Effect of Different Oil Cakes against Root Knot Nematode Infecting Tomato

[1]**Soumya Sucharita Mohanty,**
Research Scholar
Department of Botany,
MSCBD University, Baripada, Odisha
soumya.sucharita1@gmail.com
[2]**Kumanand Tayung,**
Associate Professor
Dept. of Botany, Gauhati University
Gopinath Bardoloi Nagar, Guwahati - 781014, Assam, India.

ABSTRACT

Root-knot nematode (*Meloidogyne incognita*) is a biotic limiting factor affecting the growth of tomato crop; it causes an annual yield loss of approximately 27.24% in India. To manage nematodes diseases farmers use chemicals like Cartap hydrochloride or Carbofuran. Most of these chemicals have adverse effects on environment and living organisms. The paper suggests certain biological management practices and eco-friendly approaches which could prove better option for farmers. In present paper, investigation experiments were conducted to evaluate the effectiveness of different oilcakes against root knot nematodes infecting tomato in pot cultures. Pot-culture experiment was conducted which is elaborated in the paper. Result reveals that the pot treated with neem cake showed improved plant growth rate and reduction in nematode infection as compared with other treated plants.

Key Words: Root-Knot Nematode, *M. incognita*, oil cakes, Carbofuran

1. INTRODUCTION

Vegetables are important constituents of Indian agriculture due to their short duration, high yield, nutritional richness, economic viability and ability to generate on-farm and off-farm employment. Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crops grown throughout the world. India is the second largest tomato producer and occupies second position amongst the vegetable crops in terms of production. Presently, tomato accounts for 879000 ha of the total area in India and contributes about 19402 MT of the total production with the productivity of 16.1 MT/ha (nhb.gov.in 2013-14). It is used for consumption in various forms. A number of viral

bacterial, fungal and nematode pathogens attack tomato and cause severe damage. Root-knot (*Meloidogyne spp*.) and Reniform (*Rotylenchulus reniformis*) nematodes are known to attack tomato crop in different parts of the world [1]. Tomato is regarded as the most favourable host for root-knot nematodes [2,3]. When these nematodes infect a plant, the symptoms and nature of damages can by observe i.e. the plant undergoes chlorosis, leaves and flowers will start turning yellow, wilting occurs, brownish necrotic spots on roots can be seen, stunted growth will be noticed and gall formation on roots can be a remarkable symptom (Fig. 1 & 2)[4,5]. Often the damage will be in sections or small parts of the plant rather than the entire plant. So in this case, only that section of the plant dies. But sometime the infection is so vigorous, that it destroys the entire plant. Root knot nematode causes an annual loss approximately 27.24% in tomato in India[6]. Among different species of *Meloidogyne*, *M. incognita* is the most widely distributed species on tomato in Odisha. Chemical nematicides are mainly used for the management of root knot nematodes in field condition.

However, the potential negative impacts on environment and ground water pollution have led to an urgent need for safe and more effective alternatives. Use of biological management practices against plant parasitic nematodes promises to be one of these alternatives. The oil seed cakes have shown great promise in nematode management strategies. Oil cakes change the physical and chemical properties of the soil which makes the soil atmosphere unfavourable for nematode activity and improves soil condition for greater root growth there by increasing the utilization of soil nutrients. Therefore, the present investigation was carried out to evaluate the effectiveness of essential oil cakes obtained from locally grown plants for the management of *M. incognita* infecting tomato[7-10].

2. MATERIALS AND METHODS

Seeds of tomato, *cv.* Pusa Ruby were obtained from AICRP on Nematodes in cropping system, OUAT, Bhubaneswar. The seeds were surface sterilized in 2.5% Sodium hypochlorite solution for two minutes followed by rinsing seeds thrice with distilled water followed by air drying in shade. The seeds were sown in 30 cm diameter earthen pots containing steam sterilized soil mixture. Three such pots were maintained in the net house. Light watering was done as and when necessary. Protocols are optimized for the better results. Each of the oil cakes @ 100g/m^2 was mixed thoroughly to the autoclaved soil (1kg) filled in separate surface sterilized 15cm dia. earthen pots followed by light watering. All these pots were maintained as such in the net house for a period of 7 days for proper decomposition of oilcakes. A chemical checks with carbofuran @ 0.3g

a.i./ m^2 was kept for comparison and mixed with pot soil. An inoculated check was also maintained. Hence, there were all together 6 treatments with 3 replications arranged in Completely Randomized Design. The treatments were

T_1 = Neem cake @ 100g/m^2

T_2 = Mahua cake @ 100g/m^2

T_3 = Groundnut cake @ 100g/m^2

T_4 = Mustard cake @ 100g/m^2

T_5 = Carbofuran @ 0.3g ai/ m^2

T_6 = Untreated check

Tomato seedlings raised in sterilized soil were transplanted in the pots (1 in each pot). Fifteen days old seedlings were used for transplanting in pot culture experiments. At one week after transplanting thousand freshly hatched second stage juvenile of *M. incognita* were inoculated to each pot followed by a light watering. This experiment was terminated after 45 days of inoculation during which care of each seedlings and other intercultural operations were attended regularly. After 45 days of inoculations, the data of fresh shoot and root weight, dry shoot and root weight, shoot and root length, number of gall/plant, final nematode population in soil and roots were recorded. These data were analyzed by single factor ANOVA. Least significant difference (LSD) was calculated at $P \leq 0.05$ for each variable [11].

3. RESULTS AND DISCUSSION

Table 1 & 2 show the effectiveness of four different oil cakes against root knot nematode infection and multiplication in both soil and root. Soil treatments with different oil cakes not only reduced the damage from root knot infestation but also improved plant growth parameters significantly. Application of neem cake @ 100g/m^2 resulted maximum increase of plant growth parameters in comparison to untreated check where as it was minimum with the incorporation of mustard oil cake. Neem cake caused 85.9, 58.9, 81.7, 90.1, 89.8 and 91.2% significant increase in shoot length, fresh shoot weight, dry shoot weight, root length, fresh root weight and dry root weight respectively. This was followed by Mahua cake with 73.8, 49.1, 64.8, 63.7, 75.0 and 66.8% increase over control in the above parameters. In the contrary, least significant increase was observed in these parameters with incorporation of mustard oil cake. [12]

With regards to nematode infection, it was noticed that all the treatments could significantly reduced the number of galls as well as nematode multiplication in both soil and tomato root. Neem cake treatment effectively decreased the number of galls by 73.1 % followed by mahua cake (64.1%) as compared to the untreated one. Root knot nematode multiplication in both soil and root was also reduced to the maximum with the incorporation of neem oilcake. This treatment could result 64.5 and 67.5% decrease of nematode multiplication in both soil and root, respectively. Mustard oil cake was least effective in decreasing the number of galls as well as restricting the nematode multiplication as compared to all other treatments.[13,14]

4. CONCLUSION

Our results with respect to the effect of oil cakes are in general conformity with those of Goswami *et al*. (2007) & Ashraf and Khan (2007) [15,16]. Similar findings were also reported by several workers who opined that neem cake was the best non-chemical alternative for the management of root knot nematode infecting tomato (Kalaiarasan *et al*., 2007), (Khan & Rathi, 2001), (Tariq & Siddiqui, 2005) [17-19].

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Table Legends:

Table 1: Effectiveness of oil cakes against *M. incognita* on shoot growth parameters of tomato.

Table 2: Effectiveness of oil cakes against *M. incognita* on root growth parameters of tomato.

Table 3: Effectiveness of oil cakes on root knot nematode multiplication infecting tomato.

Figure Legends:

Figure 1: Root Knot Nematode Infection (Chlorosis) in Tomato Plants

Figure 2: Infected Root of tomato with a number of galls

Table 1. Effectiveness of oil cakes against *M. incognita* on shoot growth parameters of tomato

Treatments	Shoot length (cm)	% Increase	Fresh shoot wt. (g)	% Increase	Dry shoot wt. (g)	% Increase
T1=Neem cake@ 100g/m^2	68.74	85.93	64.5	58.86	12.90	81.69
T2=Mahua cake@ 100g/m^2	64.27	73.84	60.53	49.08	11.70	64.78
T3=Groundnut cake@ 100g/m^2	50.64	36.97	51.96	27.98	9.23	30.00
T4=Mustrad cake@ 100g/m^2	46.74	26.42	48.67	19.87	8.50	19.71
T5=Carbofuran@ 0.3g ai/ m^2	56.23	52.09	55.84	37.53	10.40	46.47
T6=Untreated check	36.97	-	40.60	-	7.10	-
S.E.M (0.05)	**2.21**	**-**	**1.90**	**-**	**0.37**	**-**
L.S.D.(0.05)	**5.91**	**-**	**5.07**	**-**	**1.01**	**-**

Table 2. Effectiveness of oil cakes against *M. incognita* on root growth parameters of tomato

Treatments	Root length (cm)	% Increase	Fresh root wt. (g)	% Increase	Dry root wt. (g)	% Increase
T1=Neem cake@ 100g/m^2	32.94	90.07	20.50	89.81	6.50	91.17
T2=Mahua cake@ 100g/m^2	28.37	63.70	18.90	75.00	5.67	66.76
T3=Ground nut cake@ 100g/m^2	19.10	10.21	13.77	27.50	4.10	20.58
T4=Mustrad cake@ 100g/m^2	17.94	3.51	12.47	15.46	3.90	14.70
T5=Carbofuran@ 0.3g ai/ m^2	22.54	30.06	15.50	43.51	4.90	44.11
T6=Untreated check	17.33	-	10.80	-	3.40	-
S.E.M (0.05)	(0.77)		(0.79)		(0.16)	
L.S.D.(0.05)	(2.06)		(2.12)		(0.42)	

Table 3: Effectiveness of oil cakes on root knot nematode multiplication infecting tomato

Treatments	No. of galls/ plant	% decrease	Final Nematode population			
			200cc soil	% decrease	5g root	% decrease
T1=Neem cake @ 100g/m^2	281.67 (2.45)	73.08	680 (2.83)	64.49	123.67 (2.09)	67.45
T2=Mahua cake @ 100g/m^2	376.00 (2.57)	64.06	865.33 (2.94)	58.62	189.33 (2.27)	50.17
T3=Ground nut cake @ 100g/m^2	726.67 (2.86)	30.55	1540.33 (3.19)	26.35	307.33 (2.49)	19.12
T4=Mustrad cake @ 100g/m^2	834.00 (2.92)	20.29	1704.67 (3.23)	18.50	348.33 (2.54)	8.33
T5=Carbofuran @ 0.3g ai/ m^2	563.67 (2.75)	46.12	1186.67 (3.07)	43.26	264.33 (2.42)	30.43
T6=Untreated check	1046.33 (3.02)	-	2091.67 (3.32)	-	380.00 (2.58)	-
S.E.M (0.05)	**(0.03)**	-	**(0.01)**	-	**(0.02)**	-
L.S.D.(0.05)	**(0.09)**	-	**(0.03)**	-	**(0.07)**	-

Figure:1- Root Knot Nematode Infection (Chlorosis) in Tomato Plants

Figure:2- Infected Root of tomato with a number of galls