EFFICACY OF CERTAIN BOTANICALS AGAINST ROOT-LESION NEMATODE, *PRATYLENCHUS COFFEAE* IN BANANA

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Summary. Dry and fresh leaves of ten locally available botanicals were tested against the root-lesion nematode, *Pratylenchus coffeae* in banana cvs Nendran and Rasthali under field conditions. All the botanicals were effective in reducing the nematode population and subsequently increased the plant growth characters and yield compared to untreated control. Among the different botanicals tried, application of *Azadirachta indica, Calotropis procera, Datura stramonium, Crotolaria juncea* and *Vitex negundo* were found to be superior and effective in reducing the nematode population and increasing the yield significantly.

The root-lesion nematode, *Pratylenchus coffeae* causes extensive root damage to banana which results in serious economic losses. Because nematicides are very expensive, control strategies are nowadays directed towards the use of natural products. Manuring with green and dry plant parts have been practised as a method for the control of plant parasitic nematodes (Osman *et al.*, 1989). Leaf extracts of *Glyricidia maculata, Ricinus communis, Crotalaria juncea, Glycosmis pentaphylla, Azadirachta indica, Kalanchoe pinnata, Piper betle* and *Moringa oleifera* have been reported to be lethal to *Radopholus similis* (Jasy and Koshy, 1992). Intercropping of banana with *C. juncea* was found to reduce *R. similis* with improved growth and yield of banana in India (Charles and Venkitesan, 1993). Significant yield increases and reduction in *P. coffeae* populations were also recorded in banana plants treated with 50 per cent of N applied by neem cake (Sundararaju and Kumar, 2000). The present paper reports the result of a field experiment undertaken to test the nematicidal efficacy of leaves belonging to ten botanicals.

MATERIALS AND METHODS

The experiment was conducted during 1999-2000 at the Farm of the National Research Centre for Banana in soil infested with *P. coffeae* (Zimmermann) Filipjev *et* Schuurmans Stekhoven. After assessing the initial nematode population, two cultivars of banana (*Musa* spp.), Nendran (AAB) and Rasthali (AAB) were planted at a spacing of 1.8 x 1.8 m in cv. Nendran and 2.1 x 2.1 m in cv. Rasthali. The experiment was arranged as a completely randomised block design with five replications of each of the eleven treatments. There were eight plants per replication. The treatments comprised ten botanicals and an untreated control (Tables I and II).

Healthy suckers of uniform size, weighing about 1 kg each were pared to a depth of one cm to remove the superficial tissues and planted in the field. Plants were grown using recommended practices. Green leaves of the ten botanicals were collected in the field and dried in the shade. They were applied around plants, at the rate of 5 kg per plant, 3 months after planting and then 7 months after planting. Care was taken to cover the leaves with soil and to irrigate immediately. Control plants did not receive botanicals. Root samples were collected prior to the application of botanicals to assess the nematode populations. At harvest, data on crop duration and plant growth parameters such as plant height, pseudostem girth, number of leaves and yield were recorded. A 1-5 root-lesion index (Pinochet, 1988) was recorded at harvest, after carefully uprooting the plants. After indexing, roots were cut into small pieces, mixed thoroughly and three aliquots of 10 g each were collected from each plant. These were then stained in boiling acid fuchsin lactophenol for three minutes, cleared and macerated for 40 seconds for population counts using a Waring blender. The total root population was computed with an average population per ml. Nematodes from 250 ml soil from each plant were extracted by Cobb's sieving method for estimating total soil population.

RESULTS AND DISCUSSION

All ten botanicals were effective in reducing the nematode population, significantly increasing plant growth and yield compared to the untreated control (Table I). Maximum plant height of 320 cm was recorded in treatments with *A. indica* and *D. stramonium* followed by 310 cm in treatments with *V. negundo* and with *C. juncea* in cv. Nendran. Similar result was obtained in cv. Rasthali, where maximum plant height of 220 cm was recorded in treatment with *A. indica* followed by 215 cm in treatment with *V. negundo*. The rest of the treatments were found on par with each other in

Table I. Influence of leaves of different plants on the plant growth, crop duration and bunch characters of two cultivars of banana.*

Treatment	Plant growth parameters						Growing season (No. of days from planting to harvest)		Bunch weight (kg)	
	Plant height (cm)		Pseudostem girth (cm)		No. of leaves					
	Nendran	Rasthali	Nendran	Rasthali	Nendran	Rasthali	Nendran	Rasthali	Nendran	Rasthali
Azadirachta indica Juss.	320	220	65	58	45	33	361	414	10.5	12.5
Calotropis procera R. Br.	290	210	60	55	42	29	365	427	8.5	10.0
Vitex negundo L.	310	215	65	56	45	33	345	417	9.5	12.0
Prosopis julifera DC	290	205	65	55	41	31	384	441	8.0	11.5
Datura stramonium L.	320	210	65	55	44	31	385	436	9.0	11.0
Crotolaria juncea L.	310	210	65	55	43	30	370	443	9.5	10.0
Abutilon indicum (L.) Gaertn.	285	205	60	55	41	29	393	428	7.0	9.0
Tridax procumbens L.	300	210	60	55	42	30	388	428	7.0	8.5
Cassia auriculata L.	300	205	60	50	42	31	378	436	7.5	7.5
Xanthium indicum L.	280	205	55	55	40	30	377	456	6.0	7.5
Control	250	185	45	45	37	27	430	491	4.0	6.0
CD (P=0.05)	6.01	5.24	0.92	0.23	0.46	0.85	4.04	6.53	0.51	0.71

** Average of five replicates/measurements.

Table II. Influence of leaves of different plants on the root-lesion index and population of *Pratylenchus coffeae* in two cultivars of banana.*

Treatment	Initial population (250 ml soil)		Pre-treatment Nematode population from roots (10 g) at 3rd month		Pre-treatment Nematode population from roots (10 g) at 7rd month		Root-lesion index from 5 cm root (1-5 scale)**		Final nematode population from roots (10 g)	
	Nendran	Rasthali	Nendran	Rasthali	Nendran	Rasthali	Nendran	Rasthali	Nendran	Rasthali
Azadirachta indica	110	85	48	80	48	35	1.2	1.2	20	16
Calotropis procera	150	125	176	105	176	75	2.5	2.0	76	40
Vitex negundo	85	90	95	85	95	40	2.0	1.5	36	27
Prosopis julifera	200	185	185	135	185	85	2.8	2.5	81	68
Datura stramonium	210	215	130	115	130	45	2.0	2.0	36	29
Crotolaria juncea	220	220	185	185	185	75	2.5	2.4	75	58
Abutilon indicum	185	165	205	165	205	95	3.5	3.2	108	93
Tridax procumbens	145	185	180	145	180	90	3.0	2.7	95	71
Cassia auriculata	190	170	195	195	195	150	3.5	3.5	114	121
Xanthium indicum	185	215	185	180	185	125	3.5	3.5	110	115
Control	175	190	210	140	210	195	5.0	5.0	251	227
CD (P=0.05)	9.22	8.00	7.08	6.31	7.08	6.00	0.31	0.35	4.08	5.44

* Average of five replicates

* *1: No infection; 2: 5-10 lesions; 3: 11-15lesions; 4: 16-20 lesions; 5: above 20 lesions

increasing the plant height from 280 to 300 cm in cv. Nendran and between 205 and 210 in cv. Rasthali, whereas the minimum plant height of 250 cm and 185 cm was respectively recorded in control plants with respect to cvs Nendran and Rasthali.

Similarly, maximum pseudostem girth of 65 cm was recorded in treatments with *A. indica, V. negundo, P. julifera, D. stramonium and C. juncea* when compared to control (45 cm) in cv. Nendran. The same trend was noticed in the case of cv. Rasthali having recorded the maximum pseudostem girth of 58 and 56 cm in treatments with *A. indica* and *V. negundo* as in the case of plant height. Maximum number of leaves (45) was recorded in treatments with *A. indica* and *V. negundo* followed by *D. stramonium* and *C. juncea* in cv. Nendran whereas, in cv. Rasthali maximum number of leaves was recorded in treatments with *A. indica* and *V. negundo* followed by *P. julifera, D. stramonium, C. juncea* and the minimum number of leaves was recorded in control plants.

The minimum time taken from planting to harvest was 345 days in treatment with *V. negundo* followed by increasing period between 361 and 393 days in other treatments when compared to a maximum of 430 days in control plants in cv. Nendran. In the case of cv. Rasthali minimum time taken from planting to harvest was 414 and 417 days in treatments with *A. indica* and *V. negundo,* respectively; followed by increasing period between 427 and 456 days in all other treatments compared to a maximum of 491 days taken in untreated control plants. Similarly, maximum bunch weight (10.5 kg) was recorded in treatment with *A. indica* followed by 9.5 kg in *V. negundo* and *C. juncea* in cv. Nendran, while minimum bunch weight of 4 kg was recorded in untreated control plants. Whereas, in the case of cv. Rasthali maximum bunch weight of 12.5 and 12 kg was recorded in treatments with *A. indica* and *V. negundo,* respectively, followed by other treatments compared to a minimum bunch weight of 6 kg in untreated control plants.

Analysis of the nematode population from soil and roots in both cvs. Nendran and Rasthali (Table II) showed that all botanicals were effective in a significant reduction of the population of *P. coffeae.* Initial nematode populations varied from 85 to 220 per 250 ml of soil. Following the application of botanicals in 3rd and 7th months after planting, nematode population was reduced considerably compared to control plants. The final nematode population was significantly reduced between 20 and 81 per 10 g of roots in plants treated with botanicals *A. indica, C. procera, D. stramonium, C. juncea* and *V. negundo* followed by other botanicals (95 to 114 per 10 g of root) compared to control (251 per 10 g of root) in cv. Nendran. Whereas, in cv. Rasthali the nematode populations in roots were significantly reduced between 16 and 58 per 10 g of roots in plants treated with *A. indica, V. negundo, D. stramonium* and *C. procera* followed by other botanicals (68 to 121 per 10 g of root) compared to control (227 per 10 g of root). Significant reduction in root-lesion indices was noticed between 1.2 and 3.5 in plants treated with botanicals compared to untreated control plants (5) in both cultivars.

The experiment carried out on susceptible cultivars *viz.*, Nendran and Rasthali in separate fields, using different botanicals incorporated into the soil, showed that all botanicals were effective in reducing the nematode population and significantly increased the plant growth and yield compared to untreated control. However, maximum effect on reduction in nematode population, increased plant growth, minimum time taken from planting to harvest and bunch weight were recorded by adding green chopped leaves of *A. indica, V. negundo, D. stramonium, C. procera* and *C. juncea.* It seems that plant leaves when used as soil amendments not only increased the soil fertility, but also caused considerable stress on the nematodes. The exact mechanisms of action of organic amendments in the soil, however, remain unclear. It is likely that either secondary plant products from decomposition of organic amendments are directly toxic to the nematodes (Singh and Sitaramaiah, 1973; Mahmood and Saxena, 1992), or they have beneficial ingredients for plant growth and increasing natural enemies of nematodes in the soil. The present investigation is in agreement with Charles and Venkitesan (1993) who reported that intercropping of banana with *C. juncea* reduced *R. similis* with better growth and yield of banana in India. Previous reports also indicated that leaves of *Datura* spp. and other plants showed reduction in gall formation due to root-knot nematodes (Sharma *et al.*, 1985; Ram and Gupta, 1982). Significant yield increase and reduction in *P. coffeae* population was noticed in six commercial cultivars of banana treated with 50 per cent of N applied by neem cake (Sundararaju and Kumar, 2000). It is evident from the present results that dried leaves of *A. indica, V. negundo, D. stramonium, C. procera* and *C. juncea,* when used as soil amendments, can successfully control *P. coffeae* and significantly increase the yield with reduced duration of the crop.

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