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IMPACT OF ORGANIC AND INORGANIC MANAGEMENT AND PLANT-BASED PRODUCTS ON PLANT-PARASITIC AND MICROBIVOROUS NEMATODE COMMUNITIES

by
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Summary. Application of poultry and cattle manures, inorganic fertilizer in the form of urea and a neem-based urea-coating agent 'Nimin' and a biopesticide 'Suneem G' significantly reduced populations of *Meloidogyne incognita* and other plant-parasitic nematodes and their symptoms on the plant and increased the populations of microbivorous nematodes. Enhanced growth of tomato in treated soil was directly correlated with the suppression of plant-parasitic nematode populations. Higher dosages resulted in greater effects.

Application of organic matter to the soil is known to have beneficial effects on soil nutrients, soil physical conditions, soil biological activity and crop performance (Kang *et al.*, 1981; Wade and Sanchez, 1983). In addition, these materials have also been investigated as an alternative method of nematode management (Akhtar and Mahmood, 1994, 1996). It has been reported that applications of appropriate concentrations of 'Nimin' (a neem-based urea-coating material) with urea can promote crop yield as well as reduce the number of nematodes (Akhtar and Alam, 1993). Nimin contains azadirachtin a neem triterpene that acts by delaying the rapid transformation of ammonium nitrogen into nitrate nitrogen (nitrification inhibitor). This ensures slow and continuous availability of nitrogen during the growth of plants. In the present study, nitrogen fertilizer (urea), a neem-based industrial product ('Suneem' G-Sunida Exports, Bombay, India), a urea-coating agent ('Nimin' - Godrej Agrovet Ltd., Bombay, India) and cattle and poultry manures were assessed for their effect on plant-parasitic and microbivorous nematode communities. Suneem G and Nimin are neem (*Azadirachta indica* A. Juss.) - based commercial products containing neem-triterpenes.

Materials and methods

At Aligarh Muslim University Experimental Station, a field heavily infested with microbivorous and plant-parasitic nematodes (Viz., *Meloidogyne* sp., *Hoplolaimus* sp., *Helicotylenchus* sp., *Rotylenchulus* sp., *Tylenchorhynchus* sp.), was divided into plots measuring 10 m^2, separated from each other by a 0.5 m strip. Plots were treated separately with cattle manure, poultry manure (both plus urea at 110 kg N/ha), Suneem G (granules) at 5 kg/ha and Nimin (emulsion) at 1 kg/100 kg urea (Urea-Nimin-coating). Additional treatments included doubling and tripling the above rate of the soil amendments.

The field was tilled before the application of the treatments. After application of the treat-

ments the plots were planted with two-week-old seedlings of tomato (*Lycopersicon esculentum* Mill.) cv. Pusa Ruby. The manures were applied two weeks earlier than the other treatments to allow for their decomposition. The experiment was a randomized complete block design with five replications of each treatment, including the untreated (control) plots. The plots were weeded and watered as required.

Three months after transplanting, the tomato plants were harvested and heights and fresh (excluding fruit weights) and dry weights were recorded. Dry weights were determined by placing the plants in an oven for one day at 60 °C.

Soil was sampled with a corer (2 cm diameter) to a depth of 15-20 cm. A core was taken from the rhizosphere of each plant in each plot replicate. Samples consisted of 32-40 cores per plot, which were bulked to provide five samples per treatment. Soil samples were taken immediately before the application of the treatments and one day after harvesting the tomato plants. Nematodes were extracted from 100 g soil subsamples for each replicate, using a modified Baermann funnel technique. Nematodes were counted and identified in each sample. Root-galls caused by root-knot nematode *Meloidogyne incognita* (Kofoid *et* White) Chitw. were rated on the scale 0-5 (Sasser *et al.*, 1984).

Results and discussion

All of the treatments significantly decreased the population densities of plant-parasitic nematodes (Table I). Compared to the controls, the community of microbivorous nematodes increased in soil treated with cattle and poultry manures but not in Suneem G or Nimin treatments. Increasing doses of applications resulted in greater effects. As a consequence of the reduction in the numbers of plant-parasitic nematodes and the manurial effects of the soil amendments, plant growth was improved compared with the control (Table I).

Urea appeared to be a good nematicide when applied at rate of 300 kg N/ha, but caused some phytotoxicity. However, at 110 kg N/ha, it was still significantly effective in reducing the plant-parasitic nematode population. The high rate of nitrogen content, which perhaps caused phytotoxicity, can be obviated by the addition of fertilizer with adequate carbon content, such as organic materials, to the soil. Our findings indicate that there was a direct relation between the amount of N in organic amendments and their effectiveness as nematicides. Urea was both an effective fertilizer and nematicide.

Nematode populations were significantly reduced by the application of urea-coated with Nimin. Since Nimin is a triterpene rich material it sould have some anthelminthic properties, besides this, ureas is a major source of nitrogenous fertilizer in India. It has been estimated that out of total quantities of urea applied to crops about 50-70% is lost in various ways thereby reducing the availability of nitrogen to crops. The recommended dose of Nimin-coating on urea to prevent loss of nitrogen by leaching, is 500 g of Nimin/50 kg urea, which is additionally beneficial for the control of plant-parasitic nematodes. 'Suneem G', another neem-based product, was also effective against plant-parasitic nematodes, due to the presence of neem-triterpene.

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TABLE I - *Effect of soil amendments on nematode populations and tomato plant growth.*

Amendment	Dose per ha	No. of micro-bivorous nematodes per 100 g soil	No. of plant-parasitic nematodes per 100 g soil	Root-knot index (0-5)	Plant height (cm)	Dry shoot weight (g)	Fresh shoot weight (g)
Initial population		515	4541				
Cattle manure	110 kg N	2335	2214	2.5	45.0	10.5	51.3
	220 kg N	3040	1950	2.2	50.3	12.7	56.3
	330 kg N	3890	1450	2.0	54.0	13.6	60.3
Poultry manure	110 kg N	2135	2850	2.5	45.9	10.7	52.0
	220 kg N	2830	1780	2.1	51.9	12.9	58.7
	330 kg N	3355	1150	1.9	57.2	12.9	58.7
Urea	110 kg N	1050	2630	2.4	44.1	9.9	48.4
	220 kg N	1540	2040	1.9	48.4	10.1	51.4
	330 kg N	1890	1550	1.7	51.5	12.3	60.3
Nimin-coated urea*	5 kg	850	1740	2.1	45.9	10.0	50.7
	10 kg	1440	1250	1.9	49.2	11.7	67.7
	15 kg	2340	1040	1.5	56.4	13.3	75.1
Suneem G	5 kg	810	1540	1.6	54.3	12.0	60.8
	10 kg	1150	1012	1.5	56.4	14.8	71.3
	15 kg	1470	840	1.4	60.2	15.7	76.7
Suneem G + Urea*	5 kg	900	1240	1.2	60.2	13.5	65.4
	10 kg	1540	910	1.2	65.9	14.7	74.0
	15 kg	2210	516	1.0	71.4	16.1	80.5
Untreated (control)	–	750	10445	4.0	14.6	3.4	15.5
LSD (P = 0.05)		259	248		3.95	3.23	4.52

* Urea added at 110, 220 and 330 kg N/ha respectively.

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