

Original Research Article

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## Efficacy of Different Oil Cakes on Management of Root Knot Nematode (*Meloidogyne graminicola*) in Rice Crop in Western Uttar Pradesh, India

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### ABSTRACT

Rice is one of the most important food crops in the world. In India, rice contributes 43 per cent of the total food grain production and 46 per cent of the total cereal production. Rice crop is affected by many fungal, bacterial, viral and nematode diseases. Among the nematodes, rice root knot nematode (*M. graminicola*) is considered as a major problem in rice crop. In present study, a pot experiment was conducted to test the efficacy of oil cake against rice root knot nematode. In this experiment, eight oil cakes viz. Neem, cotton, linseed, groundnut, sunflower, sesamum, mustard and mahua oil cake were taken. It was observed that many tested oil cake significantly reduced the galls/plant. Among all the cakes were found most effective against nematode infestation in rice root, at the 60 DAS, minimum 1.89 galls/plant were recorded, when mahua cake was applied at @ 50 gm/5kg soil, whereas in control pot 14.44 galls/plant was recorded. Most of tested oil cakes were also found effective in increase for the growth parameters (shoot length, root length, shoot weight and root weight) of rice plant.

#### Keywords

*Meloidogyne graminicola*, Oil cakes, Root galls, Rice

#### Article Info

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### Introduction

Rice (*Oryza sativa* L.) belong to family Poaceae (Gramineae). Rice is the food of more than 60 % of the world's population. China and India are the largest rice producing and consuming countries in the world. India produced 106.4 m tonnes of rice and made rice 40% contribution to the total food grain production of the country (Anonymous, 2014).

Rice production is affecting by biotic and abiotic stresses. In the abiotic stresses, major limiting factors are environmental conditions such as type of soil, rainfall, irrigation

facilities etc. In these biotic stresses various pathogens *i.e.* nematodes, fungi, bacteria and viruses etc. affect rice crop adversely. Among the diseases problem, white tip, root nematode and root knot diseases are the major rice problem causes by nematode.

More than 200 species of plant parasitic nematode have been reported to be associated with rice. Among them, the rice root-knot nematodes (*Meloidogyne* sp.) are considered as the major problem in rainfed, upland and lowland rice fields. The rice root-knot nematode (*M. graminicola*) attacking rice and wheat, is considered the most serious problem

in upland rice cultivation and causes economic losses in upland, lowland, deep water rice and also in rice nurseries (Bridge *et al.*, 1990).

The rice root-knot nematode (*M. graminicola*) having established endoparasitic pest of nurseries and main crop. Nematode survives as eggs or second – stage juveniles in root pieces or soil; spread with infested soil, water and infected seedling. In India, the rice root-knot nematode has been recorded from Jammu & Kashmir, Kerala, Haryana, Himachal Pradesh, Punjab, Uttar Pradesh and Andaman Island (Singh *et al.*, 2007; Sheela *et al.*, 2005; Dabur and Jain, 2005; Pankaj *et al.*, 2010, 2011) etc. Nematode infection results in growth reduction reduced tillering, chlorosis of young plants, production of unfilled spikelet and late maturity. On roots the nematode incites the formation of terminal galls which are hooked or horse-shoe shaped (Swain and Prasad, 1988).

Root-knot nematode alone is capable of causing upto 50% yield loss in rice in many production regions (Lorenzana *et al.*, 1998). In India, it is reported to cause 17-30% yield loss due to poorly filled kernels (Mac Gowan, 1989; Jain *et al.*, 2007). The use of rice seedlings from non-treated nursery beds has resulted in yield loss of rice grain of 38% in comparison to 29% when rice seedlings from treated nursery beds were used (Gaur, 2003). In Rice – Wheat cropping system, introduction of resource conservation technologies (RCTs), has been found helpful in increasing the pre plan of this nematode (*Meloidogyne graminicola*) (Pankaj *et al.*, 2006).

## **Materials and Methods**

### **Experimental site**

The pot experiments were carried out in the premise of college of Agriculture and laboratory experiments were conducted in

“Nematology laboratory”, Department of Plant Pathology, College of Agriculture, situated in the main campus of the S.V.P. University of Agriculture & Technology, Meerut, (U.P.).

### **Preparation of pure culture of *Meloidogyne graminicola***

To maintain the pure culture of *M. graminicola*, nematode infected rice roots were collected from rice fields from Crop Research Centre (CRC), S.V.P. University of Agriculture & Technology, Meerut, (U.P.). Nematode infested rice roots were brought to the laboratory, the roots were washed properly then these roots were grinded by the grinder. Through grinding process, eggs and juvenile came out from infected rice root which were used as inoculums to inoculated the rice seedling grown in sterilised soil in earthen pot (30c.m.), to maintain the same culture of *M. graminicola* to further study. Three weak old rice plants were transplanted into the pots containing steam sterilized soil and inoculated with egg and J<sub>2</sub> of *M. graminicola*.

### **Preparation of pot experiment**

Pot experiment was conducted to check the effect of oil cake against infestation of rice root knot nematode. The experiment was conducted in a Complete Randomized Design (CRD) with seventeen treatment and three replications in pots. Pot having capacity of 5 Kg soil/ pots were filled with nematode infested soil.

The cakes were mixed in the pot soil 8 days before of seed sowing. Oil cakes were added in the pots according to the treatments (25 and 50 gm/5kg soil). Three replication were maintained for each treatment. Pots without oil cakes were maintained as control. Twenty seeds/pot of variety PB-1121 after soaking in water for overnight were sown after 8 days of

cake addition. Plants were maintained by providing timely irrigation and weeding etc.

## Results and Discussion

### Management of rice root knot nematode (*Meloidogyne graminicola*)

#### Use of different oil cakes

A pot experiment was conducted to test the efficacy of eight oil cakes viz. Neem, cotton, linseed, groundnut, sunflower, sesamum, mustard and mahua against rice root knot nematode.

The results on plant growth parameters and nematode infestation by adding various doses of oil cakes (represent in Table 1).

#### Effect of oil cakes on galls/plant at 60 DAS (Day After Sowing)

Data of (Table 1 and Fig. 2) indicates results of oil cakes on number of galls/plant. Minimum 1.89 galls/plant were recorded in mahua followed by 2.11, 2.44, 3.00, 3.56, 4.00 and 5.00 galls/ plant in case of linseed, sesamum, sunflower, cotton, mustard and neem cake respectively when applied @ 50gm/5kg soil.

Average 5.22, 5.56, 5.67 and 5.67 galls/ plant were recorded in case of sunflower, groundnut, mustard and mahua, respectively when applied @ 25gm/5kg soil.

Among all the tested oil cakes maximum 10.44 galls/ plant were recorded in case of linseed @ 50gm/5kg soil as compare to 14.89 galls /plant recorded in case of control.

Javed *et al.*, (2008) evaluated the potential of combining *P. penetrans* and neem (*Azadirachta indica*) formulations as a management system for root-knot nematode on tomato and reduced the root galling index

### Effect of oil cakes on plant growth parameters

#### Shoot length

Data of (Table 1 and Fig. 1) indicates that all tested oil cakes increased shoot length significantly as compare to control. At the 60 DAS, maximum shoot length 48.56 cm was recorded in case of linseed followed by 44.22, 44.11, 41.56 and 41.22cm in mahua, cotton, groundnut and sunflower oil cakes, respectively when applied @ 50gm/5kg soil.

Rice plants with average (40cm) shoot length were recorded in case of mustard oil cake followed linseed (38.33cm), sesamum (38.22 cm) and cotton (38.22cm) when applied @ 25 gm/5kg soil.

Whereas, minimum shoot length (28.56 cm) at 60 day after sowing was recorded in control. Ashraf and Khan (2010) highest improvement in plant growth and best protection against *M. javanica* was obtained by the integration of *P. lilacinus* with groundnut cake.

#### Root length

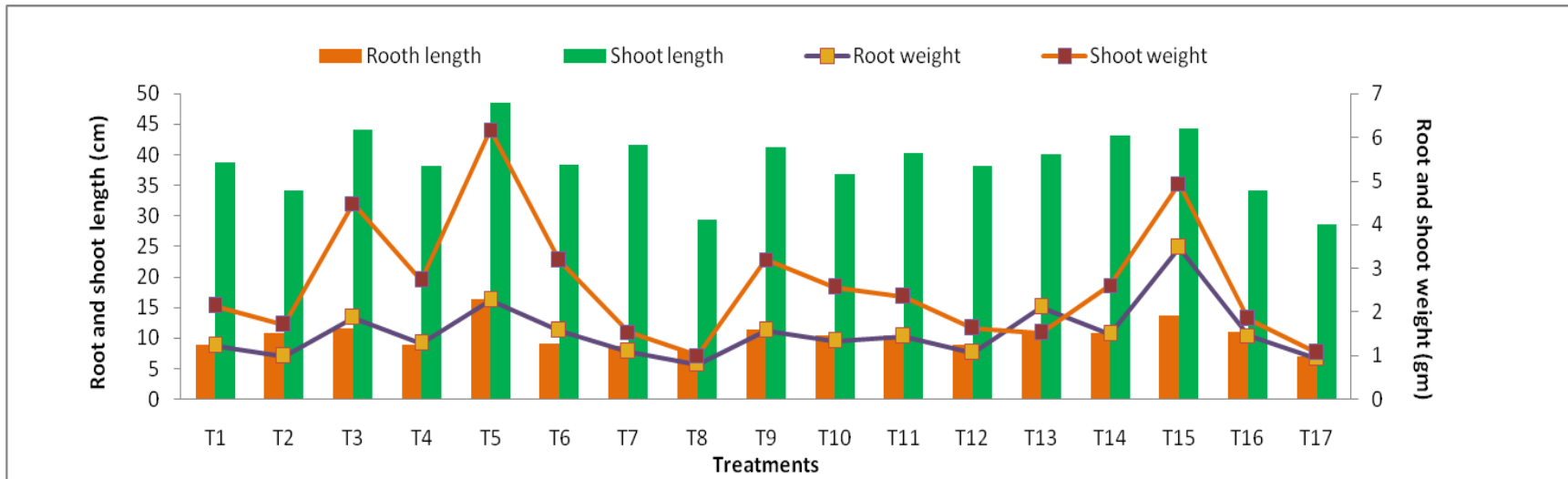
Data of (Table 1 and Fig. 1) indicates that all tested oil cakes increased root length significantly as compare to control. Maximum 16.44cm root length was recorded in linseed followed by 13.61, 11.61, and 11.39 cm in case of mahua, cotton and sunflower oil cakes, respectively when applied @ 50gm/5kg soil. Rice plants in mahua @ 25gm/5kg was recorded with 11 cm root length followed by mustard @ 50gm/5kg soil (10.78 cm), mustard oil cake @ 50gm/5kg soil (10.78 cm) and neem @ 25/5kg soil (10.72 cm).

Among the oil cake extract, minimum shoot length (7.89) was recorded in groundnut @ 25gm/5kg soil as compare to untreated control (7.06 cm).

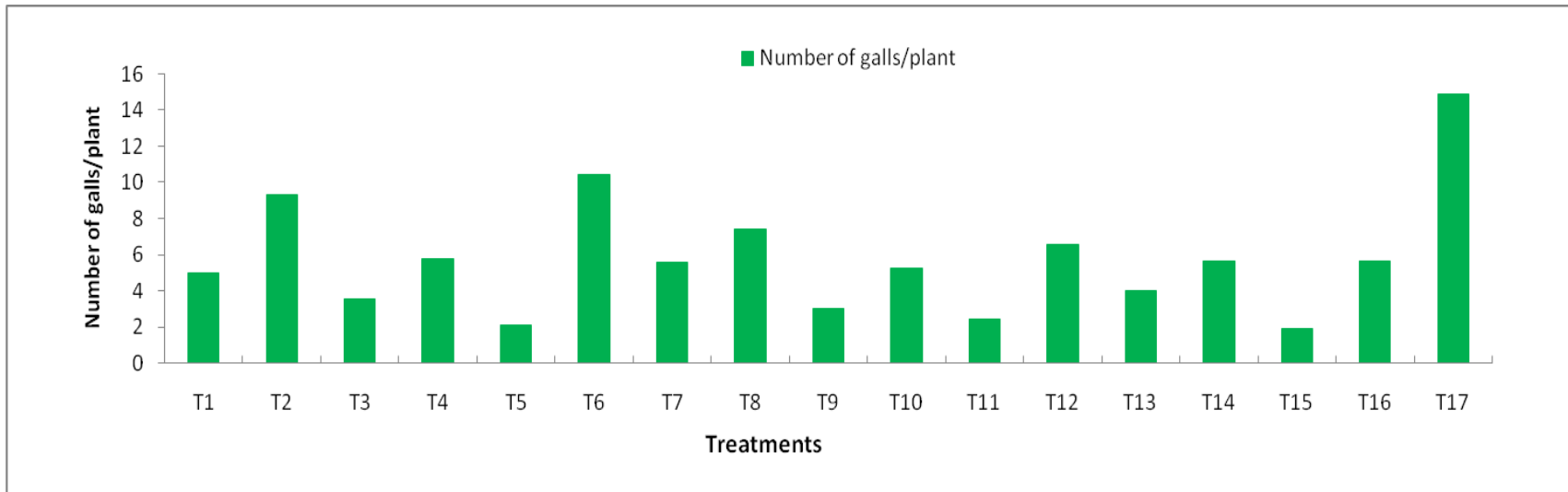
**Table.1** Effect of oil cakes on growth parameter and gall per plant, shoot and root length (cm), shoot and root weight (gm) at 60 DAS

Treatment	Treatment Details	Doses	Number of galls/plant	Shoot length	Root length	Shoot weight	Root weight
T <sub>1</sub>	NEEM	50gm/5kg soil	5	38.67	8.89	2.14	1.23
T <sub>2</sub>	NEEM	25gm/5kg soil	9.33	34.11	10.72	1.71	0.99
T <sub>3</sub>	COTTON	50gm/5kg soil	3.56	44.11	11.61	4.48	1.87
T <sub>4</sub>	COTTON	25gm/5kg soil	5.78	38.22	8.89	2.72	1.28
T <sub>5</sub>	LINSEED	50gm/5kg soil	2.11	48.56	16.44	6.17	2.27
T <sub>6</sub>	LINSEED	25gm/5kg soil	10.44	38.33	9.06	3.18	1.57
T <sub>7</sub>	GROUNDNUT	50gm/5kg soil	5.56	41.56	8.67	1.54	1.09
T <sub>8</sub>	GROUNDNUT	25gm/5kg soil	7.44	29.44	7.89	1.00	0.80
T <sub>9</sub>	SUNFLOWER	50gm/5kg soil	3	41.22	11.39	3.19	1.57
T <sub>10</sub>	SUNFLOWER	25gm/5kg soil	5.22	36.89	10.44	2.57	1.33
T <sub>11</sub>	SESAMUM	50gm/5kg soil	2.44	40.33	10.44	2.35	1.44
T <sub>12</sub>	SESAMUM	25gm/5kg soil	6.56	38.22	8.94	1.63	1.06
T <sub>13</sub>	MUSTARD	50gm/5kg soil	4	40	10.78	1.52	2.11
T <sub>14</sub>	MUSTARD	25gm/5kg soil	5.67	43.11	10.78	2.61	1.50
T <sub>15</sub>	MAHUA	50gm/5kg soil	1.89	44.22	13.61	4.94	3.47
T <sub>16</sub>	MAHUA	25gm/5kg soil	5.67	34.22	11	1.84	1.46
T <sub>17</sub>	CONTROL		14.89	28.56	7.06	1.07	0.93
<b>CD at 5%</b>			<b>1.736</b>	<b>2.92</b>	<b>2.31</b>	<b>1.334</b>	<b>0.743</b>

**Fig.1** Effect of oil cakes on growth parameter shoot length, root length (cm) and root weight shoot weight (gm) at 60 DAS



**Fig.2** Effect of oil cakes on no. of galls/plant in pot experiment at 60 DAS



### Shoot weight

Data (Table 1 and Fig. 1) indicates that all tested oil cakes increased shoot weight significantly as compare to control. Maximum rice shoot weight (6.17 gm) was found in linseed @ 50gm/5kg soil which was statistically significant than other treatments. Rice plants in mahua were recorded with (4.94 gm) which was statistically at par of cotton (4.48 gm) but differed significantly than sunflower (3.19 gm) when applied as 50gm/5kg soil. Shoot weight in cotton (2.72gm) followed by mustard (2.61gm) when applied as 25gm/5kg soil. Among the oil cake extract, minimum shoot weight (1.00gm) was recorded in groundnut @ 25gm/5kg soil as compare to untreated control (1.07gm). Neem cake mixed with other oil seed cakes, e.g. mahua, castor and groundnut remained as efficacious as neem cake alone (Alam, 1990).

### Root weight

Data (Table 1 and Fig. 1) indicates that all tested oil cakes increased root weight significantly as compare to control. At the 60 DAS, maximum rice root weight (3.47gm) was found in mahua @ 50gm/5kg soil which was statistically significant than other treatments. Root weight in linseed was recorded with (2.27gm) which was statistically at par of mustard (2.11 gm) and cotton (1.87gm) when applied as 50gm/5kg soil. Average (1.57gm) root weight was recorded in linseed@25gm/5kg soil and sunflower @ 50gm/5kg soil. Rice plants in mustard were recorded with 1.50 gm root weight which was statistically at par of mahua (1.46 gm) when applied as 25 gm/5kg soil and sesamum @ 50gm/5kg soil (1.44 gm). Among cake extract, minimum root weight (0.80gm) was recorded in groundnut @ 50gm/5kg soil as compare to untreated control (0.93gm). Ashraf and Khan (2010) highest improvement in plant growth and best protection against *M.*

*javanica* was obtained by the integration of *P. lilacinus* with groundnut cake followed by neem cake, linseed cake, castor cake and mahua cake.

The present investigation it can be concluded that oil cakes reduced the galls/plant and increased plant growth parameters (shoot length, root length, shoot weight and root weight). So, these substances may be applied for the management of root knot nematode (*M. graminicola*), but there is a need to investigation and explore the nematicide activity. That may be of great importance for management in plant parasitic nematode, particularly as an important component in integrated disease management programme for the management of plant parasitic nematodes particularly root knot nematodes in rice nursery as well as in the nurseries of different vegetable crops.

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