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Control of Root-knot Nematode *Meloidogyne incognita* in Tomato Plants by Seed Coating with Suneem and Neem Oil

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INTRODUCTION

Chemical nematicides, though instantaneous and effective, are now being reappraised in respect of environmental hazard, costs and unavailability in many developing countries. Research is now focused on alternative management strategies including organic soil amendments.¹⁻³⁾ A number of plants (their residues and byproducts) have been successfully used as nematode suppressants.⁴⁾ However, in some situations they pose application problems because bulk quantities are required for satisfactory control.

Recently, bare-root dip treatment in neem and castor oils was also found to be effective in reducing populations of plant-parasitic nematodes.⁵⁾ Management strategies may be augmented with plant-based products used as seed treatments. Considerable work has been carried out to show that neem (*Azadirachta indica* A. JUSS.) effectively suppresses populations of some plant-parasitic nematodes.²⁾ An attempt was undertaken to evaluate the nematocidal properties of a neem-based product, applied as seed treatment, against root-knot nematode *Meloidogyne incognita* (Kofoid and White) Chitwood.

MATERIALS AND METHODS

Five milliliters of Suneem (azadirachtin 80% a.i., Sunida Exports, Bombay, India), a water based emulsion, was diluted with distilled water to give different concentrations ($\times 2$, $\times 10$ and $\times 100$). Neem oil samples were prepared as follows. Five milliliters of neem oil was suspended in distilled water. After thorough-mixing, this was centrifuged, and filtrate was used as seed-coating. Seeds of nematode-susceptible tomato (*Lycopersicon esculentum* MILL.) cultivar 'Pusa Ruby,' were thoroughly dipped into the different concentrations for 15, 30 and 60 min. To give a uniform coating, the treated seeds were spread in an enamel tray and allowed to dry at $25 \pm 3^\circ\text{C}$ for 1 hr before sowing. Treated and untreated (control) seeds were sown separately in sterilized pot soil. Three-week-old seedlings of tomato were transplanted singly to 15-cm-diameter-earthenware pots containing 1 kg sterilized soil-manure mixture. Proper care, watering and weeding

were performed as needed. All the plants were inoculated with 2000 freshly hatched second-stage juveniles of root-knot nematode with five replications of each treatment in a glass-house at 30°C . Two months after inoculation plants were uprooted and carefully washed. Weights and heights of plants and number of galls per root system were recorded. The number of second-stage juveniles per 100 g soil was determined by Cobb's sieving and decanting techniques⁶⁾ with five replications.

RESULTS AND DISCUSSION

The results presented in Tables 1 and 2 indicate that root-knot development and numbers of juveniles significantly reduced in the plants treated Suneem and neem oil. All treatments with Suneem were not toxic to the seeds of tomato. The efficacy of treatment varied with different dilutions and exposure periods. The severity of nematode infection was relatively less in Suneem than neem oil.

The seed treatments of nematode-susceptible tomato plants (Table 1 and 2) produced striking positive plant growth responses. Improvements in plant weight and height were correlated to reductions in nematode infestations. The dilution $\times 1$ and $\times 2$ of Suneem gave almost two fold increase in fresh weight and length of shoots over the untreated control. The highest concentration of neem oil ($\times 1$) appeared to be slightly phytotoxic at the early growth stages and at seed germination. Other concentrations and exposure periods also resulted in a comparatively higher growth compared with the untreated control. This type of negative impact of neem oil restricts the possibility of its use.

The results indicate that the triterpenoids-azadirachtin which is present in the neem product had been absorbed by tomato seeds. The results confirm earlier findings⁷⁾ for bare-root dip treatment with neem oil and 'Nimin' for the control of plant-parasitic nematodes. 'Nimin' is neem based product contained neem-triterpenes and is recommended for ureacoating agent to compensate the loss of nitrogen by leaching.

Nematode development may have been affected by the leaching of azadirachtin coating the seeds into rhizosphere during the germination of seeds⁸⁾ and this repelled or killed the juveniles that attacked the roots. However, the mechanism by which nematode pests are controlled when seeds are coated with nematicide and plant based products is not yet to be fully explored. There is thus a need to evaluate the exact mechanisms involved in nematode control. The interesting results obtained here are recommended to farmers for incorporation of it into integrated pest management strategies for controlling nematodes.

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Table 1 Effect of seed-coating with Suneem on the growth of tomato and on the root-knot development caused by *Meloidogyne incognita*.

Concentration	Exposure period (min)	No. of gall/root system	No. of J ₂ ^{a)} /100 g soil	Plant growth					
				Weight (g)			Height (cm)		
				Shoot	Root	Total	Shoot	Root	Total
×1	15	12	174	24.4	10.1	34.5	30.4	12.4	42.8
×2		18	218	22.1	9.2	31.3	28.2	10.3	38.5
×10		29	253	19.3	8.0	27.3	26.4	9.0	35.4
×100		41	291	18.2	7.8	26.0	24.9	8.7	33.6
×1	30	8	163	26.9	10.9	37.8	33.4	12.9	46.3
×2		14	199	23.7	9.3	33.0	30.5	11.0	41.5
×10		27	211	22.2	8.1	30.3	28.2	9.4	37.6
×100		38	242	20.0	7.9	27.9	26.7	9.1	35.8
×1	60	6	141	29.7	11.5	41.5	36.3	14.4	50.7
×2		11	186	26.3	10.2	36.5	32.4	12.2	44.6
×10		19	199	23.4	9.2	32.6	29.4	10.2	39.6
×100		27	202	21.2	8.1	29.3	27.9	8.7	36.6
Untreated control	—	192	2773	14.2	4.5	18.7	15.3	4.5	19.8
L.S.D. ($p=0.05$)		4.5	18.8			3.75			5.9

^{a)} J₂: second stage juveniles of *M. incognita*. Data are mean of five replicates.

Table 2 Effect of seed-coating with neem oil on the growth of tomato and on the root-knot development caused by *Meloidogyne incognita*.

Concentration	Exposure period (min)	No. of gall/root system	No. of J ₂ ^{a)} /100 g soil	Plant growth					
				Weight (g)			Height (cm)		
				Shoot	Root	Total	Shoot	Root	Total
×1	15	18	221	22.4	9.2	31.6	28.4	11.2	39.8
×2		22	302	19.3	8.7	28.0	26.3	10.5	36.8
×10		38	379	17.2	8.2	25.4	24.2	9.4	33.6
×100		57	401	16.4	7.2	23.6	21.9	8.7	30.6
×1	30	12	189	25.9	9.8	35.7	30.9	12.2	43.1
×2		16	209	21.4	9.1	30.5	29.6	11.4	41.0
×10		31	264	19.7	8.7	28.4	28.4	10.9	39.3
×100		44	341	17.4	8.2	25.6	23.4	9.1	32.5
×1	60	9	139	27.2	10.4	37.6	33.4	13.4	46.8
×2		13	192	24.3	9.3	33.6	30.4	12.3	43.3
×10		25	205	21.9	8.3	30.2	28.2	11.4	39.6
×100		33	295	19.2	7.4	26.6	24.9	10.2	35.1
Untreated control	—	229	3755	14.2	4.5	18.7	15.3	4.5	19.8
L.S.D. ($p=0.05$)		5.1	24.4			3.27			4.59

^{a)} J₂: second stage juveniles of *M. incognita*. Data are mean of five replicates.

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要 約

サニームとニーム油のトマト種子コーティングによる
サツマイモネコブセンチュウの防除

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サニーム (アザディラクチンを 80% 含有する製剤) またはニーム油の懸濁液にトマト種子を浸漬後、乾燥した。この種子を播種し、3 週間後に得られた苗をサツマイモネコブセンチュウが接種された土壌に移植した。2 か月後に根瘤の発生状況、地上部の成長状態、土壌中の線虫の密度を調べた。サニーム、ニーム油共に、100 倍以下の希釈濃度でサツマイモネコブセンチュウの防除に効果が認められた。