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Efficacy of different soil amendment on disease incidence of dry root rot of chickpea during year 2017-2018

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Abstract
Chickpea (*Cicer arietinum* L.) is an important pulse crop of India popularly known as Gram. Dry root rot of chickpea is the most severe disease in the central and southern zone, where the crop is mostly grown under rainfed condition. *Rhizoctonia bataticola* (Taub.) Butler is one of the most distructive pathogen causing dry root rot disease in chickpea. The efficacy of different soil amendment *viz.,* Neem oil cake, Mustard oil cake, Linseed oil cake, Saw dust and Parthinium were evaluated for the management of dry root rot disease of chickpea in pot condition during 2017-18. Among the amendment, Neem oil cake was found effective in reducing the disease incidence, delay the appearance of disease and increase in germination, fresh and dry plant weight, number of branches/plant, number of pods/plant, plant height(cm), test weight (100 seed) and yield (gm)/plant. Among the amendment Neem oil cake was found most effective which delayed appereance of symptoms till 110 days after sowing (DAS) and maximum seed germination (92.67%) as compared to control 85 DAS and seed germination (80.0%) during 2017-2018.

Keywords: Chickpea, soil amendment, dry root rot, disease incidence and *Rhizoctonia*

Introduction

Chickpea (*Cicer arietinum* L.) known by different names *i.e* Gram, Spanish pea, Chestnut bean (English), Poischiche (French), Homos (Arabic), Garbanzo (Spanish) and Chana (Hindi). Chickpea belongs to Leguminaceae family usually grown after rainy season on conserved soil moisture during winter in the tropics; in spring in the temperate and Mediterranean regions. The total world acreage under pulses is about 85.40 (Mha) with production of 87.40 (Mt) and 1023 kg/ha productivity. India, with >29 Mha pulses cultivation area, is the largest pulse producing country in the world. It ranks first in area and production with 34 per cent and 26 per cent respectively. During 2017-18 the country's productivity at 835 kg/ha, is a significant increase over Eleventh (662 kg/ha) and Twelfth plans (745 kg/ha)**.** The area of Uttar Pradesh is 562 Th area with a production of 626.00 Tt and productivity of 1114 kg/ha (Anonymous, 2018) [1]. Dry root rot is one of the major production constraints that cause 10-20 per cent annual loss (Vishwadhar and Chaudhary, 2001) [12]. Dry root rot of chickpea is the most severe disease in the central and southern zone, where the crop is mostly grown under rainfed condition. *Rhizoctonia bataticola* (Taub.) Butler is one of the most distructive pathogen causing dry root rot disease in chickpea. Among the diseases of chickpea, dry root rot is emerging as the most destructive constraint to chickpea production, as the disease is more prevalent during hot temperature of 30 to 35 °C and low soil moisture conditions (Taya *et al*., 1988; Pande and Sharma, 2010) [11, 7]. Dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler [Pycnidial stage: *Macrophomina phaseolina* (Tassi) Goid] is a soil and seed borne necrotrophic fungal pathogen that has a global distribution. It can infect more than 284 plant species throughout the world including monocot and dicots (Farr *et al.,* 1995) [2].

Method and Materials

Efficacy of different soil amendment on disease incidence was conducted during *Rabi* crop season 2017-18 in pot at net house of Department of Plant Pathology, College of Agriculture, N. D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). An experiment was laid out in CRD with three replications and 6 treatments. Soil were collected and sterilized in autoclave, filled in earthen pots (kg/pots) separately. The sterilized earthen pots of 15 cm diameter were filled with sterilized soil. Neem cake (2.77gm./kg soil), mustard cake (2.53gm./kg soil), linseed oil cake (2.28gm./kg soil), sawdust (1.64gm./kg soil), and Parthinium compost (5gm./kg soil) were mixed individually in the sterilized soil filled pots, two weeks prior to sowing.

The inoculum of *Rhizoctonia bataticola* was multiplied on Sand maize meal medium for 20 days. 20 days old well multiplied inoculum of *R. bataticola* also incorporated in the sterilized soil @ 5% w/w in each pot prior to 2 days of sowing. Control pots were filled with soil without adding amendment. The seeds of succeptible chickpea variety Uday were sown in each pot (15 seed per pot) where finally 10 plants was maintained in each pot till to harvest. Soil moisture was maintained by addition of required amount of water as per requirement. The disease incidence was recorded from flowering, pod stage and maturity stage. Observation was recorded on seed germination per cent, plant height (cm), fresh and dry weight (g), number of branches, number of pods per plant, test weight, yield (g/Plant), first appearance of disease disease and incidence were observed at flowering, pod stage and maturity stage. The percent disease incidence was calculated by using 0-9 disease rating scale (AICRP Scale). Per cent disease incidence, was calculated by using following formula:

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

Per cent disease control was calculated by using formula given below

$$\text{Per cent disease control} = \frac{C - T}{C} \times 100$$

Where,
C = Per cent diseases incidence of controls pots
T= Per cent disease incidence in treated pots

Result and Discussion

The persence of antifungal compound in higher plants has long been recognized as an important factor for induced resistance in plants as well as pathogen repellent. Such compounds, being biodegradable and selective in their toxicity are considered valuable for controlling fungal disease in plants. During the persent investigation efficacy of different soil amendment *viz.,* Neem oil cake, Mustard oil cake, Linseed oil cake, Saw dust and Parthinium were evaluated for the management of dry root rot disease of chickpea in pot condition during 2017-18.

First appearence of disease

A persual of the data persented in Table revealed that, all the soil amendment was found significantaly delayed the appearance of disease symptoms in the year, 2017-18. Among the treatments the T_1 (Neem oil cake) was found most effective treatment which delayed appereance of symptoms till 110 days after sowing (DAS) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust), T_5 (parthinium) and T_6 (control) which were (100 DAS), (100 DAS), (90 DAS) (85 DAS) and (85 DAS), respectively.

Effect of seed germination

It is clear from data persented in Table the maximum seed germination (92.67%) was observed in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust), T_5 (parthinium) and T_6 (control) which were (85.00%), (84.00%), (83.33%), (83.33%) and (81.00%), respectively during 2017-18.

Fresh and dry weight of plant (gm)

A persual of the data persented in Table revealed that, the maximum fresh weight (200.37gm) was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust), T_5 (parthinium) and T_6 (control) which were (188.17gm), (165.57gm), (157.33gm), (142.68gm) and (130.13gm), respectively during 2017-18.

The maximum dry weight (50.09gm) of plant was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust), T_5 (parthinium) and T_6 (control) which were (47.04gm), (41.39gm), (39.28gm), (36.30gm) and (32.52gm), respectively during 2017-18.

No.of branches/Plant

A persual of the data persented in Table revealed that, the maximum number (2.33) of primary branches per plant was recorded in T_4 (saw dust) followed by T_1 (Neem oil cake), T_5 (parthinium), T_2 (mustard oil cake), T_3 (linseed oil cake), and T_6 (control) which were (2.0), (2.0), (1.67), (1.67) and (1.67), respectively during 2017-18.

The maximum number (5) of secondary branches per plant was recorded in T_5, T_6 (parthinium), (control) followed by T_4 (saw dust) T_1 (Neem oil cake), T_2 (mustard oil cake) and T_3 (linseed oil cake) which were (4.67), (4.33), (4.00) and (4.00), respectively.

No. of Pods/plant

A persual of the data persented in Table revealed that, the maximum number (55.33) of pods/plant was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_4 (saw dust),T_3 (linseed oil cake), T_5 (parthinium) and T_6 (control) which were (47.00), (46.67), (45.33), (41.00) and (27.67), respectively during 2017-18.

Plant height (cm)

A persual of the data persented in Table revealed that, the maximum plant height (57.83) was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust), T_5 (parthinium) and T_6 (control) which were (54.92), (53.25), (51.21), (51.19) and (50.40), respectively during 2017-18.

Plant disease incidence

Result persented in Table revealed that, the minimum (19.76%) disease incidence was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust), T_5 (parthinium) and T_6 (control) which were (24.26%), (25.25%), (29.32%), (34.33%) and (38.40%), respectively during 2017-18.

Plant disease control

Result persented in Table revealed that, the maximum plant disease control (48.44%) was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust) and T_5 (parthinium) which were (36.76%), (34.24%), (23.61%) and (17.23%), respectively during 2017-18.

Test weight (g)

Data persented in the Table revealed that, the maximum test weight (19.15gm) was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust) T_5 (parthinium) and T_6 (control) which were (17.43gm), (16.3gm), (15.4gm), (15.32gm) and (14.12gm), respectively during 2017-18.

Yield (g) /plant

Data persented in the Table revealed that, the maximum yield (10.59gm) was recorded in T_1 (Neem oil cake) followed by T_2 (mustard oil cake), T_3 (linseed oil cake), T_4 (saw dust) T_5 (parthinium) and T_6 (control) which were (9.00gm), (8.68gm), (8.24gm) (7.85), and (5.29), respectively during 2017-18.

Results of the present study obtained on the efficacy of the soil amendments against *Rhizoctonia bataticola* are in conformity with those reported earlier by several workers. Organic amendments *viz.,* FYM, caster cake, poultry manure, Mustard cake, vermicompost and neem seed cake were reported earlier by several workers, Singh *et al.* (1981) [8], Singh *et al.* (1990) [9], Jha *et al.* (2000) [5], Muthuswami and Mirippan, 1991 [6]; Hundekar *et al,* 1998 [3]; Suriachandraselvan *et al,,* 2005; Jaiman *et al,,* 2009 [4].

Table 1: Efficacy of different soil amendment on disease incidence of dry root rot in chickpea during year 2017-2018

Treatment	First appearence of disease (DAS)	Seed germination (%)	Fresh & Dry weight of plant (gm)		No.of branches/ Plant		No. of Pods/ plant	Plant height (cm)	PDI	PDC	Test Wt. (100 seed)/g	Yield (gm) /plant
			Fresh	Dry	Primary	secondary						
T_1 (Neem oil cake)	110	92.67	200.37	50.09	2	4.33	55.33	57.83	19.76 (26.38)	48.44 (44.10)	19.15	10.59
T_2 (Mustard oil cake)	100	85.00	188.17	47.04	1.67	4.00	47.00	54.92	24.26 (29.50)	36.76 (37.30)	17.43	9.00
T_3 (Linseed oil cake)	100	84.00	165.57	41.39	1.67	4.00	45.33	53.25	25.25 (30.16)	34.24 (35.80)	16.3	8.68
T_4 (Saw dust)	90	83.33	157.13	39.28	2.33	4.67	46.67	51.21	29.32 (32.78)	23.61 (29.00)	15.4	8.24
T_5 (Parthinium)	85	83.33	142.68	36.30	2	5.00	41.00	51.19	34.33 (35.85)	17.23 (29.42)	15.32	7.85
T_6 (Control)	85	81.00	130.13	32.52	1.67	5.00	27.67	50.40	38.40 (38.29)	-	14.12	5.29
SEm±		1.664	3.052	1.01	0.029	0.063	1.587	0.935	0.924	2.00	0.788	0.296
CD at 5%		5.184	9.509	3.15	0.092	0.197	4.944	2.914	2.840	6.52	2.455	0.921

*PDI (Plant disease incidence), PDC (Plant disease control), DAS (Days after sowing), Figure in parenthesis are angular transformed value

Conclusion

The efficacy of different soil amendment *viz.,* Neem oil cake, Mustard oil cake, Linseed oil cake, Saw dust and Parthinium were evaluated for the management of dry root rot disease of chickpea in pot condition during 2017-18 and 2018-19. Among the amendment, Neem oil cake was found effective in reducing the disease incidence, delay the appearance of disease and increase in germination, fresh and dry plant weight, number of branches/plant, number of pods/plant, plant height(cm), test weight (100 seed) and yield (gm)/plant. Among the amendment Neem oil cake was found most effective which delayed appereance of symptoms till 110 days after sowing (DAS) and maximum seed germination (92.67%) as compared to control 85 DAS and seed germination (80.0%) during 2017-2018 and same trends were also observed in 2018-19. All the treatments were found significantly superior over untreated check (T6) in pooled data.

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