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Management of dry root rot disease [*Rhizoctonia bataticola*] of chickpea through fungicides

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Abstract
Chickpea (*Cicer arietinum* L.) is one of the important pulse crops of India. Occurrence of dry root rot caused by *Rhizoctonia bataticola* (Taub.) Butler is emerging as a serious biotic constraint in recent years for successful and profitable cultivation of chickpea the efficacy of various fungicides *viz.* Carbendazim, Thiram, Carboxin, Phenylpyrrole, Thiophnate Methyl and Chlorothalonil as seed treatment and soil application were evaluated against *Rhizoctonia bataticola* causing root rot disease of Chickpea. Management study of root rot disease of chickpea done under both pot and field condition. Seed treatment with Carbendezim was proved most effective in minimizing the disease as well as pathogen population in soil followed by Thiophnate Methyl. Seed treatment with Chlorothalonil was found least effective in minimizing the disease as well as pathogen population in soil.

Keywords: Chickpea, *Rhizoctonia bataticola* root rot, Management

1. Introduction
Chickpea, Cicer arietinum L. is one of the most important pulse crop of India It occupies very important position in semi-arid farming system both for human nutrition and restoring the soil fertility (Singh and Sirohi, 2003) [5]. Total production of chickpea 7060.00 thousand tonnes in year 2015-16 and 43.18 per cent share in Total production of pulses (Anonymous 2016) [1]. The average production of chickpea is 15-20 quintal per hectare which is low in spite of high yielding varieties and new agronomic practices. The reasons of low yield are so many apart from other reasons the main cause of low yield of this crop is the incidence of diseases. India is the world leader in chickpea production. The chickpea crop is attacked by 172 pathogens (67 fungi, 22 viruses, 3 bacteria, 80 nematodes and mycoplasma) from all over the world (Nene *et al.* 1996) [3]. Among all, only a few of them have the potential to devastate the crops. Some of the serious disease in order of their importance are wilt *Fusarium oxysborum f. sp. ciceri)* wet root rot (*Rhizoctonia solani),* dry root rot (*Rhizoctonia, bataticola)* Ascochyta blight (*Ascocthya rabiei)* and coller rot *(Sclerotium rolfsie).* 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. Dry root rot disease caused by *Rhizoctonia bataticola* was observed on variety ICC-4951 in Rajasthan. Considering the importance of the disease and crop, the present investigation was undertaken for management of disease through various systemic and non systemic fungicides.

Materials and Methods
Considering the importance of disease, an experiment was conducted to study the efficacy of various systemic and non-systemic fungicides. As seed treatment and soil for controlling root rot disease of chickpea caused by *Rhizoctonia bataticola.* In the pot experiment seeds of chickpea verity ICC-4951 were treated with each of the six fungicides including Carbendezim (1.0 g/kg seed), Thiram (2.0 g/kg seed), Carboxin (1.0 g/kg seed), Phenylpyrrole (1.0 g/kg seed), Thiophnate Methyl (1.0 g/kg seed) and Chlorothalonil (1.0 g/kg seed). Pots without seed treatment were treated as control. Fifteen seeds treated with each fungicides were sown in each pot with four replication. Pots regularly watered and observation of disease incidence was commenced after 15 days of sowing and continued up to 75 days. Similar set of treatments was also sown in field with plot size 2 m × 2.1 m, under sick soil condition. Observations of the disease incidence were started recording after 15 days of sowing till harvest. Grain yield per plot was recorded. Each treatment was replicated four times and mycelia propagules were

counted as g^{-1} soil through samples drawn from each plot. 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.

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

Results and Discussion

All the treatments significantly checked dry root incidence incidence over untreated control during both the years 2014-15 and 2015-16 (Table1 and 2). In pot experiment seed treatment with Carbendezim @ 1 g/kg seed was found most effective exhibiting the lowest incidence of 16.66 and 13.33 per cent in 2014-15 and 2015-16, respectively. This was closely followed by Thiophanate methyl and Thiram with disease percentage of 19.99 and 23.33 in 2014-15; and 18.33 and 21. 66 in 2015-16. Carboxin, Phenylpyrrole and Chlorothalonil were comparatively less effective in reducing the disease incidence but significantly superior over check. However, Taya *et al*. (1990) [7] in their study reported that Carbendazim alone or in combination with thiram performed better as seed treatment. As regard pathogens populations, it was minimum, 5.3×10^{-2} propagules g^{-1} of soil when seeds treated with Carbendezim as against 1.34×10^{-3} propagules in control (without seed treatment) (Table-1). In field experiment the chemical treatments checked dry root incidence incidence over untreated control during both the years 2014-15 and 2015-16. As seed Carbendezim @ 1 g/kg seed provided minimum incidence, highest grain yield of 20.7 and 17.3 per cent in 2014-15 and 2015-16, respectively. This was closely followed by Thiophanate methyl and Thiram (Table-2). Carboxin, Phenylpyrrole and Chlorothalonil were proved poore for increasing the grain yield. The results similarly found by Singh *et al*. (1993) [6], Sigh and Sindhn (1998) [4] and Khan et al. (2012) [2].

Table 1: Efficacy of fungicides against dry root rot incidence on chickpea caused by *R. bataticola* (in pot)

Treatments	Dose g/kg seed	PDI* (%)		Propagules g^{-1} of soil
		2014-15	2015-16	
Carbendezim	1.0	16.66	13.33	5.3×10^{-2}
		(23.98)	(21.06)	
Thiram	2.0	23.33	21.66	7.5×10^{-2}
		(28.44)	(27.51)	
Carboxin	1.0	26.66	24.99	8.0×10^{-2}
		(30.97)	(29.85)	
Phenylpyrrol	1.0	33.33	28.33	9.3×10^{-2}
		(35.19)	(32.02)	
Thiophanate	1.0	19.99	18.33	7.3×10^{-2}
Methyl		(26.39)	(25.27)	
Chlorothalonil	1.0	34.99	29.99	8.8×10^{-2}
		(36.18)	(33.02)	
Control	-	46.66	56.66	1.34×10^{-3}
		(43.05)	(48.85)	
SEm±		2.16	2.23	
CD (p = 0.05)		6.34	6.57	

Average of four replications
Figures in parentheses are angular transformed values
PDI = Percent disease incidence

Table 2: Efficacy of fungicides against dry root rot incidence on chickpea caused by *R. bataticola* in field conditions.

Treatments	Dose g/kg seed	Dry root rot incidence* (%)		Grain yield* (Kg ha^{-1})		Propagules g^{-1} of soil
		2014-15	2015-16	2014-15	2015-16	
Carbendazim	1.0	20.70	17.31	1274	1324	1.20×10^{-2}
		(26.97)	(24.49)			
Thiram	2.0	28.70	25.35	1116	1183	1.58×10^{-2}
		(32.46)	(30.19)			
Carboxin	1.0	32.14	28.56	1025	1015	1.49×10^{-2}
		(34.49)	(32.26)			
Phenylpyrrol	1.0	34.10	33.03	968	973	1.59×10^{-2}
		(35.69)	(35.04)			
Thiophanate	1.0	24.00	21.24	1175	1186	1.50×10^{-2}
Methyl		(29.34)	(27.51)			
Chlorothalonil	1.0	34.28	34.46	976	974	1.60×10^{-2}
		(35.00)	(35.91)			
Control	-	41.11	38.56	943	9343	2.10×10^{-3}
		(39.84)	(38.36)			
SEm±		0.95	0.83	10.82	10.72	
CD (p = 0.05)		2.81	2.47	32.10	31.81	
CV		5.68	5.20	4.81	4.74	

Average of four replications
Figures in parentheses are angular transformed values
PDI = Percent disease incidence

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