

Root-Knot Nematodes & Vegetable Crops

Nematodes are tiny, thread-like eelworms (roundworms). Many are free-living saprophytes found in the soil that live and feed on decaying plant and animal matter. Other soil borne nematodes are plant parasites that can retard plant growth and diminish yields.

Root-knot nematodes are a group of plant parasitic nematodes that feed on roots resulting in the formation of galls or knots on plant roots. Two root-knot nematodes feed on vegetable crop roots in Maryland and are capable of over-wintering in our soils:

Meloidogyne hapla (northern root-knot nematode) produces tiny galls on a wide variety of plants.

Meloidogyne incognita (southern root-knot nematode) produces larger galls and more severe stunting, yellowing and wilting symptoms than *M. hapla*.

Both species are also introduced on vegetable transplants and other imported plant material.

Pest Behavior

A microscope or hand lens is necessary to see most root-knot nematodes. Mature females are about 1/16 inch in size. They damage plants by inserting a thin tube, called a stylet, into roots and sucking sap. This decreases the size and efficiency of root systems. They begin feeding when soil temperature approaches 65° F. Juveniles feed on the outside and inside of susceptible plant roots. Mature females lay hundreds of eggs in a mass on these galls. After hatching, juveniles move a short distance, locate a favorable plant root and begin feeding. Thirty days are required to complete the life cycle, so several generations can develop in one season. Root-knot nematodes can persist in the soil for several years without feeding on host plants.

Common Host Plants

M. hapla: strawberry, bean, cantaloupe, carrot, cucumber, dill, eggplant, endive, escarole, gourd, horseradish, lettuce, mustard, onion, shallot, leek, okra, parsley, parsnip, pea,



Root galls from root-knot nematodes

pepper, potato, pumpkin, radish, rutabaga, and tomato.

M. incognita: bean, cabbage, cantaloupe, carrot, celery, chard, corn, cucumber, eggplant, lettuce, okra, onion, pepper, potato, pumpkin, radish, rhubarb, spinach, squash, sweet potato, tomato, turnip and watermelon.

Symptoms

Symptoms include, stunted growth, leaf yellowing and wilting during the hottest part of the day. Affected plants produce fewer and smaller fruit. Symptoms spread through a site as the season progresses and succeeding generations of juveniles hatch out. Plants rarely die prematurely from nematode feeding unless pest pressure is very high.

Root-knot nematode feeding stimulates the development of abnormally large cells, resulting in gall formation along the roots (1-20mm in size). These galls prevent adequate water and nutrient uptake resulting in stunted, unthrifty plants. Unlike the nitrogen-fixing nodules of legumes, these galls cannot be rubbed off the root. Pinhead-sized females may be seen when galls are sliced open.

Galls may not form on crops such as asparagus, corn and onion. Exaggerated root branching may also be observed.

Russetting, pimpling and distortion of edible roots and tubers (carrots, beets, potatoes, etc.) are signs of feeding by juveniles. Feeding injury also promotes the spread of plant diseases.

Both species thrive in a wide variety of soils in Maryland. Root-knot nematode problems may be more severe in Southern Maryland and on the Eastern Shore because of the large acreage devoted to commercial vegetable production, extensive use of Southern-grown transplants, good overwintering sites and warm, light soils which encourage nematode populations.

Management

1. Select resistant varieties when available.
2. Incorporate organic matter- this helps to introduce invertebrates and microbes that consume and compete against root-knot nematodes.
3. Till infested soil to expose root-knot nematode populations to weather extremes and predators.
4. Good cultural practices (watering, mulching and fertilizing, etc.) so that plants can tolerate some feeding damage.
5. Rotation to oats, grasses or fallow (bare soil for one year) where space permits.
6. Keep weeds to a minimum.
7. Avoid buying vegetable transplants unless they are certified nematode-free.
8. Do not move soil from an infested to a clean part of your garden.
9. Examine the root systems of stunted and wilted plants for gall formation to positively identify the problem. Discard seriously infested plants.
10. Try growing early and late crops in heavily infested soils. Root-knot nematode populations are less active in cooler weather.

11. Test your soil for nematodes if a problem is suspected. UMD no longer has a nematode testing lab, contact Virginia Tech Nematology Lab, <https://www.ppws.vt.edu/extension/nematode-laboratory/index.html> or Rutgers Plant Diagnostic Lab and Nematode Detection Service, <https://njaes.rutgers.edu/plantdiagnosticlab/>

No chemical fumigants or other pesticides are available to control root-knot nematodes. Soil solarization is not effective in Maryland because solar radiation is not sufficiently intense during the summer months. Growing and turning under a dense cover crop of African marigolds, *Tagetes erecta*, can help reduce root-knot nematode populations.

References:

Sardanelli, S, L.R. Krusberg, J.G. Kantzes. 1983. Plant Parasitic Nematodes in Maryland. Fact Sheet 381. Univ. of MD Coop. Ext.

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