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COMPARISON OF DIFFERENT METHODS OF CONTROL OF *MELOIDOGYNE INCOGNITA* IN RELATION TO GROWTH AND YIELD OF PAPAYA

by

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Summary. Experiments were conducted in the glasshouse and in the field with the egg parasitoid *Paecilomyces lilacinus*, neem as leaves and cake, farm yard manure, fenamiphos 10G and carbofuran 3G at different dosages, in single and split application, for the management of *Meloidogyne incognita* on papaya. Carbofuran at the rate of 3 g c.f./kg of nursery soil mixture and 2 g c.f. per plant applied in two equal split applications, before planting and at flowering, controlled *M. incognita* population in the glasshouse and the field, respectively, and increased the plant growth and fruit yield of papaya. The increase in number of fruits, mean fruit weight and fruit yield per plant was 40, 14 and 62%, respectively, compared to untreated. Neem cake at 5 g per kg of nursery soil mixture and 1 kg per plant in the field was effective but less than carbofuran. Fenamiphos was as effective as neem cake in the glasshouse.

Meloidogyne incognita is a major pest of papaya (Lamberti *et al.*, 1980; Routary and Das 1988, McSorley, 1992). It affects seed germination, seedling survival, plant growth and fruit yield (Nath and Singh, 1992). However, information available on the management of the root knot nematode on this crop, particularly in the field, is scarse and assessment of yield potential in relation to control was not quantified by earlier workers.

Considering the increasing importance of papaya and its potential nematode pest *M. incognita*, the present study was undertaken in the glasshouse and in the field to quantify growth and yield improvement in relation to nematode control measures.

Materials and methods

In a glasshouse experiment, chopped leaves of neem (50 g), neem cake (5 g), *Paecilomyces lilacinus* (Thom.) Samson infected sorghum grain (10 g with an average load of 10^6 spores per grain), fenamiphos 10G (1 g c.f.) and carbofuran 3G each (1, 2, 3 g c.f.) per kg of soil were thoroughly and individually mixed into 1kg of soil in 15 cm clay pots. Two/three seeds of papaya, *Carica papaya L.*, cv. Co 6 were sown per pot and the seedlings thinned to one per pot as soon as possible after germination. At 21 days after sowing the pots were inoculated with 1000 J_2 of *M. incognita* (Kofoid *et* White) Chitw. A set of untreated inoculated pots was maintained to serve as control. The experiment was in a randomized block design with five replicates. It was terminated 45 days after inoculation and observations on number of leaves, leaf area, length and weight of shoot and root as well as galls per root system, galls per g root, egg masses per g root and number of eggs per egg mass were recorded (Gangadhara Nayak *et al.*, 1990).

Papaya cv. Co 6 was also used, in the field trial. Each of the treatments (listed in Table III)

were replicated five times and randomly, distributed. Soil (200 cm^3) and root (5g) samples were processed for *M. incognita* using a modified Baermann funnel technique and blender, respectively. Number of fruits, fruit yield per tree and mean fruit weight were recorded.

Results and discussion

In the glasshouse experiment, all the treatments significantly reduced the incidence of *M. incognita* on papaya seedlings and improved growth of plants compared to untreated. Among the treatments the highest per cent reduction in total number of galls per root system, galls and egg masses per g of root was observed on carbofuran treated plants, but there was no significance among the treatments in respect of number of eggs per egg mass. With regard to different carbofuran rates the % reduction in number of root galls per g root at 1 g c.f. (67.6), 2 g c.f. (79) and 3 g c.f. (84.8) increased with the increase of dosage and significantly differed from each other. However, it was not significant in respect of number of root galls per root system and number of egg masses per g root among the different dosages. Neem cake at 5g/kg of soil was the most effective treatment after carbofuran at 3g c.f./kg of soil in reducing the number of galls per root system (80) and galls per g of root (8) compared to untreated. The effectiveness of the remaining treatments in relation to the control of *M. incognita*, based on number of galls per root system, was in the descending order of carbofuran c.f. 2 g, 1g, fenamiphos c.f. 1g, neem leaves 50 g and *P. lilacinus* 10g/kg of soil (Table I).

The treatments did not differ significantly with regard to number of leaves (Table II) but leaf area, shoot length and weight, root lenght and weight were significantly increased in the treatment with carbofuran at 3g c.f./kg of soil. This was the most effective treatment for the control of *M. incognita* and is in accordance with the findings of Gangadhara Nayak *et al.* (1990). The effect of this treatment in increasing the plant growth, except root length, was on a par with neem cake at 5g and carbofuran at 2 g c.f./kg of soil.

All the treatments were effective for the control of *M. incognita* on papaya in the field (Table III). Carbofuran at 2 g a.i./plant in a single application produced the best control of soil

TABLE I - *Control of* Meloidogyne incognita *on papaya in the glasshouse.*

Treatment (per kg soil)	No. of galls/ root system	No. of galls/ g root	No. of eggmasses/ g root	No. of eggs/ egg mass
Neem leaves 50g	40.0 (65.0)	4.0 (70.6)	1.4 (83.5)	184
Neem cake 5g	22.6 (80.2)	2.6 (80.9)	0.8 (73.4)	172
Paecilomyces lilacinus 10g	50.0 (56.2)	3.6 (73.5)	1.4 (53.5)	193
Fenamiphos 1g c.f.	37.0 (67.6)	3.4 (75.0)	1.2 (60.1)	193
Carbofuran 1g c.f.	24.8 (78.3)	3.0 (77.9)	1.2 (60.1)	178
Carbofuran 2g c.f.	24.0 (79.0)	2.8 (79.4)	0.8 (73.4)	166
Carbofuran 3g c.f.	17.4 (84.8)	2.4 (82.4)	0.6 (80.1)	180
Control	114.2	13.6	3.0	205
CD (P=0.05)	4.14	0.92	0.744	–

Figure in parantheses are percentage decrease over control.

TABLE II - *Effect of treatments on papaya growth in the glasshouse.*

Treatment per kg soil	Leaves		Shoot		Root	
	Number	Leaf area (cm^2)	Length (cm)	Weight (g)	Length (cm)	Weight (g)
Neem leaves 50g	8.0	28.6	18.2	12.1	12.6	7.8
Neem cake 5g	8.1	30.1	19.9	13.1	14.0	9.4
Paecilomyces lilacinus 10g	8.0	28.6	18.3	11.9	12.7	8.0
Fenamiphos 1g c.f.	8.0	28.8	18.3	12.2	13.2	8.8
Carbofuran 1g c.f.	8.0	29.6	18.4	12.6	13.5	9.0
Carbofuran 2g c.f.	8.1	30.1	19.7	12.8	13.8	9.6
Carbofuran 3g c.f.	8.2	30.5	20.0	13.2	14.2	9.7
Control	7.5	28.3	18.0	11.5	12.3	7.6
CD (P=0.05)	NS	0.49	0.36	0.57	0.24	0.39

TABLE III - *Control of* M. incognita *and yield of papaya in the field.*

Treatments/plant	Post treatment Nem. Pop.						Fruit yield		
	Before flowering			180 days after flowering			No. of fruits/tree	Mean fruit weight (kg)	Fruit yield/ tree (kg)
	Soil (200 cm^3)	Root (5g)	Total	Soil (200 cm^3)	Root (5g)	Total			
Farm yard manure 10 kg	248	24	272	308	48	356	19.4 (4.9)	0.622 (2.4)	12.07 (7.8)
Neem cake 1 kg	171	19	190	169	36	205	20.7 (11.9)	0.653 (7.6)	13.49 (20.4)
Neem cake 0.5 kg in two doses	207	22	229	228	44	272	19.4 (4.9)	0.641 (5.6)	12.42 (10.9)
Carbofuran 3G 1 g a.i	149	18	167	170	32	202	22.4 (21.1)	0.651 (7.3)	14.57 (30.1)
Carbofuran 3G 2 g a.i	93	12	105	117	20	137	24.4 (31.9)	0.673 (10.9)	16.65 (47.8)
Carbofuran 3G 1 g a.i in two doses	145	16	161	72	14	86	26.3 (42.2)	0.690 (13.7)	18.15 (62.0)
Paecilomycess lilacinus 40g	183	20	203	94	24	118	22.7 (22.7)	0.700 (15.3)	15.95 (42.3)
Control	498	53	421	570	89	659	18.5	0.607	11.20
CD (P=0.05)	0.64	0.18	0.06	0.10	0.03	0.45	0.96	0.01	0.65

Figures in parentheses are percentage of increase over control.

and root populations during the early stages of plant growth up to flowering. Treatment with same dosage of chemical but applied as two split applications at 1g a.i./plant before planting and at flowering was the most effective in the control of soil, root and total nematode populations of *M. incognita* before and after flowering. This supports the hypothesis that repeated application of systemic nematicides is necessary as their effect remains for only a short time in most plants (Thomson, 1987). Such results with carbofuran 3G at 1 and 2 g a.i./plant on the control of *M. incognita*, and *Rotylenchulus reniformis* on papaya in the field are in agreement with Jonathan *et al.* (1992) and Rajukannu *et al.* (1992).

The number of fruits per plant harvested from treated plants significantly differed from the untreated. It was maximum with carbofuran at 1g a.i./plant applied in two doses with an increase of 42.2% of fruits per plant. The highest mean fruit weight (0.7 kg) recorded in the treatment with *P. lilacinus* at 40 g/plant was on a par with the carbofuran at 1g a.i./plant applied in two doses, before planting and at flowering (0.69 kg). The same treatment of carbofuran at 1g a.i./plant in two doses also resulted in the highest fruit yield per plant, 62% over the untreated (Table III).

It is concluded that the application of carbofuran 3G at 3 g c.f./kg of nursery soil mixture and at 2 g a.i./plant in two equal split doses, before planting and at flowering, is effective in the control of *M. incognita* and improves plant growth and fruit yield of papaya.

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