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Efficacy of *Trichoderma viride* against *Fusarium* wilt of chickpea

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ABSTRACT

A non-farm trial was conducted at farmer's field to diminish *Fusarium* wilt of chickpea. The assessed practice of seed treatment with *Trichoderma viride*at @ 5 g/kg seed plus incorporation of *T. viride* at 5 kg/ha multiplied on decomposed FYM at 100 kg/ha at the time of sowing recorded minimum disease incidence (7.85%) with maximum efficacy of disease control (76.13) as compared to farmers' practices. There was 37.41 per cent more yield in assessed practices plots than farmers' practices and highest net return and benefit cost ratio was also obtained.

Key Words: Chickpea, Fusarium wilt, Trichoderma viride

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is an important pulse crop in India. Wilt disease is the major limiting factor in chickpea production, incited by *Fusarium oxysporum* f.sp. *ciceri*is. This disease is widespread in chickpea growing areas resulting in considerable economic losses. Pulse crops are an important source of food proteins, vitamins, lipids and certain minerals and generally grown under risk prone marginal land (Animisha *et al,* 2012). The wilt of chickpea incited by *Fusarium oxysporum* f. sp. *ciceri* is a major yield constraint of chickpea in India. This pathogen is internally seed (Haware *et al,* 1978) and soil borne (Singh *et al,* 2009) and causes heavy losses (20-100%) depending upon stage of infection and wilting (Haware and Nene, 1980). It infects chickpea crop with more incidence at flowering and pod forming stage, if the crop is subjected to sudden temperature rise and water stress (Chaudhry *et al,* 2007). In India, it is estimated that 10per cent yield losses are caused annually. Under certain conditions, it may go up to 60% (Singh *et al,* 2007). Infested soil and infected seeds are the sources of primary inoculum. The spores of fungus enter into the plants passing through the roots. After reaching the xylem tissues, the fungus spread up in vessels by means of hyphal growth and microconidia. They produce enzymes and disgrace cell walls and obstructs the plants transport system (Animisha *et al,* 2012). Discolouration occurs inside the tissues from the roots to aerial parts, yellowing and wilting occurs (Leslie and Summerell, 2006) with no external rotting of roots and black internal discoloration involving xylem and pith (Dubey *et al,* 2007). Keeping in view the severity of the disease and economic importance of chickpea, on-farm trials (OFTs) were planned to assess the field efficacy of *T. viride* against *Fusarium* wilt of chickpea.

MATERIALS AND METHODS

An eco-friendly disease management technology i.e. use of *Trichoderma* as seed and soil treatment with rotted FYM have been evaluated on ten farmers' field with an objective to assess field efficacy of *T. viride* during *Rabi* 2019-20 in two villages *viz*., Mundiya and Dungapura of the district Karauli through on farm trials (OFTs). In selected villages of the district, technological gap between improved management practices and farmer's practices were studied based on survey and group discussion with farmers' interactive group (FIG) of chickpea growers. Out of 100 farmers, 25 farmers were selected randomly and discussions were held on seven improved management practices to study the technological gap. The gap between recommended

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Table 1. Technological gap between improved production technology and farmers' practices in Chickpea

Practice	Recommended Practices	Farmers' Practice	Gap observed
Cultivars	GNG-1958, GNG-1581, RSG-974	RSG-888, GNG-663 and other local varieties	Full gap
Seed rate	70-80 kg/ha	80-100 kg/ha	Partial gap
Seed treatment	Carbendazim @ 2 g/kg seed or *Trichoderma viride* @ 4 g/kg seed and Rhizobium and PSB @ 10 ml/ kg seed	done by 30-40% farmers	Partial gap
Bio- agent for soil treatment	*Trichoderma viride* @ 5 kg/ha multiplied on decomposed FYM and broadcasted @ 100 kg/ha at the time of sowing	No soil treatment	Full gap
Weed management	Pendimethalin 30 EC@3.33 l/ha (PE)	Inadequate weed management: One hand weeding	Partial gap
Fertilizers	N @ 20 kg/ha P @ 40 kg/ha	Imbalanced use of fertilizers (N&P)	Partial gap
Plant protection measures	Quinalphos 1.5 % @ 25 kg/ha Emamectin benzoate 5 SG 250 g /ha	Quinalphos 25 EC @1 l/ha (40% farmers)	Partial gap

technologies and existing technologies was identified and categorized into three levels *viz.,* full (8-12), partial (4-7) and non-adoption (less than 3). The integrated approaches *i.e.* Seed treatment with *Trichoderma viride* @ 5 g/kg seed plus incorporation of *T. viride*at @ 5 kg/ha multiplied on decomposed FYM to 100 kg/ha and then broadcasting at the time of sowing were assessed under on farm trials. The area under each treatment was 1000 m^2. The details of treatment for management of *Fusarium* wilt of chickpea were T1 (Farmers' Practices): Seed treatment with carbendazim 50per cent WP at 2g/kg seed, T2 (Recommended Practice): Seed treatment with carbendazim 50 per cent WP at 2g/kg seed plus soil application of *T. viride*at 2.5kg/ha and T3 (Assessed Practice): Seed treatment with *T.viride*at 5 g/kg seed plus incorporation of *T. viride* at 5 kg/ ha multiplied on decomposed FYM to100 kg/ha at the time of sowing.The disease incidence was observed at 75 and 100 days after sowing (DAS) in each treatment from 20 randomly selected plants in each plot and the PDI was calculated. The per cent efficacy disease control (PEDC) was also worked out. Seed yield of chickpea was recorded on the basis of individual plot and converted into kg/ha. The cost benefit ratio was calculated using the formula (Reddy and Reddy, 2004)

RESULTS AND DISCUSSION

The gap between improved technology and farmers' practices of chickpea cultivation is presented in table 1. The data pointed out that there was full gap in soil treatment with bioagents and sowing of cultivars which were observed to be the reasons of severe incidence of fusarium wilt of chickpea in farmer's field. Partial gap was found in cultivars, seed rate, seed treatment, fertilizer dose, weed management and plant protection measures.

The data (Table 2) revealed that both treatments lowered down and reduced the disease incidence as compared to farmer's practices. The initial disease symptoms emerged 60 days after sowing, and the severity of the disease increases in lockstep

Table 2. Efficacy of *Trichoderma viride* against Fusarium wilt of chickpea

Technology Option	Per cent Disease incidence		Mean	Per cent Efficacy
	75 DAS	100 DAS		
T1: Seed treatment with carbendazim 50 per cent WP @ 2g/kg seed (Farmers practices)	23.50	42.30	32.90	-
T2: Seed treatment with carbendazim 50 % WP @ 2g/kg seed + Soil application of *T. viride*@ 2.5kg/ha (Recommended Practice)	12.90	20.78	16.84	48.81
T3: Seed treatment with *T. viride* @ 5 gram/kg seed + Incorporation of *T. viride* @ 5 kg/ha multiplied on decomposed FYM @ 100 kg/ha at the time of sowing (Assessed practices)	5.30	10.40	7.85	76.13

with the plant's growth. The treatment consisting seed treatment with *T. viride*at @ 5 g/kg seed plus incorporation of *T. viride* @ 5 kg/ha multiplied on decomposed FYM to 100 kg/ha at the time of sowing was found most effective with minimum disease incidence 5.30 (75 DAS) and 10.40 (100 DAS) with maximum efficacy of disease control (76.13) as compared to farmers' practices. This was followed by seed treatment with carbendazim 50per cent WP at 2g/kg seed plus soil application of *T. viride* at 2.5 kg/ha with PDI 12.90 (75 DAS) and 20.78 (100 DAS) as compared to farmers' practices which was 23.50 and 42.30, respectively. Similar findings were reported by Kumar *et al* (2012) who observed disease incidence from 38.7 to 59.2 per cent. Ghosh *et al* (2013) reported incidence of chickpea wilt from 9.7 to 13.8 per cent in central and southern parts of India. The incidence varied from 14 to 32 per cent in different states as reported by Dubey *et al* (2010) and 72.16 per cent as recorded by Kumar and Bourai (2012). Vats *et al* (2016) reported that soil and seed treatments with *Trichoderma* resulted in lowering the wilt disease. The similar report was reported by Patra *et al* (2017).

Data analysis pointed out that the average yield recorded was 21.30 q/ha in assessed practices whereas in farmers' practice it was found to be 15.50 q/ha (Table 3). Hence, 37.41 per cent more yield was recorded in assessed practices plots than farmers practices. The losses of yield were due to higher incidence of fusarium wilt disease. The results were in conformity with the findings of Khan *et al(* 2004) who reported that cultivars of chickpea suffered 9 to 41 per cent seed yield due to wilt disease incidence. The economic analysis revealed that net returns of assessed plots was Rs. 58959/ha in comparison to farmers practice of Rs. 38517/ha. Benefit cost of 2.93 were found under assessed practices while it was 2.44 in farmer's practices. These results were in accordance with the findings of Bawane *et al* (2022) who reported that soil application with *Trichoderma viride* was found most effective in the percentage of disease control in chickpea as well as maximum yield were

Table 3. Yield and economic performance of chickpea with improved technology and farmer's practices

Treatment	Yield (q/ha)	Increase in yield over farmers practice(%)	Net Return (Rs./ha)	B:C Ratio
T1	15.50	--	38517	2.44
T2	19.00	22.58	49424	2.62
T3	21.30	37.41	58959	2.93

also found. Moreover, chemical control is not good enough; therefore, biological control is a substitute to chemical control against this disease (Anjajah *et al,* 2003).

CONCLUSION

The present study revealed that application of *T. viride* as seed treatment @ 5 g/kg seed plus soil application at 5 kg/ha multiplied on decomposed FYM and broadcasting @ 100 kg/ha at the time of sowing was observed to be superior which resulted in 76.13 percent efficacy of disease control. Soil and seed treatments with *Trichoderma resulted in lowering the wilt disease and considerably increased grain yield of chick pea over farmers› practice. The use of Trichoderma for the management of Fusarium wilt was very much appreciated by the farmers. The success of Trichoderma in the target villages outlines the need for its popularization in larger areas.*

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