EFFECT OF NEEM OIL CAKE AND NEMATICIDE FOR THE CONTROL OF BURROWING NEMATODE, *RADOPHOLUS SIMILIS* IN THE ARECANUT BASED ON CROPPING SYSTEM

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ABSTRACT : Three field experiments were carried our in arecanut monocrop, arecanut + banana and arecanut + banana + pepper to evaluate the efficacy of neem oil cake @ 1 kg and phorate @ 30g singly and in combination for control of burrowing nematode *Radopholus similis* population in arecanut, banana and pepper in the cropping system. Event hough, all the treatments were significantly superior over the untreated control, the best treatment in these experiments was 15 g of phorate in combination with 1 kg neem oil cake which controlled the *R. similis* population in arecanut and subsidiary crops very well.

Key words : Neem, Oil cake, Nematode, burrowing nematode

INTRODUCTION

Favorable effect of manuring on rhizosphere nematode population has been reported by Moslov *et al.*, (1959) Gadzhieva (1959), Davey and Papavizas (1959; 1960) Papavizas (1963). Application of organic additives in the form of oil cakes have also been suggested for controlling nematodes (Singh and Sitaramaiah 1970, Khan *et al.*, 1970). Efforts have been made to control the disease caused by plant parasitic nematodes using nematicides, oil cake etc. (Singh and Sitaramaiah 1967; Alam *et al.*, 1977, Khan *et al.*, 1979). In the present investigation an attempt has been made to find out the effect of nematicide and neem cake alone and in combination for the control of burrowing nematode in arecanut based cropping system.

MATERIALS AND METHODS

Three experiments were laid out at CPCRI Regional Statio, Vittal in 1986 in randomized block design which wer replicated four times. The first experiment was with arecanut as monocrop, second with the combination of banana and the third with arecanut, banana and pepper.

In all the three experiments, one hundred and twenty palms each of arecanut of uniform age of the variety Mangala were selected. In the first experiment was devoted to arecanut solc crop. In the second plot, two plants each of banana of the variety 'Kadali' were planted in the middle of six arecanut palms. Rooted pepper cuttings of the variety 'Karimunda' were also planted in the basins of each arecanut palm. All the crops under these three experiments received the normal recommended doses of fertilizers as per schedule.

The treatment details are as follows:-

T_1	-	Phorate @ 30g/plant
T_2	-	Neem oil cake @ 1 kg/plant
T_3	-	Phorate @ 15 g + Neem oil cake @ 1 kg/plant
T_4	-	Phorate @ 15g + Neem oil cake @ 500g/plant
T_5	-	Untreated control
Plot size	-	6 palms.

All the three experiments had the same treatments.

Two samples each of soil and roots were collected from each treatment which consisted of six palms and the nematode population was assessed every year during September/October before imposing the treatments. Root and soil samples were collected 75 cm away from the bole of the palm at a depth of 10 to 50 cm with a soil auger. In the case of black pepper soil samples were collected at a distance of 25 to 50 cm away from the bole of the plant from a depth of 20-40 cm. Samples of tender to semi hard portions of the main and lateral roots of colour ranging from creamy white to light orange were taken and to this, root bits available in the auger samples were also added for the purpose of analysis.

Root samples were processed as per the method described by Koshy *et al.*, (1975) and the nematode population level was assessed. Soil samples were processed by Cobb's sieving and sifting method (Cobb, 1918). These samples were collected for three consecutive years and the nematode population assessed.

Root samples of arecanut, banana and black pepper were separately cut into 2.5 cm bits sliced longitudinally and left in petridish (15 cm) containing 100 ml of tap water for 72 hrs in a BOD incubator at 15 ± 1°C. (Koshy *et al.*, 1975). After 72 hrs the suspension containing nematodes was passed through a set of 840, 250 and 38µ size sieves and the sieving of 38µ size mesh were collected in a beaker.

In order to apply nematicides and neem oil cake singly and in combination in the basins of the crops, the basins were cleaned and the soil around the basin was gently raked to remove the top soil to a depth of 3 to 5 cms. The the required quantity of nematicides and neem oil cake were applied to the basin uniformly and the basins were covered properly with the top soil. Application of nematicides and neem cake was done during. May/June and September/October depending upon the availability of soil moisture. Plants were irrigated immediately after every application.

RESULTS

Data on the efficacy of phorate alone @ 30g/palm, Nem cake alone @ 1 kg/palm and the combination of lower dose of phorate @ 15 g with ½ and 1 kg of neem cake applied twice a year for a period of three years against *R. similis* on arecanut as monocrop, arecanut + banana and arecanut + banana + black pepper combinations are furnished from Table No. 1 to 6.

In the arecanut monocrop, the treatment with 15 g of phorate along with neem cake @ 1 kg per palm was the most effective treatment in controlling *R. similis*. But a gradual increase of nematode population was seen in the control palms from an initial population 51 in 1986 to 64.90 in 1987, 164.58 in 1988 and 179.9 in 1989.

In the second experiment arecanut + banana combination in the second and third year, the population level was significantly decreased in the treated plants than in the untreated control. The control palms has recorded significantly higher nematode populations. The treatment with 30 g phorate/palm had an initial population of 87.25/ gram root which was reduced to 0.55/gram root during 1989. In the treatment with neem cake @ 1 kg/palm also the same trend was observed where the initial population of 39/gram root was found to be reduced to 0.26/gram root. These results very clearly indicate that the control plants had very high nematode counts than the treated plants which had an initial population of 45.25/gram root of arecanut which increased to 57.86/gram root.

The treatments showed significant effect on banana plants also. The treatment with 30g phorate/plant come out most effective. This treatment had an initial

population of 88/gram root of banana had been reduced to nil during 1989. The untreated control plants registered an initial population of 70/gram root of banana which had increased to 144.73/gram root by the end of three years.

In the experiment of arecanut + banana + black pepper, the treatment with phorate @ 15g and neem cake @ 500 g/palm has reduced the initial population of 166.50 gram root in 1986 to nil during 1989 where as in the control palms there is an increase of nematode population from 103.25/gram root of arecanut in 1986 to 115.30/gram root in 1989.

The same trend was observed in the banana plants also. The treatment with phorate @ 15 g + neem cake @ 1 kg was the most effective treatment on banana and reduced the nematode population of 129/gram root of banana to 8.48/gram root as against the control with an initial population of 124.33 which had increased to 151.63 per gram root of banana over a period of three years. In pepper the initial population of 134.16/gram root has been reduced to 7.89/gram root of pepper where as in the untreated control the nematode population had increased from 108.33/gram root over a period of three years.

DISCUSSION

Generally arecanut is inter/mix cropped with either one or more crops like banana, black pepper, cardamom, cocoa etc. which are all susceptible to one or more species of nematodes. A serious nematode problem ws encountered due to high density cropping system of approach. Hence, the present study was undertaken to find out the suppressing effect of nematicide in combination with organic amendments in the form of neem oil cake on the burrowing nematode, the major nematode pathogen of arecanut and component crops in the arecanut based cropping syste. Application of organic additives in the form of oil cakes have been suggested for controlling the nematode problems (Mosolv *et al.*, 1959). Sundararaju (1984) had studied the efficacy of nematicides and neem cake as the organic amendment in the control of *R. similis* population on both arecanut seedlings as well as on bearing areca palms. In this investigation, the applciation of lower dosages of nematicide along with neem cake has been given importance in fear of residue effect which may occur in the fruits and this may prove to be the most relevant information as far as farmers are concerned. In all the three systems the *Radopholus similis* population was suppressed within three years of timely and systematic applications of nematicides and neem cake. Even though, the same trend was seen in all the three experiments, the extent of suppression offered by neem cake and nematicide varied from crop to crop and system to system.

In arecanut monocrop, the application of phorate @ 15 g and 1 kg neem cake could effectively control the burrowing nematode population in the arecanut roots where as in the arecanut + banana crop combination, the arecanut root showed very good respone to phorate @ 15 g and neem cake @ 500g. Here the *R. similis* population of banana could be effectively controlled by the applicatin of phorate @ 30g per plant. In arecanut, banana and pepper crop combination, the application of nematicide and neem cake together (Phorate @ 15g + neem cake @ 1 kg) could very well control the nematode in the roots of arecanut whereas the banana roots responded only to the applciation of phorate @ 30g/plant.

A steady decrease in nematode population was also observed in the case of phorate treatments. Koshy *et al.*, (1985) recorded complete control of *R. similis* with phorate @ 25g a.i./ha when applied thrice at intervals of three months in coconut nursery. Similar resutls with phorate was obtained by various workers on banana (Figueroa and Mora 1977 and Figueora, 1980). In pepper also the same response was observed just as banana

in this cropping system. Therefore the present study authentically shows that the applicatin of lower dosages of nematicides in combination with neem cake control the burrowing nematode population in arecanut, banana and pepper, either grown as mono crop or as mixed crop.

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Effect of nematicide and neem cake alone and in combination for the control of *Radopholus similis* on arecanut as a monocrop

(Mean of four replications)

Sl.No.	Treatment	Nematode population/g root Initial population	Post treatment population (Adjusted)		
		1986	1987	1988	1989
1	Phorate @ 30g/plant	43.00	23.80	27.18	12.99
2	Neem cake @ 1 kg/plant	49.75	23.51	18.66	8.05
3	Phorate @ 15g + Neem cake @ 1 kg/plant	72.50	12.43	0.00	0.00
4	Phorate @ 15g + Neem cake @ 500g/plant	48.00	27.36	23.37	16.16
5	Control	51.00	64.90	164.58	179.97
AV.SE of difference between two treament means			5.99	26.51	31.55
CD (P=0.05)			13.18	58.36	69.44

Effect of nematicide and neem cake alone and in combination for the control of *Radopholus similis* on arecanut in arecanut + banana crop Combination

(Mean of four replications)

Sl.No.	Treatment	Nematode population/g root Initial population	Post treatment population (Adjusted)		
		1986	1987	1988	1989
1	Phorate @ 30g/plant	87.25	33.72	14.02	0.55
2	Neem cake @ 1kg/plant	39.00	24.19	4.56	0.26
3	Phorate @ 15 g + Neem cake @ 1 kg/plant	57.50	20.30	8.77	1.31
4	Phorate @ 15g + Neem cake @ 500g/plant	38.75	22.26	4.55	1.76
5	Control	45.25	27.03	45.86	57.87
AV.SE of difference between treatment means			5.45	4.89	5.54
CD (P=0.05)			NS	10.75	12.19

Effect of nematicide and neem cake alone and in combination for the control of *Radopholus similis* on arecanut in arecanut + banana + pepper crop combination

(Mean of four replications)

Sl.No.	Treatment	Nematode population/g root Initial population	Post treatment population (Adjusted)		
		1986	1987	1988	1989
1	Phorate @ 30g/plant	73.75	13.76	42.48	24.63
2	Neem cake @ 1kg/plant	101.75	11.19	23.88	18.23
3	Phorate @ 15 g + Neem cake @ 1 kg/plant	138.00	11.64	13.05	2.61
4	Phorate @ 15g + Neem cake @ 500g/plant	166.50	38.98	0.00	0.00
5	Control	103.25	91.42	101.08	115.30
AV.SE of difference between treatment means			26.66		28.84
CD (P=0.05)			58.68		63.47

Effect of nematicide and neem cake alone and in combination for the control of *Radopholus similis* on banana in arecanut + banana crop combination

(Mean of four replications)

Sl.No.	Treatment	Nematode population/g root Initial population	Post treatment population (Adjusted)		
		1986	1987	1988	1989
1	Phorate @ 30g/plant	58.00	28.11	11.00	0.00
2	Neem cake @ 1kg/plant	48.00	34.66	14.44	0.06
3	Phorate @ 15 g + Neem cake @ 1 kg/plant	80.00	45.54	23.80	7.20
4	Phorate @ 15g + Neem cake @ 500g/plant	63.75	34.85	14.53	3.48
5	Control	70.00	119.34	135.48	144.73
AV.SE of difference between treatment means			8.76	9.79	7.82
CD (P=0.05)			19.29	21.54	17.20

Effect of nematicide and neem cake alone and in combination for the control of *Radopholus similis* on pepper in arecanut + banana + pepper crop combination

(Mean of four replications)

Sl.No.	Treatment	Nematode population/g root: Initial population	Post treatment population (Adjusted)	
		1987	1988	1989
1	Phorate @ 30g/plant	29.37	9.37	7.93
2	Neem cake @ 1kg/plant	50.89	41.12	56.00
3	Phorate @ 15 g + Neem cake @ 1 kg/plant	40.94	44.44	41.55
4	Phorate @ 15g + Neem cake @ 500g/plant	39.95	7.69	63.54
5	Control	60.10	87.13	147.73
AV.SE of difference between treatment means			21.75	34.89
CD (P=0.05)			47.87	76.79

Effect of nematicide and neem cake alone and in combination for the control of *Radopholus similis* on banana in arecanut + banana + pepper crop combination

(Mean of four replications)

Sl.No.	Treatment	Nematode population/g root: Initial population	Post treatment population (Adjusted)	
1	Phorate @ 30g/plant	38.59	23.34	20.03
2	Neem cake @ 1kg/plant	103.52	31.94	16.82
3	Phorate @ 15 g + Neem cake @ 1 kg/plant	49.18	34.18	19.09
4	Phorate @ 15g + Neem cake @ 500g/plant	120.25	58.17	25.47
5	Control	74.22	106.12	133.59
AV.SE of difference between treatment means			46.44	45.48
CD (P=0.05)			NS	100.10

REFERENCES

Alam, M.M., Siddiqui, S.A. and Khan, A.M. 1977. Mechanism of control of plant parasitic nematodes due to the application of organic amendments to the soil-role of phenols. *Indian J. Nematol.* 7: 27-31.

Cobb, N.A. 1918. Estimating the nema population of soil. *U.S.Dept. Agr. Bur. Plant. Ind. Agr. Tech. Cir.* I : 1-48.

Davery, C.B. and Papavizas, G.C. 1959. Effect of organic soil amendments on the Rhizoctonia disease of snap beans. *Argan. J.* 51: 493-496.

Davey, C.B. and Papavizas, G.C. 1960. Effect of decomposing organic soil amendments and nitrogen on fungi in soil and bean rhizosphere. *Trans. Indian. Cong. of Soil Sci.* 7th Cong. Machsin, Wesc. USA. 2: 551-557.

Figueora, A. and Mora, R. 1977. Effect of nematicides, aldicarb, aldoxycarb and DBCP on nematode control and yield of bananas. *Nematropica.* 10: 15-20.

Figueroa, A. 1980. Effects of the nematicides, aldicarb, aldoxycarb and DBCP on nematode control and yield of bananas. *Nematropica.* 10: 15-20.

Gadzhieva, M.A. 1959. The importance of organomineral mixtures and their components for the development of the root microflora of winter wheat and grass mixtures. *Agrobiology.* 4: 581-589.

Khan Abrar, M., Azra Adhami, Siddiqui, Z.A. and Saxena, S.K. 1970. Effect of different oil cakes on hatching of larvae and on the development of root-knot caused by *Meloidogyne incognita* (Kofoid and White) Chitwood. *Plant disease problems.* pp 583-588. Indian Phytopathological Society, IARI, New Delhi.

Khan, A.M., Mashkoor, M. and Ahmed, R. 1979. Mechanism of the control of plant parasitic nematodes as a result of the application of oil cakes to the soil. *Indian J. Nematol.* 9 : 93-96.

Koshy, P.K. and Sosamma, V.K. and CPR Nair 1975. Preliminary studies on *Radopholus similis* (Cobb, 1893) Thorne, 1949 infesting coconut and arecanut palms in South *India. Indian J. Nematol.* 5: 26-35.

Koshy, P.K., Sundararaju, P., Sosamma, V.K. and Ravikumar, K. 1985. Efficacy of four systemic nematicides against *Radopholus similis* in coconut nursery. *Indian J. Nematol* 15(2) : 148-150.

Moslov, J.V., Remp, E.K.L. and Alexandreu-Skaya, U.A. 1959. The interaction of fertilizers on higher plants and Micro organisms Agrobiology (USSR). 3: 425-439.

Papavizas, G.C. 1963. Microbial antagonism in bean rhizosphere s affected by straw and supplemented nitrogen. *Phytopathology.* 53 : 1430-1435.

Singh R.S. and Sitaramaiah 1970. Control of plant parasitic nematodes with organic amendments. *Pans.* 16 : 287-297.

Singh, R.S. and Sitaramaiah, K. 1967. Effect of decomposing green leaves, saw dust and urea on the incidence of root-knot in okra and tomato. *Indian Phytopathology.* 20: 349-355.

Sundararaju, P. 1984. Ph.D. thesis entitled 'Studies on burrowing nematode, *Radopholus similis* on arecanut , submitted to University of Kerala, pp 93-97.