a subsequent susceptible tomato crop.

Do not locate seedbeds where other susceptible crops have been grown. In small vegetable plantings interplanting with French marigold (*Tagetes patula*) or African marigold (*T. erecta*) is very effective in lowering the nematode density in soil.

The fruit, foliage and stems can be composted, but all infested root debris should be removed from the field entirely and burned since composting temperatures are too low to kill all the nematodes in the roots.

Adding organic matter (compost and manures) to the soil will reduce nematode populations. The effectiveness of a soil amendment depends on ammonia production. The amount of ammonia produced varies with the level of nitrogen in the organic amendment. Oil-cakes and animal manures have high nitrogen contents of 2–7% and are the most nematicidal amendments but they must be applied at 4–10 t/ha to be effective.

Solarization for 4 to 8 weeks in small gardens is also possible. It will be most effective when conducted during the hottest season of the year. The soil should be well tilled and moistened to allow for even penetration of heat. Two layers of thin transparent polyethylene tarp should be used to maximize temperatures. The first layer is tightly pressed to the soil and the other is placed slightly above the first. Most plant parasitic nematodes are killed between 44 and 48°C. The depth of penetration with solarization is about 5 to 10 cm. The loss of productive land and loss of economic returns for the treatment period will need to be assessed before solarization measures are implemented.

Nonfumigant chemicals such as carbofuran, oxamyl, and others may be applied as granular or liquid formulations, and incorporated into the top few centimeters of soil. They may be applied scattered, banded in-the-row, placed in-furrow, or strip applied. They are not as effective as fumigants but they are easier to apply, more economical, and less phytotoxic.

Soil fumigants, although effective for the early period of plant growth, are dangerous to use and may not be economical for the small-scale farmer. They require application under certain conditions of soil tillth, soil moisture, and soil temperature. Time for aeration of soil is required between fumigation and planting. A further disadvantage is that all beneficial soil microorganisms are also destroyed.

For more information on the production of tomato and other vegetables, go to <www.avrdc.org>.