

Root-Knot Nematode of Groundnut and Their Management

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In 2010, *Meloidogyne arenaria* (Neal) were found in tomatoes, cucumbers, and eggplants in Turkey. *Meloidogyne hapla* has been observed in the temperate climate regions of Central and Eastern Anatolia in Turkey. While there have been numerous recorded hosts for *Meloidogyne arenaria* and *Meloidogyne hapla* in Turkey, there have been no reports of infestation of pepino by these nematode species. In the Punjab, India, *Meloidogyne spp.* juveniles were present in an average of 47% of soil samples collected from three groundnut-growing districts). Galling on groundnut due to *Meloidogyne spp.* was noted in 31% of locations sampled.



Groundnut root

Economic Importance

Yield suppression by plant nematodes is difficult to estimate because damage is seldom confined to a single nematode.

Also, damage caused by low to moderate densities of plant nematodes often goes unnoticed. Where damaging levels of *Meloidogyne arenaria* or *Meloidogyne javanica* occur, more than 50% of yield potential can be lost. Even 100% losses have been observed in sections of severely infested fields; however, because of the uneven distribution of plant nematodes, losses over large fields may average less than 50%.

Classification

Domain: Eukaryota
 Kingdom: Animalia
 Phylum: Nematoda
 Class: Secernentea
 Order: Tylenchida
 Family: Heteroderidae
 Genus: *Meloidogyne*
 Species: *arenaria*

Biological races

- Among the root knot nematode species that infect groundnut, there are two races reported for *Meloidogyne arenaria* and four proposed for *Meloidogyne javanica*.
- The two races of *Meloidogyne arenaria*, race 1 infects groundnut and race 2 does not; whereas, of the four proposed races of *Meloidogyne javanica*, races 3 and 4 infect groundnut, races 2 and 4 infect pepper, and race 1 infects neither.

Meloidogyne infection

- The J2 stage of Meloidogyne nematodes infects pegs and pods, causing minimal damage to root tips unless there is a high concentration in a specific area.
- *Meloidogyne arenaria* can infect groundnut roots just one day after plant inoculation.
- The feeding of the juveniles on vascular cells leads to the development of large, multinucleate giant cells within eight days.
- This process triggers hyperplasia in adjacent tissue, resulting in the disorganization of vascular tissue and the formation of galled tissue.
- The parenchymatous cells surrounding the developing juveniles in the stele multiply and extend into the cortex, causing damage to adjacent cortical cells.
- Severely galled roots experience reduced elongation, leading to a stunted root system.
- One consequence of root knot nematode development and giant cell formation is the deformation of xylem elements and the inhibition of secondary growth in xylem and phloem tissues.
- Infected roots struggle to efficiently absorb nutrients and water.
- Infected roots of groundnut are observed in the given figure.

Symptoms of damage

- Root knot nematodes on groundnut can show noticeable symptoms both above and below the ground, with the earliest signs appearing around 45-75 days after planting.
- The most severe symptoms tend to manifest after 90-120 days.
- The above-ground symptoms of this disease can range from subtle to highly conspicuous, particularly as the crop approaches maturity.
- The intensity of these symptoms is influenced by the growing conditions and the population density of root knot nematode juveniles present at the time of planting.
- In certain instances, young plants may experience significant stunting.
- The overall characteristics of diseased groundnut plants resemble those of other plants affected by these nematodes.
- As the crop nears maturity, heavily infected plants may exhibit severe stunting, along with symptoms such as chlorosis, wilting, nutrient deficiencies, or even death under hot and dry conditions.
- The symptoms are typically distributed in patches of varying sizes, and infected plants often display a rusty, yellowish, and mottled appearance.
- Sandy areas within a field often show the most severe symptoms.

Survival and dissemination

- Females are spherical, measuring around the size (800 μm in length \times 500 μm in width), with a pearly white coloration.
- They possess sharp pointed necks and heads that are usually visible on one side.
- Each female typically extrudes an egg mass from the vulva end, near the root surface. This placement of the egg mass on the exterior surface of the galled tissue aids in both egg hatching and the subsequent infection of roots by the newly hatched juveniles.
- The egg masses are approximately 1 mm wide, appearing as brownish masses that adhere to the galled tissue and can contain anywhere from 300 to 500 eggs each.
- It is noteworthy that wind and water significantly contribute to the dispersal of nematodes.
- Although plant nematodes can be spread through the displacement of freshly dug pegs, pods, or roots, their developmental stages typically do not survive in these plant parts once they have thoroughly dried.

Management

- Reducing the potential for damage can be achieved by destroying the roots of host crops.
- Drying soils after they have been turned can potentially decrease the presence of plant nematodes.
- Another effective method is practicing clean fallowing for extended periods of time.
- It has been observed that growers who employ adequate organic fertilizers, encounter fewer issues with root knot nematodes.
- Root knot nematode was less severe in irrigated fields compared to non-irrigated ones.
- Crop rotation is a highly efficient management strategy that involves utilizing plants that are both non-hosts like cotton, maize, small grains, and pasture.
- *Pasteuria penetrans*, a bacterial endospore-forming obligate parasite of root knot nematodes has been reported as a suppressive agent for *Meloidogyne arenaria* in groundnut fields.
- Application of DD-100 @225 litres/ha at least one month before sowing or use of Nemagone-60 @ 34 lit/ha in irrigation water in standing crop also controls the nematode.
- Soil application of granular pesticide carbofuran 3G @ one kg a.i/ha is recommended to groundnut crop under field condition.
- Non-fumigant nematicides- Carbofuran, Ethoprop, Fenamiphos, and Oxamyl.
- Seed dressing with aldicarb sulfone or carbosulfan @ 2-3% w/w.