NEMATODE POPULATIONS AND SHORT-TERM TOMATO GROWTH IN RESPONSE TO NEEM-BASED PRODUCTS AND OTHER SOIL AMENDMENTS

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RESUMEN

Akhtar, M. y I. Mahmood. 1994. Poblaciones de nematodos y crecimiento de tomate en suelos enmendados con compostas de estiercol vacuno, urea, sulfato de amonio y productos a base de neem. Nematrópica 24:169-173.

La incorporción de compostas a base de estiérol bovino, urea, sulfato de amonio y los productos a base de neem "Achook" y el "Nimin" recubierto de urea a suelos agrícolas, resultaron en mayor aumento de nematodos de vida libre y menor aumento de los fitoparásitos, aunado a un mejor crecimiento del tomate (*Lycopersicon esculentum* Mill.). Todos los tratamientos significativamente redujeron el número de nematodos fitoparasitos; pero los tratamientos con Achook y Nimin recubierto de urea fueron los que produjeron las mayores reducciones. Los pesos secos y humedos del follaje fueron inducidos en todos los tratamientos.

Palabras clave: estiércol de bovino, biopesticida, fertilizador inorgánico, neem, nematodos fitoparásitos, urea.

Soil amendment with organic waste materials has been recognized as a means to suppress plant-parasitic nematode populations (2,4,12,19). Use of organic wastes can improve the physical, chemical, and microbial characteristics of soil and increase crop yield (13,14,20). Free-living nematodes accelerate the decomposition of organic soil amendments (1) and increase the mineralization of nitrogen and phosphorus (9). Following the addition of organic and inorganic fertilizers to soil, populations of microbivorous nematodes can increase rapidly (6,11), and densities of plant-parasitic nematodes may decline (7,10,21). Rodriguez-Kabana *et al.* (17) concluded that the efficacy of organic additives depends on their chemical composition and the type of micro-organisms which develop during degradation. Free-living nematodes directly increase amounts of nitrate-nitrogen in soil and thus have an important role in decomposition of organic matter and recycling of plant nutrients (9). Organic amendments may thus supply plant nutrients which result in crop-yield improvement. The objective of this experiment was to evaluate the effect of composted cattle manure, urea, ammonium sulfate and two neem-based products on tomato growth and populations of free-living and plant-parasitic nematodes.

An experiment was conducted in a field that had been under cultivation for several years. The soil was a sandy loam with a pH of 8.3 and organic matter less than 1.0%. The field was divided into 80 plots (2 × 3 m) separated by 0.5 m wide alleys. The field was disced twice before addition of the soil amendments.

Plots were treated separately with composted cattle manure (110 kg N/ha), urea (110 kg N/ha), ammonium sulfate (110 kg N/ha), Achook® (5 kg/110 kg N urea/ha) or Nimin® (1 kg/110 kg N urea/ha) (Achook® and Nimin® are neem-based products of Godrej Agrovet Ltd., Bombay, India). Achook is a neem-based biopesticide containing 2800 ppm neem compounds including azadirachtin, azadiradione, nimbicinol, and epinimbocinol. Nimin is an urea-coating agent containing "neem triterpenes", which helps to improve the efficiency of N fertilizer utilization by the crop (3). Additional treatments included doubling and tripling the above rate of the soil amendments. Untreated plots were included and did not receive soil amendments or fertilizer. All treatments were applied immediately before transplanting except the composted cattle manure treatment which was added 2 weeks prior to transplanting 15-day-old seedlings of 'Pusa Ruby' tomato (*Lycopersicon esculentum* Mill.). Forty seedlings were transplanted into each plot. The experimental design was a randomized complete block with 5 replications of each treatment including untreated plots.

Proper care, weeding, and watering were performed as needed. Ninety days after transplanting, tomato plants were harvested and fresh and dry foliar weights and heights were recorded. Dry weights were determined by placing the plants in an oven for three hours at 60°C.

Soil samples consisting of 16-20 cores were collected 3 days before treatment and the next day after harvest to 20-25 cm deep from the center of each plot using a standard 2.5-cm-diam cylindrical probe. Cores were composited and a 100-cm^3 aliquant was used for nematode extraction. Populations of free-living and plant-parasitic nematodes were extracted from the soil by Cobb's sieving and decanting method followed by the Baermann funnel technique (8).

Free-living and plant-parasitic nematodes (*Meloidogyne incognita* (Kofoid & White) Chitwood, *Hoplolaimus indicus* Sher, *Helicotylenchus indicus* Siddiqi, *Rotylenchulus reniformis* Lindford and Oliveira, *Tylenchus filiformis* (Bastion) were counted separately. Root-galling by *Meloidogyne incognita* was rated on the 0-5 scale of Sasser *et al.* (18). Fisher's least significant differences (FLSD) were calculated ($P \leq 0.05$) on all data collected.

The addition of composted manure, urea, or ammonium sulfate significantly reduced the total number of plant-parasitic nematodes, reduced root-galling on tomato and increased numbers of free-living nematodes (Table 1). However, the greatest reduction in plant-parasitic nematode population and lowest development of root galling was observed with the Achook treatment followed by Nimin treatment, while composted manure was found to be the least effective. Populations of free-living nematodes were most stimulated by the incorporation of ammonium sulfate, followed by Nimin®, composted manure, and urea alone. Increased doses of the treatments were found effective in further reducing the populations of plant-parasitic nematodes. All treatments resulted in increased dry and fresh weights (excluding fruit weights) and height of tomato plants over the nontreated control. Foliar weight of plants treated with Achook was increased three-fold over the control. Plant height was generally similar to plant weight, but treatment effects were less evident.

Anderson *et al.* (5) showed a positive correlation between nitrogen mineralization and activity of free-living nematodes. Opperman *et al.* (15) also noted that ammonia nitrogen concentrations were enhanced immediately after the addition of cattle manure and resulted in a synchronous increase in bacterivorous nematode populations. Inorganic fertilizers containing ammonia nitrogen or formulations releasing this form of nitrogen in the soil can suppress nematode populations (16). In this study, urea was effective in suppressing the plant-parasitic nematodes when applied at 110 kg N/ha. The neem-based

Table 1. Effect of soil amendments on nematode numbers, root-galling, and shoot weight and height of tomato plants treated with soil amendments.[x]

Soil amendment	Rate	No. of free-living nematodes[y]	No. of plant-parasitic nematodes[y]	Root galling[y]	Dry shoot weight (g)	Fresh shoot weight (g)	Plant height (cm)
Composted cattle manure	1X[z]	1260	870	2.2	13.5	65.5	80.8
	2X	1980	682	1.8	15.3	70.2	84.6
	3X	2120	470	1.0	16.7	77.7	89.5
Urea	1X	950	782	2.8	12.4	60.3	77.6
	2X	1135	580	2.0	13.3	65.7	82.0
	3X	1450	392	1.6	14.5	71.4	86.6
Ammonium sulfate	1X	1796	816	2.5	14.3	70.0	64.0
	2X	1970	677	1.8	15.2	76.0	70.7
	3X	2175	409	1.3	16.1	80.1	74.1
Achook®	1X	680	412	1.0	16.7	80.0	90.6
	2X	900	318	0.8	17.2	87.7	96.4
	3X	1020	200	0.3	18.4	90.4	100.7
Nimin® coated Urea	1X	1780	512	1.3	15.6	75.0	86.2
	2X	2012	400	1.0	16.7	80.4	89.4
	3X	2210	280	.08	17.8	84.3	94.6
Untreated (control)	–	760	2570	3.0	9.8	28.4	55.6
FLSD ($P \leq 0.05$)	–	178	98	0.1	3.8	2.8	4.2

[x]Data are a mean of five replicates.

[y]Nematodes were extracted from 100 cm^3 soil; root-galling was rated on a scale of 0-5.

[z]1X = single strength composted cattle manure, urea, or ammonium sulfate at 110 kg N/ha and Achook at 5 kg/110 kg urea N/ha and Nimin at 1 kg/100 kg urea N/ha; 2X = double strength, 3X = triple strength.

products Achook and Nimin were effective under the conditions of this test. Akhtar and Alam (2,3) also observed that neem oil cakes, leaves and oil were effective in reducing plant-parasitic nematode populations. Further work on efficacy and economics, however, will be needed on these products.

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