

Nematode problems in millets and their management

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Millets are important warm weather cereal crops. There is not much information available on nematodes of most of the millets crops except sorghum and pearl millet classified as minor millets. These minor millets are cultivated for grain and fodder essentially as dry land crops. In India, millets rank fourth after rice, wheat and maize.

Nematode pest of sorghum :

Sorghum (*Sorghum bicolor*) is an economically important food and useful forage crop of rain fed agriculture. A number of plant parasitic nematodes have been reported to be associated with this crop. The species of *Meloidogyne* (root-knot), *Pratylenchus* (Lesion nematode), *Tylenchorhynchus* (stunt nematode) and *Heterodera sorghi* (sorghum cyst nematode) are considered most important.

Root-knot nematode (*Meloidogyne* spp):

Root-knot is an important nematode disease and is reported to be associated with poor growth of the sorghum crop, *M. incognita* is the most commonly encountered species in India. The field observations indicated that the nematode causes chlorosis and stunting of infected plants. The infestations by *M. incognita* result in production of elongated swellings and root proliferations.

Lesion nematode (*Pratylenchus* spp):

Pratylenchus zae and *P. hexincisus* are the two most important species of lesion nematodes. *P. zae* is considered economically important to sorghum crop in tropical region of the world. The infested plants show stunting and leaf chlorosis in heavily infested fields with lesion nematodes. The infested roots exhibit brown necrotic lesions.

Stunt nematode (*Tylenchorhynchus* spp):

Several species of stunt nematode have been associated with poor and unthrifty growth of sorghum

crops. Though several species of this nematode have been recorded from various regions of the world, *T. vulgaris* occurs most frequently in sorghum fields in India.

Sorghum cyst nematode (*Heterodera sorghi*):

This nematode appears to be potentially important for cereals and millets grown in *Kharif* and *Rabi* seasons and presents a great possibility of its ability to survive and cause yield losses *Heterodera gambiensis* is the only other species of cyst nematode found associated with sorghum crop. The other nematodes found associated with sorghum are *Helicotylenchus dihystra*, *Hoplolaimus indicus*, *Longidorus africans*, *Paratrichodorus* spp. and *Paratrophurus* spp. but their role in limiting production of this crop is not known.

Nematodes of pearl millets :

A number of plant parasitic nematode species have been recorded from the rhizosphere of this crops. In North-western regions of India especially Gujarat, the root-knot nematode, *Meloidogyne incognita* has been considered to cause field problem where it occurs in a combined association with a fungus, *Sclerospora graminicola*. When both the organisms (fungus + nematode) interacted synergistically and increase the disease severity by 83 to 96% and reduced the plant growth Pearl millet is also reported to be most favourable host for multiplication of *Tylenchorhynchus vulgaris*. A report from the southern part of India also suggests that the reniform nematode, *Rotylenchus reniformis* may be a problem on pearl millets

The other nematodes associated with pearl millet crop in India as well as in other countries are *Belonolaimus longicaudatus*, *Criconemella ornate*, *Helicotylenchus* spp., *Hoplolaimus* spp., *Paratrichodorus minor* and *Trichodorus* spp. but have little importance for their role in cultivation of pearl millet.

Nematodes of Ragi (Finger millet):

The occurrence of cyst forming nematode, *Heterodera delvi* from finger or African tall millet (*Eleusine coracana*) was for the first time reported from Karnatak by Jayarajpuri *et al.* (1979). The main symptoms of the cysts are the stunting of plants and

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yellowing of leaves in patches. The affected plants show unthrift growth even under optimum conditions of moisture and nutrition and can easily be pulled out. The cysts embedded or attached to the roots of the affected plants can be seen by naked eye. The reniform nematode, *Rotylenchulus reniformis* is also reported to be a problematic nematode in the ragi fields of some of the areas of Southern India. Increased populations of this nematode has positive correlations with the reduction in plant height, top weight, root weight and yield. In addition to *Heterodera* and *Rotylenchulus*.

Nematodes of Kodo millets:

Although not many nematodes are known on kodo millet, *Meloidogyne incognita* (Kofoid and White) Chitwood has been reported from Aligarh as new host and *Tylenchorhynchus vulgaris* was reported on kodo being a good new host.

Nematodes of little millets :

Nematodes are not major problems on little millets. However, *Meloidogyne incognita* (root-knot nematode), *Tylenchorhynchus vulgaris*, *Heterodera delvi* (ragi cyst nematode) and *Helicotylenchus abunaamai* (spiral nematode) have been reported by different workers to occur on little millet also.

Nematodes of proso millet :

The nematodes was identified as *Aphelenchoides besseyi* by Gokte *et al.* (1992) from New Delhi.

Management Strategies:

Chemical approaches :

Pre-sowing soil application of Phenamiphos resulted in higher reduction of cyst production than other chemicals. The carbosulfan seed treatment accompanied with carbosulfan foliar spray resulted in additional control of the nematode. The potential of carbosulfan seed treatment proved to be very effective approach in reducing the total requirement as also the cost of the chemicals against *Heterodera zea* on maize.

Other non-chemical approaches like crop rotation and nematode resistant cultivars which have been proved to be quite effective under experimental conditions.

A combination of different approaches including organic amendments and bio-control agents may be useful for developing the integrated management schedule for this, *Heterodera zea* nematode.

Cultural practices :

There is a good scope for adopting crop rotation as control measure for different nematodes. In case of host specific nematode, *Heterodera zea*, monoculturing of the same crop should be avoided. Two years rotation with non-host crops can be fruitful as it would bring down the nematode population below economic threshold limits. Summer ploughing and keeping the fields free from weeds can also help in checking the survival and perpetuation of nematodes in off-season. Two to three deep ploughing during April/ May month in hot summer would also reduce the nematode populations to a considerable extent.

Resistance/ Tolerance :

The use of nematode resistant and tolerant cultivars are most effective and economical management approach.

Soil amendments :

The use of oil-cakes and other organic soil amendments have also been proved effective in managing the population of most of the nematodes. Field trials using various soil organic amendments have clearly indicated that combination of mustard-cake and tobacco dust @2.5q/ha a good practice adopted by farming of the country is as efficient as carbofuran soil treatment @2.0kg ai/ha in terms of increased crop yield and containment of the nematode populations.

Biocontrol agents :

It is effective to some extent. The real potentialities is still to be exploited and explored for the management of nematode.

Environmental factor:

Temperature, soil type, moisture and tillage operations are important environmental factors which greatly affect the development and reproduction of nematode species as well as disease development.

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