Integrated Approach for the Management of Burrowing Nematode, *Radopholus similis* in Arecanut based Cropping System

S. SUDHA AND P. SUNDARARAJU[1]

Central Plantation Crops Research Institute, Kasaragod, Kerala - 671 124

ABSTRACT : A trial was laid out at CPCRI, Kasaragod, to study the effect of green manure alongwith phorate and neem oil cake, singly and in combination, for the control of *Radopholus similis* infesting arecanut, banana and black pepper. Phorate, @25g/plant, alone or in combination with neem cake @1kg/plant was effective in reducing the nematode population on all the tested crops. Application of *Glyricidia* leaves @5kg/plant also reduced the nematode population significantly.

Key words: *Radopholus similis*, Phorate, Neem cake, *Glyricidia* leaves.

In Kerala and Karnataka black pepper, cacao and banana are the usual component cash crops in arecanut based farming systems (Bavappa, 1978). Even though cacao is free from nematode problems, root-knot and burrowing nematodes are known to infest heavily on black pepper and banana. Sundararaju & Koshy (1991) reported that banana and black pepper, grown as intercrops, favoured multiplication of *Radopholus similis* in arecanut based cropping system. Indiscriminate use of nematicides is not a practical proposition in arecanut based cropping systems because of residual toxicity on the economic produce, especially when most of the crops involved in the system are consumed directly without further processing. Hence, it was decided to develop an integrated nematode management schedule involving minimum quantity of nematicides incorporating organic amendments for the control of the burrowing nematode in arecanut based cropping system.

MATERIALS AND METHODS

Three field trials were laid out in a farmer's field at Majal, Maipady and Kasaragod in order to study the effect of green manure, if any, alongwith phorate and neem oil cake singly and in combinations with each other for the control of *R. similis* in arecanut. banana and black pepper in various combinations such as arecanut as monocrop, arecanut+banana and arecanut+black pepper.

The arecanut monocrop experiment consisted of 5 year old, 120 arecanut palms of local variety. In the case of arecanut+black pepper combination, 120 arecanut palms of the local variety were selected on the basins of which black pepper, variety 'Karimunda' were freshly planted.

One hundred and eighty bearing arecanut palms, variety local, with uniform age, were selected for the arecanut + banana experiment. The banana plants, variety Kadali, were freshly planted in the arecanut+banana crop combination experiment.

There were 6 arecanut palms and 2 banana plants per plot in arecanut+banana combination.

The treatments were the same for all the crops involved in all 3 experiments. All the crops under these experiments were given the normal recommended dose of fertilisers.

There were 10 treatments each replicated 3 times.

T1 - Phorate @25g/palm

T2 - Phorate @50g/palm

[1]National Research Centre on Banana, 44, Ramalinga Nagar South Extension, Vayalur Road, Trichy - 620 017

T3 - Neem cake @1kg/palm

T4 - Neem cake @2kg/palm

T5 - *Glyricidia* leaves @5kg/palm

T6 - Phorate @25g + Neem cake @1kg/palm

T7 - Phorate @25g + *Glyricidia* leaves @5kg/palm

T8 - Neem cake 1 kg + *Glyricidia* leaves @5kg/palm

T9 - Phorate @25g + Neem cake @1kg + *Glyricidia* leaves @5kg/palm

T10 - Control without any applications

Pre-treatment root and soil samples were collected and assessed for initial population of *R. similis* by the modified Baermann funnel method. The required quantity of phorate, neem cake and *Glyricidia* leaves were applied as per schedule every year twice (May and September). The post treatment samples were collected from all the treatments during September for 3 consecutive years.

Soil samples were processed by Cobb's sieving and decanting method. Roots were cut into small pieces after indexing, mixed thoroughly and 3 aliquots of 10g each were collected from each palm, stained in boiling acid fuchsin lactophenol for 3 minutes, cleared and churned for 40 seconds using a waring blender for population assessment. Three aliquots of 5 ml each of this suspension were drawn in counting dish and the nematode population, in each sample, was assessed. The total root population was based on the average of these counts.

RESULTS AND DISCUSSION

In the arecanut monocrop experiment, 25g phorate/plant was most effective since this brought down the nitial population of nematode 211/10 gram root to 17/10 gram root after 2 years as against untreated control. (Table 1). In the arecanut+banana experiment, (Table 2) all treatments were effective in reducing the nematode population in arecanut root with most effective treatment being phorate @25g+neem cake @1kg/palm (from 215.8/10 gram root to 8.2/10 gram root after 2 years) However in banana root (arecanut+banana crop combination) the most effective treatment was phorate @25g/ plant (Table 3).

In the present investigation, green leaves in the form of *Glyricidia* was used to control the population of burrowing nematode. The results showed that the 3 years of continuous application, twice in a year, *Glyricidia* leaves alone, @5kg/plant, had very good effect in bringing down *R. similis* population on arecanut, banana and black pepper roots. When *Glyricidia* was applied alongwith phorate and neem cake, the effect was still better (Table 4&5). Thus, application of Glyricidia leaves (5Kg) singly or in combination, with low dose of phorate, @25g or neem cake @1kg can control plant parastic nematode population in the roots of arecanut and banana.

ACKNOWLEDGEMENT

The authors express their sincere gratitude to Director, CPCRI, for providing necessary facilities and to Mr. K. Vijayakumar, Sr. Scientist (Statistics), CPCRI., Kasaragod for the statistical analysis of the data.

Table 1 : Effect of nematicide, neem cake and *Glyricidia* leaves alone and in combination for the control of *Radopholus similis* on arecanut in the Arecanut Monocrop experiment.

(Mean of three replications)

Treatments	*R. similis* population/ 10g root of arecanut *Initial population* 1991	*Post-treatment population* 1992	*Final population* 1993	Mean
Phorate @ 25g/palm	14.5 (211.0)	8.5 (71.7)	4.1 (17.0)	9.0 (99.9)
Phorate @ 50g/palm	14.4 (206.7)	8.6 (73.8)	4.7 (21.8)	9.2 (100.8)
Neem cake @ 1 kg/palm	14.9 (221.5)	9.6 (91.7)	4.3 (18.8)	9.6 (110.7)
Neem cake @ 2kg/palm	14.8 (218.5)	8.7 (75.7)	5.9 (35.0)	9.8 (109.7)
Glyricidia @ 5kg/palm	14.6 (213.0)	8.9 (78.5)	5.4 (29.7)	9.6 (107.1)
Phorate @ 25g + Neem cake @ 1 kg/palm	14.9 (222.5)	8.5 (71.7)	4.9 (24.2)	9.4 (106.1)
Phorate @ 25g + *Glyricidia* @ 5 kg/palm	14.3 (204.7)	8.1 (65.3)	5.2 (26.8)	9.2 (98.9)
Neem cake @ 1 kg + *Glyricidia* @ 5kg/palm	14.9 (220.8)	9.4 (88.7)	5.0 (25.3)	9.8 (111.6)
Phorate @ 25g + Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	14.5 (211.2)	9.9 (98.3)	7.9 (61.7)	10.8 (123.7)
Control	14.5 (210.5)	15.6 (244.5)	17.3 (297.7)	15.8 (250.9)
Mean	14.6 (214.0)	9.6 (96.0)	6.5 (55.8)	

CD for Treatment: 0.33; CD for year: 0.17;
CD for years at the same level of Treatment: 0.54; CD for Treatment at the same or diff. level of years: 0.55
Analysis is done after using the square root transformation ($\sqrt{X}$)
where X is the nematode count. All CD's are on transformed values;
Figures in parenthesis are the original counts of nematodes

Table 2 : Effect of nematicide, neem cake and *Glyricidia* leaves alone and in combination for the control of *Radopholus similis* on arecanut root in the Arecanut + Banana crop combination.

(Mean of three replications)

Treatments	*R. similis* population/10g root of arecanut							
	Initi al population 1991		*Post-treatment population* 1992		*Final population* 1993		Mean	
Phorate @ 25g/palm	12.7	(160.7)	6.5	(42.2)	3.6	(13.0)	7.6	(71.9)
Phorate @ 50g/palm	12.2	(149.5)	5.4	(29.2)	2.9	(8.7)	6.9	(62.4)
Neem cake @ 1 kg/palm	12.6	(160.0)	5.8	(33.5)	3.0	(8.8)	7.13	(67.4)
Neem cake @ 2 kg/palm	13.4	(179.2)	6.3	(39.8)	3.2	(10.5)	7.6	(76.5)
Glyricidia @ 5 kg/palm	15.0	(225.0)	7.2	(52.2)	3.2	(10.3)	8.47	(95.8)
Phorate @ 25g + Neem cake @ 1 kg/palm	14.7	(215.8)	5.6	(31.2)	2.9	(8.2)	7.7	(85.1)
Phorate @ 25g + *Glyricidia* @ 5 kg/palm	14.8	(218.0	7.0	(48.8)	3.4	(11.5)	8.4	(92.8)
Neem cake @ 1 kg + *Glyricidia* @ 5kg/palm	13.5	(182.2)	7.4	(54.8)	3.8	(14.8)	8.2	(83.9)
Phorate @ 25g + Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	13.9	(192.3)	7.1	(51.0)	3.3	(11.2)	8.1	(84.8)
Control	14.4	(206.7)	14.9	(221.5)	10.0	(255.0)	5.1	(227.7)
Mean	13.7	(188.9)	7.3	(60.4)	4.5	(35.2)		

CD for Treatment: 0.52; CD for year: 0.24;
CD for years at the same level of Treatment : 0.76; CD for Treatment at the same or diff. level of years: 0.81

Analysis is done after using the square root transformation ($\sqrt{x}$), where x is the nematode count.
All CD's are on transformed values.

Table 3 : Effect of nematicide, neem cake and *Glyricidia* leaves alone and in combination for the control of *Radopholus similis* on banana root in the Arecanut + Banana Crop combination.

(Mean of three replications)

Treatments	*R. similis* population/10g root of banana. *Initial population* 1991		*Post-treatment population* 1992		*Final population* 1993		Mean	
Phorate @ 25g/palm	12.7	(162.2)	7.6	(57.5)	3.1	(9.3)	7.8	(76.3)
Phorate @ 50g/palm	13.2	(173.7)	8.4	(70.5)	3.4	(11.8)	8.3	(85.3)
Neem cake @ 1 kg/palm	13.2	(174.2)	8.3	(69.2)	3.5	(12.0)	8.3	(85.1)
Neem cake @ 2 kg/palm	13.1	(172.5)	7.7	(59.0)	4.1	(17.0)	8.3	(82.8)
Glyricidia @ 5 kg/palm	13.1	(172.50)	8.2	(66.7)	5.1	(25.7)	8.8	(88.3)
Phorate @ 25g + Neem cake @ 1 kg/palm	14.8	(219.2)	7.8	(60.7)	5.1	(26.2)	9.2	(102.0)
Phorate @ 25g + *Glyricidia* @ 5 kg/palm	14.1	(200.0)	7.8	(61.2)	4.7	(22.7)	8.9	(94.6)
Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	12.7	(161.3)	8.1	(65.3)	5.5	(31.3)	8.8	(86.0)
Phorate @ 25g + Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	14.4	(207.3)	8.9	(78.8)	6.6	(43.3)	9.9	(109.8)
Control	13.8	(190.0)	14.9	(222.5)	16.2	(263.3)	5.0	(225.3)
Mean	13.5	(183.3)	8.8	(81.1)	5.7	(46.3)		

CD for Treatment: 0.56; CD for year: 0.29;
CD for years at the same level of Treatment: 0.91; CD for Treatment at the same or diff. level of years: 0.93

Analysis is done after using the square root transformation ($\sqrt{x}$), where x is the nematode count.
All CD's are on transformed values.

Table 4 : Effect of nematicide, neem cake and *Glyricidia* leaves alone and in combination for the control of *Radopholus similis* on arecanut in the Arecanut + Pepper Experiment.

(Mean of three replications)

Treatments	*R. similis* population/10g root of arecanut							
	Initial population 1991		*Post-treatment population* 1992		*Final population* 1993		Mean	
Phorate @ 25g/palm	13.2	(174.7)	6.3	(43.0)	4.1	(17.2)	7.9	(78.3)
Phorate @ 50g/palm	14.3	(205.0)	7.0	(55.0)	4.6	(22.0)	8.7	(94.0)
Neem cake @ 1 kg/palm	13.7	(189.5)	7.5	(61.2)	5.2	(27.5)	8.8	(92.7)
Neem cake @ 2 kg/palm	13.4	(180.3)	8.0	(66.2)	7.2	(53.8)	9.5	(100.1)
Glyricidia @ 5 kg/palm	14.2	(202.8)	8.0	(64.3)	6.8	(46.2)	9.7	(104.4)
Phorate @ 25g + Neem cake @ 1 kg/palm	14.1	(198.3)	7.7	(63.8)	5.0	(25.2)	9.0	(95.8)
Phorate @ 25g + *Glyricidia* @ 5 kg/palm	13.7	(188.7)	8.4	(73.2)	6.5	(42.8)	9.6	(101.6)
Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	14.6	(213.2)	8.1	(67.8)	6.4	(40.7)	9.7	(107.2)
Phorate @ 25g + Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	14.5	(209.8)	9.2	(85.2)	8.1	(66.0)	10.6	(120.3)
Control	14.6	(213.3)	15.7	(248.0)	17.1	(293.3)	15.8	(251.6)
Mean	14.1	(197.6)	8.6	(82.8)	7.1	(63.5)		

CD for Treatment: 0.84; CD for year: 0.58
CD for years at the same level of Treatment: 1.82;CD for Treatment at the same or diff. level of years: 1.71

Analysis is done after using the square root transformation ($\sqrt{x}$), where x is the nematode count.
All CD's are on transformed values.
Figures in parenthesis are the original counts of nematodes

Table 5 : Effect of nematicide, neem cake and *Glyricidia* leaves alone and in combination for the control of *Radopholus similis* on pepper in the Arecanut + Pepper Experiment.

(Mean of three replications)

Treatments	*R. similis* population/10g root of pepper							
	Initial population 1991		*Post-treatment population* 1992		*Final population* 1993		Mean	
Phorate @ 25g/palm	8.6	(73.7)	5.4	(29.2)	3.1	(9.5)	5.7	(37.4)
Phorate @ 50g/palm	7.9	(63.2)	6.4	(40.8)	3.6	(13.2)	6.0	(39.1)
Neem cake @ 1 kg/palm	9.0	(81.7)	5.9	(34.7)	3.8	(14.7)	6.3	(43.7)
Neem cake @ 2 kg/palm	10.3	(105.8)	7.0	(48.7)	4.9	(23.7)	7.4	(59.4)
Glyricidia @ 5 kg/palm	8.4	(69.8)	5.5	(30.0)	3.5	(12.3)	5.8	(37.4)
Phorate @ 25g + Neem cake @ 1 kg/palm	9.0	(81.3)	5.8	(34.0)	4.0	(16.3)	6.3	(43.9)
Phorate @ 25g + *Glyricidia* @ 5 kg/palm	9.9	(99.0)	5.9	(35.3)	4.9	(24.2)	6.9	(52.8)
Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	9.5	(90.3)	6.7	(45.5)	3.9	(15.5)	6.7	(50.4)
Phorate @ 25g + Neem cake @ 1 kg + *Glyricidia* @ 5 kg/palm	9.7	(93.8)	5.9	(35.7)	4.8	(22.7)	6.8	(50.7)
Control	12.0	(147.8)	11.6	(133.8)	13.9	(192.7)	12.5	(158.1)
Mean	9.4	(90.7)	6.6	(46.8)	5.0	(34.5)		

CD for Treatment: 0.53; CD for year: 0.30
CD for years at the same level of Treatment: 0.95; CD for Treatment at the same or diff. level of years: 0.94

Analysis is done after using the square root transformation ($\sqrt{x}$), where x is the nematode count.
All CD's are on transformed values.
Figures in parenthesis are the original counts of nematodes

REFERENCES

Bavappa. KVA (1978). Mixed cropping and crop diversification, National Agricultural Diversification and Settlement Auhrority Staff Seminar, Perademya.

Sundararaju, P & Koshy, PK (1986). Effect of different nematicides and neem oil cake in the control of *Radopholus similis* in yellow leaf disease affected arecanut palms. *Indian J. Nematol.* **16** : 44-47.

Sundararaju, P. & Koshy, P.K. (1991). Effect of intercrops on occurrence of *Radopholus similis* in Arecanut Palms. *J. Plant. Crops* **18** : 299-301.

Accepted for Publication : February, 2001