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Organic amendments for the management of *Meloidogyne incognita* in tuberose

G. JOTHI[1] and K. POORNIMA[2]*

[1]Department of Plant Protection, ADAC & RI, Trichy, Tamil Nadu Agricultural University, Tamil Nadu, India.
[2]Department of Nematology, Tamil Nadu Agricultural University, Coimbatore - 641003, Tamil Nadu, India.
E-mail: jothipugal@yahoo.co.in, poornimamurtysista@gmail.com

ABSTRACT: The efficacy of three oil seed cakes *viz.,* neem, castor and *mahua* were evaluated against root knot nematode, *Meloidogyne incognita* in tuberose under glass house conditions. There was a significant increase in plant growth and decrease in root knot damage in all the treatments compared to control. Among the treatments combination of neem cake with carbofuran recorded the highest flower yield (5.4g) with maximum reduction in nematode population (78 nematodes / 200 cc soil). The next best treatment was *mahua* with carbofuran (114 nematodes / 200 cc soil) for the management of *M. incognita* and improved the flower yield (4.6g) of tuberose.

Keywords: *Meloidogyne incognita*, oil cakes, tuberose

INTRODUCTION

A number of organic additives of plant origin, including oil seed cakes have been used as nematode controlling agents (Muller & Gooch, 982). The efficacy of organic amendments against nematodes depends on the chemical and physical properties of the amendments (Rodriguez - kabana, 1986). Nematicidal components are released from decomposing organic matter or synthesized by microorganisms involved in the decay process. The microbial byproducts are organic acids, hydrogen sulfide, phenols and tannins and nitrogenous compounds (Mian and Rodriguez - kabana, 1982).

Oilcakes and other organic manures are reported to be effective against population of root - knot, spiral, stunt, lesion and stubby root nematodes (Sunitha Devi and Debanand Das, 2016). The beneficial effects of organic amendments with respect to the suppression of plant pathogens, including nematodes and fungi, as well as fertilizing has been recognized in recent years. The aim of the present investigation was to evaluate the efficacy of oil seed cakes in combination with carbofuran against soil inhabiting plant parasitic nematode, *Meloidogyne incognita* on tuberose.

MATERIALS AND METHODS

Powdered oil cakes of castor (*Ricinus Communis* L.,) *mahua* (*Madhuca indica* Gmel.) and neem (*Azadirachta indica* Juss.) were applied at the rate of 10g/kg autoclaved soil contained in 16 x 20 cm earthen pots. The pots were watered after treatment to ensure proper decomposition of organic matter. After two, the healthy bulbs of tuberose were transplanted, one per pot. Three weeks latter the bulbs were inoculated with 2000 freshly hatched second stage juveniles of *M. incognita.* Fifteen days later 0.5g of carbofuran / pot was applied as per treatment. Untreated uninoculated pots served as control. Three replications were maintained for each treatment.

Observation on weights of shoot and root were taken and number of flowers per plant counted. Nematodes were separated from soil by using Cobb's sieving and decanting method followed by Baermann funnels (Cobb, 1918). The root gall index was recorded (Baker, 1985). All data from the experiment were subjected to analysis of variance (ANOVA).

In vitro Studies

Water Soluble Fractions (WSF) of the oil cakes were used to determine rate of mortality of *M. incognita* juveniles. The WSF was prepared by adding 2, 5 and 10 g oil cakes in 100 ml distilled water contained in 250 ml Erlenmayer flasks. After 10 days of decomposition, the suspensions were filtered through Whatman no. 1 filter paper and 10 ml each were transferred into Doncaster's counting dishes and the observations were made at 24 hours interval.

RESULTS AND DISCUSSION

A significant improvement was observed in plant growth parameters like plant weight, spike length, spike

Table 1. Management of *Meloidogyne incognita* by using oil cakes in tuberose.

Treatment	Shoot		Root		Gall Index	Nematode population /200cc soil	decrease in nematode (%)	Flower yield (g)	increase flower yield (%)	Spike length (cm)	Spike weight (g)
	weight (g)	length (g)	Weight (g)	Length (g)							
Castor cake @ 10g/kg soil	42.0	45.0	25.3	40.3	3.1	112	41.0	2.1	320	84.3	29.0
Neem cake @ 10g/kg soil	46.3	34.0	29.6	47.6	2.8	107	43.6	2.9	480	86.3	26.3
Mahua cake @ 10g/kg soil	46.3	19.3	22.6	40.0	2.3	123	35.2	3.1	520	108	30.4
T1+carbofuran @ 1 kg a.i./ha	38.3	31.3	22.6	53.3	3.0	106	44.2	1.4	180	94	23.0
T2+carbofuran @ 1 kg a.i./ha	33.3	50.3	24.0	53.6	2.0	78	58.9	5.4	980	108.3	28.0
T3+carbofuran @ 1 kg a.i./ha	23.6	20.3	37.3	20.0	2.6	114	40.0	4.6	820	96.6	30.0
Carbofuran alone @ 1kg a.i./ha	37.6	26.6	14.0	22.6	3.0	96	49.4	2.7	440	97.6	24.6
Nematode alone	49.3	32.0	22.3	51.3	4.6	190	-	0.50	-	90.0	23.0
Control	34.0	21.3	27.0	29.3	-	-	-	1.2	-	82.0	31.6
CD P=(0.05)	0.52	19.5	NS	29.34	0.10	31.2	-	2.39	-	22.4	12.3

Table 2. Effect of water soluble fractions of the oilcakes on *Meloidogyne incognita* juveniles in tuberose

Treatment (g of oilcakes/ 100ml distilled water)	Decomposition period (days)	Percent mortality after		
		12h	24h	48h
Castor				
2g	10	24	28	39
5g	10	37	48	55
10g	10	78	79	75
Neem				
2g	10	32	68	78
5g	10	65	68	87
10g	10	75	89	97
Mahua				
2g	10	23	25	34
5g	10	35	37	39
10g	10	48	54	65

weight and flower yield. The gall indices were reduced due to oil cake application. The population of plant parasitic nematodes increased in untreated pots. Inoculated plant grown in amended soil showed improvement in growth. Among the different soil organic amendments soil amended with neem cake and carbofuran not only resulted in the highest improvement in plant growth but also considerably reduced the nematode multiplication (58.9%) and root galling (Table 1). This was followed by *mahua* cake. Neem and neem cake with carbofuran gave the best results and among the treatments, carbofuran with neem gave the highest yield and lowest nematode population.

The *in vitro* studies showed that WSF severely affected the survival of the nematodes. Results were obtained for juvenile mortality which increased with increasing levels off oilcakes (Table 2) and also time. Among the oilcakes, neemcake was the best with 97% mortality at 48 h. Non of the juvenile regained mortality when transferred to distilled water.

Organic amendments induce a certain degree of resistance to nematodes by enhancement of phenols in the roots. Amino acids released during decomposition of organic amendments and also water soluble fractions of oil cakes are toxic to nematodes (Reddy *et al.,* 1975 & Khan *et al.,* 1975). Neem cake followed by Karanj cake were found to be effective in reducing *R. reniformis* and produce better plant growth of french bean (Mishra & Padhi, 1985). Combination of neem cake and neem leaf extracts with *Paecilomyces lilacinus* were found to be effective against root knot nematode in tuberose (Nagesh *et al.,* 1997 a ; Nagesh *et al.,* 1997 b). Badra *et al.*, (1979) believed that fatty acids and phenols produced during decomposition of oil cakes and chicken manure were nematicidal. Khan *et al.*, (1994) studies that ammonia released during decomposition of amendments was toxic to plant parasitic nematodes. The enzymatic activities are enhanced due to the application of organic materials for the control of *M. incognita* (Chavarria-Carvajal and Rodriguez-Kabana,1998). In greenhouse trials, 1% neem cake (mass/mass soil) caused a 67%–90% reduction in the number of lesion (*Pratylenchus penetrans)* and root-knot (*Meloidogyne hapla*) nematodes in tomato roots grown in three different soils. (Abbasi *et al.,*2005). Neem cake plus *G. fasciculatum* reduced the nematodes' multiplication and root-galling, and increased the plant growth of tomato as compared to unamended and *Meloidogyne incognita*-inoculated tomato plants. (Geeta Singh *et al.,* 2015). Application of neem cake @ 1 t/ha was effective in suppression of nematode and increased the growth parameters and yield in cucumber (Sunitha Devi and Debanand Das, 2016) and in green gram (Kshetrimayum and Das *et al.,* 2015)

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