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Efficacy of neem cake and carbofuran against root-knot nematode (*Meloidogyne incognita*) in ginger

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Abstract

An experiment was conducted regularly for nine years, for the management of root-knot nematode (*Meloidogyne incognita*) in ginger (*Zingiber officinale* Roscoe), under field conditions. Neem cake (@ 2.5 tones/ ha) and carbofuran 3 G (@ 3 kg a.i./ ha) were applied in the nematode infested field, individually and in combinations. Though, the nematode populations (2nd stage juvenile) decreased more in carbofuran treated plots, neem cake was found superior to carbofuran in increasing the crop yield. Neem cake and carbofuran when applied individually, at planting time and 45 days after planting, the former treatment improved 23.5 and 12.4 per cent more yield in comparison to the latter, respectively. However, contrary to this carbofuran decreased the juvenile populations 10.8-20.3 per cent more than neem cake in the two treatments, respectively.

Key words: *Meloidogyne incognita*, ginger, nematode management, neem, carbofuran.

Introduction

Ginger (*Zingiber officinale* Roscoe) an important spice crop throughout the world, is known to be susceptible to the nematodes, especially *Meloidogyne* spp. (Anonymous, 1988, Dohroo, 1990, Kaur and Sharma, 1988, Makhnotra, 1994). Annual yield losses ranging from 11- 80 per cent have been recorded due to root- knot nematode by various workers from India and abroad (Colbran, 1961, Charles, 1978, Mohapatra *et al.*, 1986, Willers, 1985, Parihar and Yadav, 1986, Anonymous, 1993). In India, Himachal Pradesh is one of the pioneer producers of this crop. For the last about a decade, the growers have been facing tremendous losses (up to 40 per cent) to their production every year (Anonymous, 1993), mainly due to nematode fungal complex, in which nematodes do play predominating role (Dohroo, 1990). From intensive survey studies, root-knot nematode (*Meloidogyne incognita*) is known to be a major nematode problem in ginger fields and facilitates the entry and multiplication of fungal pathogens (*Fusarium oxysporum* / *Pythium* spp.) thereby enhancing the severity of root rot disease (Kaur and Sharma, 1988).

In view of heavy loss to this crop due to the nematode infestation, studies were undertaken for its management through the application of neem cake and carbofuran.

Material and Methods

Experiment was conducted regularly for nine years in the Entomology farm of University of Horticulture and Forestry, Solan, HP. Neem cake and carbofuran were applied in six different treatments: T1: neem cake at planting T2: carbofuran at planting T3: neem cake at planting + carbofuran 45 days after planting T4: carbofuran at planting + neem cake 45 days after planting T5: neem cake 45 days after planting and T6: carbofuran 45 days after planting. Besides, there was one untreated check (T7). Crop was sown in 6m^2 beds. Each treatment was replicated four times. Neem cake was applied @ 2.5 tones/ha, while carbofuran @ 3 kg a. i. / ha. Agronomic practices were performed as per package of practices. Before treating the prepared fields, initial populations of the 2nd stage juveniles (J2) of the nematode were estimated. For this, a composite soil sample (approx. 500-1000 cc), made up of 4-5 sub-samples (each of 100- 200 cc soil) was collected from the field, before planting the crop. From thoroughly mixed composite sample, nematode population (J2) was assessed in only 200 cc soil by sieving and decanting technique. At harvesting, observations were recorded on nematode

(J2) population and yield per plot. Observations on the root gall index could not be recorded due to wide spread root system in the rhizosphere.

Results and Discussion

Yield: The results (Table 1) revealed the superiority of neem cake over carbofuran in all the treatments and during all the years of experimentation, except for the 1st year where carbofuran (applied 45 days after planting; T6) did show maximum yield (75.3 q/ ha). In the 2nd year, a treatment with neem cake at planting time + carbofuran 45 days after planting (T3) gave significantly higher yield (80.0 q/ ha), as compared to other treatments. In the 3rd and 5th year, the same treatment (T3) again showed considerably improved yields (134.5 and 165.0 q/ ha, respectively), in comparison to other treatments, excluding T1 (neem cake at planting) of both the years and T4 (carbofuran

Table 1. Effect of neem cake and carbofuran on ginger yield against the infestation of *M. incognita*

Year	Yield (q/ ha)							CD
	T1	T2	T3	T4	T5	T6	T7	(0.05)
1st	67.8 (4.1)	51.3 (3.1)	51.3 (3.1)	57.5 (3.5)	41.9 (2.5)	75.3 (4.5)	49.7 (3.0)	- (1.05)
2nd	62.5 (3.8)	47.5 (2.9)	80.0 (4.8)	50.0 (3.0)	60.0 (3.6)	47.5 (2.9)	37.5 (2.3)	- (0.62)
3rd	128.8 (7.7)	95.0 (5.7)	134.5 (8.1)	89.5 (5.4)	100.0 (6.0)	82.5 (4.9)	66.8 (4.0)	- (1.75)
4th	65.0 (3.9)	60.6 (3.6)	60.5 (3.6)	63.8 (3.8)	75.3 (4.5)	60.7 (3.6)	49.7 (3.0)	- (0.64)
5th	133.0 (8.0)	128.0 (7.7)	165.0 (9.9)	165.0 (9.9)	137.0 (8.2)	132.0 (7.9)	117.0 (7.0)	- (1.68)
6th	40.5 (2.4)	40.9 (2.5)	48.8 (2.9)	35.0 (2.1)	40.5 (2.4)	35.0 (2.1)	28.8 (1.7)	- (0.62)
7th	153.3 (9.2)	156.6 (9.4)	162.5 (9.8)	147.5 (8.9)	154.1 (9.3)	141.6 (8.5)	113.3 (6.8)	- (1.09)
8th	117.5 (7.0)	112.5 (6.8)	105.0 (6.3)	102.4 (6.1)	117.0 (7.0)	100.0 (6.0)	84.0 (5.0)	- (1.54)
9th	368.3 (22.1)	255.0 (15.3)	238.3 (14.3)	212.3 (12.7)	262.6 (15.7)	234.0 (14.0)	154.6 (9.3)	- (2.97)
Mean	126.3 (7.6)[a]	105.3 (6.3)[b]	116.2 (7.0)[ab]	102.5 (6.2)[b]	109.6 (6.6)[ab]	100.7 (6.0)[b]	77.9 (4.7)[c]	- (1.25)
% increase in yield over control	54.7	31.2	52.0	28.9	40.0	27.6	-	-

Figures in the parentheses denote yield in kg/ plot ($6m^2$)

at planting + neem cake 45 days after planting) of latter year. In the 6th year of experimentation although, yield was maximum again in T3, statistically it was at par to T1, T2 and T5. During 7th and 8th years of trial, whereas all the six treatments yielded considerably higher to control, it remained at par among one another. In the last year (9th) treatment T1 produced maximum and significantly higher yield in comparison to all other treatments. However, the remaining five treatments did produce considerably higher to check i.e. T7.

Overall results showed that all the six treatments improved the yield of ginger significantly over control. Highest yields could be harvested from the beds treated with neem cake at planting time; T1 (126.3 q/ ha) , followed by neem cake at planting + carbofuran 45 days after planting;T3 (116.2 q/ ha) and neem cake 45 days after planting; T5 (109.6 q/ ha). However, these yield variations were statistically at par to each other.

Pooled data of nine years (Fig 1) graded treatment T1 the best, as it increased the crop yield up to 54.7 per cent against the nematode infestation, followed by T3 (52.0%). It can also be concluded from the results that when neem cake and carbofuran were applied independently at planting time and 45

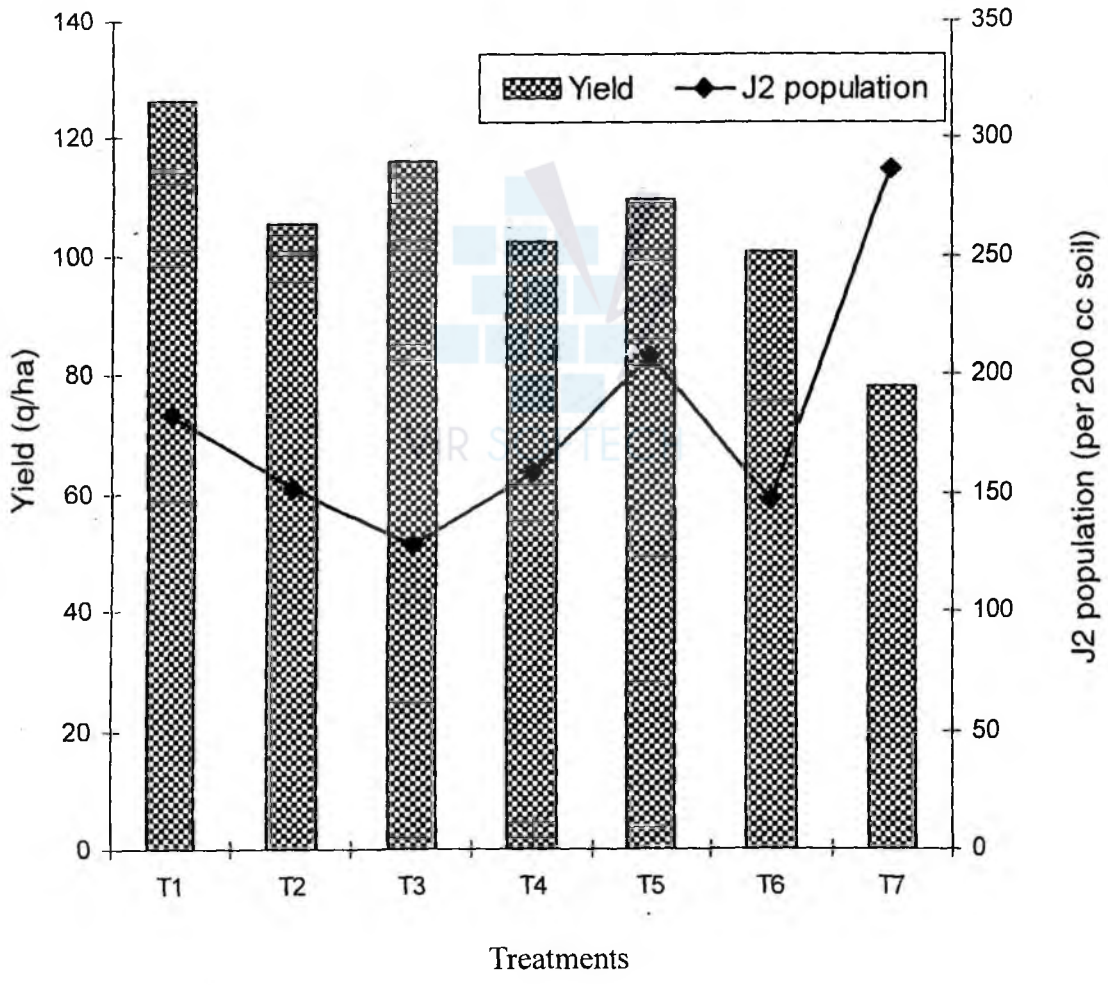


Fig 1. Impact of neem cake and carbofuron on the yield and root-knot nematode population in ginger

days after planting, the former treatment in comparison to the latter improved the yield to 23.5 per cent (54.7 and 31.2 %) and 12.4 per cent (40.0 and 27.6 %), respectively. Similar results have also been reported by Mohanty *et al.* (1992).

Nematode (J2) population: Carbofuran was found more effective to neem cake in reducing the nematode population (Table 2). Carbofuran when applied alone 45 days after planting (T6) and with neem cake (T3), harboured minimum population of 147 and 128 per 200 cc soil, respectively. Though, the neem cake alone also reduced the nematode population, the reduction was less in comparison to carbofuran. Excluding control, maximum nematode population (208) was

Table 2. Juvenile (J2) population of *M. incognita* in neem and carbofuran treated field

Year	J2 population/ 200 cc soil							CD
	T1	T2	T3	T4	T5	T6	T7	(0.05)
1st (50)	45	35	15	35	55	15	60	27.31
2nd (240)	150	140	120	190	210	120	130	79.69
3rd (650)	250	210	200	240	300	130	450	78.65
4th (280)	220	100	100	100	250	150	300	95.36
5th (200)	200	100	100	100	200	100	300	101.93
6th (300)	210	190	100	200	150	100	180	99.79
7th (200)	230	235	210	280	300	310	350	97.81
8th (150)	170	170	120	120	170	200	350	86.23
9th (200)	170	190	190	170	240	200	460	131.97
Mean	183^{bc}	152^{cd}	128^{d}	159^{c}	208^{b}	147^{c}	287^{a}	47.98
% decrease in J2 population over control	36.2	47.0	55.2	44.4	27.3	48.6	-	-

Figures in the parentheses denote initial nematode (J2) count.

recorded in plots treated with only neem cake after 45 days of planting (T5), followed by the plots applied with neem cake at planting time; T1 (183). It is also clear from the results (Fig 1) that maximum reduction (55.2 %) in J2 population of the nematode was achieved with the application of neem cake and carbofuran (T3), followed by applying only carbofuran 45 days after planting; T6 (48.6 %). Minimum reduction in the population over control was recorded with neem cake alone when applied 45 days after planting; T5 and at planting time; T1 (27.3 and 36.2 %, respectively).

From the overall observations it can be inferred that the more improved yield in neem cake treated plots against the infestation of *M. incognita* may be due to the following reasons;

i. During the microbial decomposition of organic amendments, volatile fatty acids are released in the soil, which are toxic to nematodes. Also, the process promotes the growth and multiplication of microfauna in the rhisosphere, which are parasitic and predatory to the phytoparasitic nematodes.

ii. It has manurial effect on the plant growth thus increases the tolerance of the plants against nematodes.

iii. It improves the soil conditions (texture, water holding capacity etc.) thus facilitate the plant growth and thereby masks the effect of nematode damage.

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