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INTEGRATED MANAGEMENT OF ROOT ROT DISEASE [*MACROPHOMINA PHASEOLINA* (TASSI.) GOID] OF CHICKPEA THROUGH BIOAGENTS, OIL CAKES AND CHEMICALS UNDER FIELD CONDITIONS IN SOUTH GUJARAT CONDITIONS

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Abstract

Chickpea (*Cicer arietinum* L.) is one of the important pulse crops of India. Occurrence of root rot disease has become a major constraint in recent years for successful and profitable cultivation of chickpea. The efficacy of various Bioagents *viz. Tricoderma viride* and *T. harzianum*, Oil cakes *viz.* neem cake and castor cake, FYM and Carbendanzim through seed treatment and soil application were evaluated against *Macrophomina phaseolina* (Tassi.) Goid causing root rot disease of Chickpea. Integrated management study of root rot disease of chickpea under field condition showed that soil application of *T. harzianum* @ 5 kg in 500 kg neem cake/ha in furrow 5 days prior to sowing resulted in higher seed germination (74.90%). In case of disease incidence and yield of crop, soil application of *T. harzianum* @ 5 kg in 500 kg FYM /ha in furrow 5 days prior to sowing has lowest disease incidence (11.81%) and gave highest yield (1533 kg/ha).

Key words : Chickpea, *Macrophomina phaseolina*, root rot, Integrated Disease Management.

Introduction

Chickpea is the world's third most important grain legume globally grown in over 40 countries after common bean and pea (Anwar *et al*., 2009). It occupies very important position in semi-arid farming system both for human nutrition and restoring the soil fertility (Singh and Sirohi, 2003). More than 50 pathogens have been reported to infect chickpea (*Cicer arietinum* L.) crop but only few of them cause economically important diseases. In India, the first report on chickpea dry root rot (*M. phaseolina*) was given by Mitra in 1931 and Dastur in 1935 carried out some studies on the disease in central India (Nene and Reddy, 1987). The grain losses due to chickpea wilt and root rot has been estimated around 10 per cent, which amounts to approximately 520 thousand tons annually. *Macrophomina phaseolina* (Tassi.) Goid has a wide host range and is responsible for causing losses on more than 500 cultivated and wild plant species (Khan, 2007). Integrated Disease Management has emerged as the promising approach for management of soil borne diseases. Considerable success has been achieved by introducing antagonists, oil cakes and FYM. Keeping in view, the present investigation was carried out to find the potential of IDM to manage this disease.

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Materials and Methods

Considering the importance of disease, an experiment was conducted to study the efficacy of various bio-agents, oil cakes and fungicides as seed treatment and soil application for controlling root rot disease of chickpea caused by *M. phaseolina.* The antagonists *viz, T. viride* and *T. harzianum* as seed dresser and soil application and in combination with castor cake, neem cake, FYM and other chemicals were evaluated for their efficacy against root rot pathogen in field conditions. The experiment was carried out at Agronomy Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari during *Rabi* 2010-11 in Randomized block design (RBD) with 10 treatments given in table 1 along with 3 replication. All the recommended agronomical practices were followed during experimentation. The seeds of

chickpea (cv. GG-2) were sown in each plot at 30 × 10 cm spacing, 5 days after respective treatments. The irrigations were given as and when required. Insecticidal measures were also taken out as and when required. The observations on root rot incidence prior to harvest were recorded at one month interval and done statistically analyzed and also taken chickpea yield data. Root rot incidence (%) in each treatment was calculated using following formula.

$$\text{Root rot incidence (\%)} = \frac{\text{Number of diseased plant}}{\text{Total number of plants observed}} \times 100$$

Design	: RBD
Treatment	: 10 (Table -1)
Replication	: 3
Year	: 2010-2011
Location	: Agronomy Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari – 396 450
Season	: *Rabi*
Crop	: Chickpea (*Cicer arietinum* L.)
Variety	: GG - 2
Seed rate	: 60 kg/ha
Spacing	: 30 × 10 cm
Gross plot size	: 2.50 × 3.00 m
Fertilizers	: 20- 40- 0 NPK kg/ha
Observations recorded	: 1. Germination (%) 2. Root rot incidence (%) 3. Yield (kg/ha)

Results and Discussion

After the world wide stimulation of interest in biocontrol of plant disease during the past decade, attempts to develop bio-control methods for the management of root rot disease were made by several workers. The effective bio-control agents, oil cakes and chemicals, which were found promising under laboratory studies were further evaluated for the management of root rot (*M. phaeolina*) disease of chickpea under field conditions. The data presented in table 1 revealed that the effects of all the treatments were found significantly superior over control in managing the root rot disease of chickpea.

Germination

Considering germination per cent treatment $\mathbf{T_7}$ resulted in high germination per cent 93.13%, which was statistically at par with treatment $\mathbf{T_6}$ with 90.84 per cent germination and treatment $\mathbf{T_4}$ with 88.75%. Treatment $\mathbf{T_2}$, treatment $\mathbf{T_8}$ and treatment $\mathbf{T_3}$ gave medium germination 86.04%, 85.42% and 85.21%, respectively. While treatment $\mathbf{T_9}$, treatment $\mathbf{T_5}$ and treatment $\mathbf{T_1}$ have minimum germination per cent *viz*., 83.75%, 82.71% and 79.79%, respectively.

Disease incidence

In case of disease incidence treatment $\mathbf{T_6}$ has lowest disease incidence 5.56%, which was statistically at par with treatment $\mathbf{T_7}$ with disease incidence 5.60% and treatment $\mathbf{T_8}$ with disease incidence 6.29%. Treatment $\mathbf{T_3}$, treatment $\mathbf{T_9}$ and treatment $\mathbf{T_5}$ recorded medium disease incidence 7.00%, 7.24% and 7.54%, respectively. While treatment $\mathbf{T_4}$, treatment $\mathbf{T_2}$ and treatment $\mathbf{T_1}$ have highest disease incidence *viz*., 8.17%, 8.94% and 9.07%.

Yield

In case of yield treatment $\mathbf{T_6}$ had highest yield 1533 kg/ha, which is statistically at par with treatment $\mathbf{T_7}$ with yield 1489 kg/ha, treatment $\mathbf{T_8}$ with yield 1378 kg/ha, treatment $\mathbf{T_4}$ with yield 1324 kg/ha, treatment $\mathbf{T_5}$ with yield 1267 kg/ha and treatment $\mathbf{T_1}$ with yield 1204 kg/ha. While treatment $\mathbf{T_3}$, treatment $\mathbf{T_2}$ and treatment $\mathbf{T_9}$ have lowest yield *viz*., 1184 kg/ha, 1142 kg/ha and 1084 kg/ha, respectively as compare to others treatments.

Considering overall effect of treatments, it can be concluded that in case of germination, soil application of *T. harzianum* (THNI) @ 5 kg in 500 kg Neem cake/ha in furrow 5 days prior to sowing resulted in high seed germination per cent, while soil application of *T. harzianum* (THNI) @ 5 kg/ha in 500 kg FYM/ha in furrow 5 days prior to sowing resulted in lowest disease incidence and gave highest yield. The decomposition of the organic matter helps in altering the physical, chemical and biotic conditions of the soil. The altered conditions reduced the inoculum potential of the pathogen and also promoted root growth of the chickpea crop in the field. In-corporation of amendments into the soil can be effective in reducing the population of soil borne pathogens by increasing the population of bio-agents into the amended soil. It can increase their moisture holding capacity; improve soil texture and structure, biotic conditions of soil and thereby improving the vigour of chickpea plant.

The similar results to this present investigation were achieved by Rajani and Parakhia (2009), who reported

Table 1 : Integrated management of root rot disease [*Macrophomina phaseolina* (Tassi) Goid] of chickpea through bioagents, oil cakes and chemicals under field conditions.

S. No.	Treatments	Per cent germination	Yield (kg/ha)	Disease*** incidence (%)	Per cent disease over control
1.	Seed treatment with *T. viride* (TVNI)@ 30 gm/kg seed at the time of sowing	63.27* (79.79)**	1204	16.34* (9.07)**	41.10
2.	Seed treatment with *T. harzianum* (THNI) @ 30 gm/kg seed at the time of sowing	68.06 (86.04)	1142	16.34 (8.94)	41.95
3.	Soil application of *T. viride* (TVNI)@ 5 kg/ha in 500 kg FYM/ha in the furrow 5 days prior to sowing	67.44 (85.21)	1184	13.90 (7.00)	54.55
4.	Soil application of *T. viride* (TVNI) @ 5 kg/ha in 500 kg neem cake/ha in furrow 5 days prior to sowing	70.47 (88.75)	1324	15.74 (8.17)	46.95
5.	Soil application of *T. viride* (TVNI) @ 5 kg/ha in 500 kg castor cake/ha in furrow 5 days prior to sowing	65.42 (82.71)	1267	14.92 (7.54)	51.04
6.	Soil application of *T. harzianum* (THNI) @ 5 kg/ha in 500 kg FYM cake/ha in furrow 5 days prior to sowing	72.39 (90.84)	1533	11.81 (5.56)	63.90
7.	Soil application of *T. harzianum* (THNI) @ 5 kg/ha in 500 kg Neem cake/ha in furrow 5 days prior to sowing	74.90 (93.13)	1489	12.21 (5.60)	63.63
8.	Soil application of *T. harzianum* (THNI) @ 5 kg/ha in 500 kg castor/ha in furrow 5 days prior to sowing	67.68 (85.42)	1378	13.34 (6.29)	59.16
9.	Seed treatment with carbendazim @ 3 gm/kg Seed at the time of sowing	66.38 (83.75)	1084	14.60 (7.24)	52.99
10.	Control (Untreated)	60.25 (75.37)	778	22.55 (15.40)	
	S. Em. ±	1.51	116	0.61	
	C.D. at 5%	4.48	344	1.72	
	C.V. %	3.86	16	14.41	

Mean of three replications

* Figures are arcsine transformed values.

** Figures in parenthesis are retransformed values.

*** Disease incidence data are pooled data of 40,55,70,85 days after date of sowing.

that the application of neem cake @ 500 kg/ha along with *T. harzianum* @ 10 g/kg soil amendment was found effective for the management of root rot (*M. phaseolina*) disease in castor followed by application of neem cake @ 500 kg/ha along with *T. viride* @ 10 g/kg soil amendment. Chavan (2006) reported that combine application of *T. harzianum* with FYM was more effective as it gave 68.39 per cent control of root rot disease of crop with higher germination per cent and yield. Rajani (1998) reported that the application of neem cake @ 20 q/ha was effective for the management of root rot disease of castor followed by mustard and castor cake.

Field experiment of integrated management of root rot, indicated that Field experiment of integrated management of root rot, indicated that incorporation of soil with bioagents and organic manures are reported here for the first time and constitute a new information for the management of chickpea root rot disease in South Gujarat condition.

Conclusion

Field experiment of integrated management of root rot, indicated that of combined soil application of *T. harzianum* @ 5 kg in 500 kg neem cake/ha in furrow 5 days prior to sowing resulted in higher seed germination. In case of disease incidence and yield of crop, soil application of *T. harzianum* @ 5 kg in 500 kg FYM/ha in furrow 5 days prior to sowing has lowest disease incidence and gave highest yield.

Incorporation of soil with bioagents and organic manures are reported here for the first time and constitute a new information for the management of chick pea root rot disease in south Gujarat condition.

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