

Original Research Article

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Management of Root Knot Nematode (*Meloidogyne incognita*) in Tomato (cv. Pusa ruby) using Different Oil Cakes

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ABSTRACT

A replicated pot culture experiment was conducted to study the comparative efficacy of different oil cakes on management of root knot nematode (*Meloidogyne incognita*) infecting tomato. The results revealed that barring the untreated check, all other treatments significantly increased the plant growth parameters, total chlorophyll content and reduced root knot nematode population as well as number of galls. Among various treatments, T₈ where neem cake @ 100g/m² and T₇ where mahua cake 100g/m² were applied in pot soil, resulted plant growth parameters, total chlorophyll content and population growth of root knot nematode were found statistically at par. Both the aforesaid T₈ and T₇ treatments performing better than others contributed significantly as percentage of increase in plant height by 85.91% and 73.84%, fresh shoot weight by 60.66% and 55.85%, root length by 89.50% and 78.43%, fresh root weight by 87.04% and 78.98%, total chlorophyll content by 83.09% and 72.88% with corresponding decrease in order of number of root galls by 78.91% and 68.06% over untreated inoculated check (T₁₀). Though T₇ and T₈ exhibited better results as compared to other treatments and over check (T₁₀), yet in view of easy availability and low management option, application of neem oil cake @ 100g/m² in T₈ is considered the most promising management option against root knot nematode (*Meloidogyne incognita*) infecting tomato.

Keywords

Different oil cakes,
Carbofuran, Chlorophyll,
Meloidogyne incognita,
Solanum lycopersicum

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Introduction

Tomato (*Solanum lycopersicum* L.) belonging to the family Solanaceae is one of the most important and nutritive vegetable crop grown all over the world. India is the second largest tomato producer and occupies second position amongst the vegetable crops in terms of production. Among the major biotic factors that affect the tomato production, root knot nematode (*Meloidogyne incognita*) is the most serious pest causing considerably low yield in

all parts of India. Root knot nematode causes an annual loss approximately 27.24% in tomato in India (Jain *et al.*, 2007). Among different species of *Meloidogyne*, *M. incognita* is the most widely distributed species on tomato in Odisha. Management of nematode problems by applying chemical pesticides causes serious concern about environment and human health and also has residual toxicity which persists for more than 45 days affecting beneficial soil microbes. Therefore, incorporation of cultural and use of biocontrol

agents including organic amendments and botanicals have been regarded to be effective against nematode infestations. Organic amendments like oil cakes can provide safe and pollution free control of plant parasitic nematodes. Oil cakes change the physical and chemical properties of the soil which makes the soil atmosphere unfavorable for nematode activity and improves soil condition for greater root growth there by increasing the utilization of soil nutrients.

Therefore, an attempt was made to evaluate the efficacy of certain organic amendments and carbofuran 3G both individually under field condition to manage root-knot nematode problem infecting tomato.

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.

Each of the oil cakes @ 100g/m² were 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 ai/ m² was kept for comparison and mixed with pot soil. An inoculated check was also maintained. Hence, there were all together 10 treatments with 3 replications arranged in Completely Randomized Design (CRD). The treatments were

T₁ – Soil application of Karanja oil cake @ 100g/m²

T₂ - Soil application of Mustard oil cake @ 100g/ m²

T₃ - Soil application of Jatropha oil cake @ 100g/ m²

T₄ - Soil application of Groundnut oil cake @ 100g/ m²

T₅ - Soil application of Polango oil cake @ 100g/ m²

T₆ - Soil application of Kusum oil cake @ 100g/ m²

T₇ - Soil application of Mahua oil cake @ 100g/ m²

T₈ - Soil application of Neem oil cake @ 100g/ m²

T₉ - Soil application of Carbofuran @ 0.3g a.i. / m²

T₁₀ - Untreated inoculated 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 plant height and root length, fresh shoot and root weight, number of galls per plant, and also total chlorophyll content in leaves were recorded. Various observations recorded from

different treatments and tabular data were subjected to statistical analysis for each parameter for comparison of different treatments following Fisher's method of analysis of variance at 5% level.

Results and Discussion

The effect of different oil cakes like karanja, mustard, jatropha, groundnut, polango, kusum, mahua and neem were estimated on the basis of the differential changes in plant growth parameters (Plant height, fresh and dry shoot weight) and nematode infection parameter as number of galls and also total chlorophyll content in leaves.

The data (Table 1) indicated that there was progressive increase in plant growth parameters in respect of plant height, fresh shoot and root weight in all treatments over untreated check. Application of neem cake @ 100g/m² 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 85.91%, 60.66%, 89.50% and 87.04% significant increase in plant height, fresh shoot weight, root length and fresh root weight respectively. This was followed by Mahua cake with 73.84%, 55.85%, 78.43% and 78.98% increase over control in the above parameters. In the contrary, least significant increase was observed in these parameters with incorporation of mustard oil cake. This result corroborates with the findings of Rathar and Siddiqui (2007) and Kalaiarasan *et al.*, (2007) that proved the effectiveness of oilcakes improving plant growth and reducing nematode population in tomato. Increased microbial activity in amended soil is to bring about increased conversion of nitrogen to nitrate form, resulted ultimately in increased metabolic activity of plants and plant growth (Prasad and Tomar, 2007). This supports the findings in T₈ (neem oil cake @100g/m²)

where there is better growth of tomato plant. Singh *et al.*, (2009) and Sreenivasan (2010) applied neem oilcakes and found significant increase in the plant growth and decrease in root knot nematode population in green gram and medicinal coleus respectively. Similar observation was also reported by Srivastava, (2002) in papaya.

The results were also in conformity with the work of Bhattacharya and Goswami, (1989) who observed that significant increase in plant growth in crops treated with neem cake infected by *M. incognita*. Neem cake at 80 q/ha was found to be more effective than carbofuran at 2 kg a.i. /ha in reducing root-knot nematode population and enhanced plant growth on tomato (Jain and Gupta, 1997).

So far as population growth of *M. incognita* is concerned, data (Table 2) indicated that there was decline in number of galls in all treatment over untreated check. Singh *et al.*, (2009) and Sreenivasan (2010) also observed similar results with use of oilcakes. Highest reduction in galls was noticed in treatment having neem oil cake (248.33) followed by mahua oil cake (376) than untreated check (1177.33). Highest reduction in percentage of galls was noticed in T₈ (78.91%) followed by T₇ (68.06%), T₆ (61.81%), T₉ (52.12%), T₅ (41.96%), T₄ (38.28%), T₁ (29.16%), T₂ (16.65%) and T₃ (11.13%) over check in descending order. This finding was agreement with the findings of Cavoski *et al.*, (2011) and Mehlhom *et al.*, (2011). They reported that neem is one of the most important botanical pesticides which possess fungicidal, nematicidal, bactericidal molluscicidal, diuretic and antiarthritic properties. Singh *et al.*, (2012) reported in chickpea that ammonia, hydrogen sulphide and phenolic compounds were released following the decomposition of organic additives in the soil. These compounds were found detrimental to the population build-up of nematodes *in vitro*.

Table.1 Influence of *Meloidogyne incognita* in different oilcakes on plant growth parameters of tomato cv. Pusa ruby

(Average of 3 replications)

Treatments	Shoot Length (cm)	Percentage of increase	Fresh Shoot Weight (g)	Percentage of increase	Root length (cm)	Percentage of increase	Fresh Root Weight (g)	Percentage of increase
T ₁ (Karanja oilcake @ 100g/m ²)	46.74	26.43	48.67	18.71	18.13	14.03	12.77	18.24
T ₂ (Mustard oilcake @ 100g/m ²)	44.7	20.91	46.6	13.66	17.70	11.32	12.07	11.76
T ₃ (Jatropha oilcake @ 100g/m ²)	41.23	11.52	45.17	10.17	17.50	10.06	11.9	10.19
T ₄ (Groundnut oilcake @ 100g/m ²)	50.63	36.95	51.97	26.76	20.53	29.12	14.1	30.56
T ₅ (Polango oilcake @ 100g/m ²)	52.7	42.55	52.97	29.20	21.03	32.26	15	38.89
T ₆ (Kusum oilake @ 100g/m ²)	62.33	68.60	58.5	42.68	26.37	65.85	17.93	66.02
T ₇ (Mahua oilcake @ 100g/m ²)	64.27	73.84	63.9	55.85	28.37	78.43	19.33	78.98
T ₈ (Neem oilcake @ 100g/m ²)	68.73	85.91	65.87	60.66	30.13	89.50	20.2	87.04
T ₉ (Carbofuran@1kg a.i/ha)	56.23	52.10	55.83	36.17	23.83	49.87	16.63	53.98
T ₁₀ (Untreated check)	36.97	-	41	-	15.90	-	10.8	-
S.E. (m)	2.12	-	1.72	-	0.75	-	0.43	-
L.S.D (0.05)	6.27	-	5.08	-	2.21	-	1.27	-

Table.2 Effects of oil cake on number of galls in roots and chlorophyll content of leaves in tomato cv. Pusa ruby infected by *Meloidogyne incognita*

(Average of 3 replications)

Treatments	No. of Galls	Percentage of decrease	Total Chlorophyll content (mg/g)	Percentage of increase
T ₁ (Karanja oilcake @ 100g/m ²)	834 (2.92)*	29.16	1.55	42.20
T ₂ (Mustard oilcake @ 100g/m ²)	981.33 (2.99)	16.65	1.54	41.28
T ₃ (Jatropha oilcake @ 100g/m ²)	1046.33 (3.02)	11.13	1.47	34.86
T ₄ (Groundnut oilcake @ 100g/m ²)	726.67 (2.86)	38.28	1.66	52.29
T ₅ (Polango oilcake @ 100g/m ²)	683.33 (2.83)	41.96	1.73	58.72
T ₆ (Kusumoilake @ 100g/m ²)	449.67 (2.65)	61.81	1.83	67.89
T ₇ (Mahua oilcake @ 100g/m ²)	376 (2.57)	68.06	1.92	76.15
T ₈ (Neem oilcake @ 100g/m ²)	248.33 (2.37)	78.91	1.99	82.57
T ₉ (Carbofuran@1kg a.i/ha)	563.67 (2.75)	52.12	1.82	66.97
T ₁₀ (Untreated check)	1177.33 (3.07)	-	1.09	-
S.E. (m)	0.048	-	0.03	-
L.S.D (0.05)	0.14	-	0.08	-

*Figures in parentheses indicate log transformed values

With regards to data (Table 2), it was noticed that application of oilcakes significantly increased the chlorophyll content in leaves of tomato plant. Neem cake treatment effectively increased the chlorophyll content by 73.1 % followed by mahua cake (64.1%) as compared to the untreated one. Similarly, mustard oil cake was least effective in increasing the chlorophyll content of the leaves as compared to all other treatments. Siddiqui and Akhtar (2008) observed that the increase in chlorophyll contents in leaves in the presence of decomposed organic wastes is due to increase in N uptake by the addition of organic compounds resulted in increased photosynthetic efficiency, translocation of nutrients, and other metabolites toward formation of fruits. Similarly, Oka *et al.*, (2007) reported that nitrogen content in form of ammonium present in organic amendments which is more harmful to nematodes.

To conclude with the present investigation, it was evident that the application of neem oil cake @ 100g/m² and mahua oil cake @ 100g/m² provided better for management but in view of easy availability and low management option, application of neem oil cake @ 100g/m² in T₈ is considered the most promising management option against root knot nematode (*Meloidogyne incognita*) infecting tomato. However, it is worthwhile to study the efficacy of the treatment in the field condition for more meaningful result in managing root-knot nematode.

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