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Research Note

Integration of bioagents and fungicides for management of collar rot of chickpea

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ABSTRACT: **Two fungicides (carboxin and thiram) and two bio-control agents (*Pseudomonas fluorescens* and *Trichoderma harzianum*) were evaluated as seed treatment in different combinations against *Sclerotium rolfsii*, the causal organism of collar rot of chickpea (*Cicer arietinum*). Seed treated with *T. harzianum* (4g/kg seed) + carboxin (0.5g/kg seed) provided maximum protection to the crop by giving maximum seedling emergence (495.0/20 m²), final plant stand (480.4/20m²) and grain yield (18.2q/ha). Other treatment combinations significantly increased seedling emergence, final plant stand and grain yield compared to control.**

KEY WORDS: Carboxin, *Pseudomonas fluorescens*, *Sclerotium rolfsii*, seed treatment, Thiram, *Trichoderma harzianum*.

The soil borne pathogenic fungus *Sclerotium rolfsii* (Sacc.) has a host range of more than 500 species of cultivated and wild plants in tropical and subtropical regions (Punja, 1985). It causes collar rot in chickpea and is considered as one of the economically important diseases of chickpea in India (Nene, 1985). The disease results from infection by germinating sclerotia produced by pathogen which are resting structures and control of the pathogen through host resistance or fungicides is difficult.

It is now widely recognized that biological control of plant pathogens is a distinct possibility for the future and can be successfully exploited in modern agriculture, especially with in the frame work of integrated disease management system. The combination of biocontrol agents with fungicides as seed treatment could be very effective against chickpea collar rot, as *S. rolfsii* makes the plant vulnerable throughout its life starting from rooting of seeds to the death of mature plants. The present work was undertaken to test the efficacy of combination of bioagents and chemicals against *S. rolfsii* in the field.

The antagonists *Trichoderma harzianum* (10^6/g *CFU*) and *Pseudomonas fluorescens* (10^7/g *CFU*) were obtained from the Biocontrol laboratory of Sardar Vallabh Bhai Patel University of Agriculture & Technology, Meerut, Utter Pradesh, India for the present investigations.

The field experiments were carried out at the Crop Research Center of S.V.B.P.U.A. &T., Meerut, Utter Pradesh, India during *Rabi* seasons of 2003-04 and 2004-05 in a sick plots. The experiment was conducted using randomized block design with a plot size 4' 5 m² and 4 replications. Seeds of chickpea

Table 1. Effect of different seed treatments on germination, collar rot and yield of chickpea.

Treatments	Doses (g/kg seed)	Seed germination* (20 m²)	Increase in emergence (%)	Final plant stand* (20 m²)	Increase in plant stand (%)	Yield (q/ha)*	Increase in yield (%)
T. harzianum	4	465.5	30.9	452.5	49.9	16.9	38.9
P.fluorescence	4	450.5	26.7	420.5	39.5	15.8	29.5
Thiram	3	461.5	29.8	432.5	43.5	16.2	32.8
Carboxin	1	475.5	33.8	435.5	44.5	16.3	33.5
T. harzianum + Thiram	4+3	469.5	32.1	445.0	47.6	16.6	36.1
T. harzianum + Thiram	4+1.5	460.5	29.5	440.5	46.1	16.3	33.6
T. harzianum + Carboxin	4+1	470.0	32.2	445.5	47.8	16.8	37.7
T. harzianum + Carboxin	4+0.5	495.0	39.2	480.4	59.4	18.2	49.2
T. harzianum + *P. fluorescens*	4+4	460.0	29.4	440.0	45.9	16.3	33.6
T. harzianum + *P. fluorescens*	2+2	420.0	18.1	390.5	29.5	14.5	18.9
P. fluorescens + Thiram	4+3	440.5	23.9	421.0	39.6	16.1	32.0
P. fluorescens + Thiram	4+1.5	399.5	12.4	380.5	27.9	15.6	27.9
P. fluorescens + Carboxin	4+1	451.5	27.0	415.0	37.7	15.9	30.3
P. fluorescens + Carboxin	4+0.5	403.5	13.5	389.0	29.0	15.7	28.7
Control	-	355.5	-	301.5	-	12.2	-
C.D. at 5%	-	13.3	-	18.6	-	1.2	-
SE (d)	-	6.7	-	9.3	-	0.6	-

variety *Sadbhavna* were first treated with fungicide and thereafter coated with antagonist. A total 14 treatments consisting of biocontrol agents (4g/kg seed) alone and/or in combinations (2g/kg seed) with carboxin (1g/kg seed) and thiram (3g/kg seed) were evaluated. In combinatory half dose of fungicides and bioagents was used and untreated seeds served as control. 160g seeds were sown at 40 cm x 10 cm spacing in each plot. Standard agronomical practices were followed as per recommendations. Observations on seedling emergence and final plants stand were recorded at 15 days after sowing (DAS) and at crop maturity stage, respectively. Yield per plot was recorded after harvesting the crop and calculated on per ha basis.

The seed treatment combinations significantly increased seedling emergence, final

plants stand and grain yield of chickpea (Table 1). Seeds treated with *T. harzianum* (4g/kg seed) + carboxin (0.5g/kg seed) supported the maximum seedling emergence (495.0), final plants stand (480.0) and grain yield (18.0 q/ha). Similar result was also observed when seed treated with *T. virens* + carboxin. (Multhamilan and Jeyarajan, 1996; Tiwari and Mukhopadhyay, 2003). Seedling emergence was lowest (399.5) in *P. fluorescens* (4g/kg seed) +thiram (1.5g/kg seed). In case of final plant stand, it was lowest (380.5) in *P. fluorescens* (4g/kg seed) +thiram (1.5g/kg seed). Yield was lowest (14.5q/ha) in *T. harzianum* (2g/kg seed) + *P. fluorescens* (2g/kg seed). The treatments *T. harzianum* (4g/kg seed), thiram (3g/kg seed), carboxin (1g/kg seed) were statistically at par for yield, respectively. Successful control of collar rot by integration of bicontrol agents with chemical has been also reported by many workers. (Asghari and Mayee, 1991; Multhamilan and Jeyarajan, 1996; Tiwari and Mukhopadhyay, 2003).

The efficacy of biocontrol system can be improved by utilizing the biocontrol agent as a component of an integrated disease management system. During present investigation application of *T.harzianum* and *P. fluorescens* as seed treatment in combinations with carboxin and thiram provided significantly higher degree of disease control than either chemical or bio control alone. The integration of biocontrol agent with sub-lethal dose of fungicide not only improved efficacy of biological control system but also simultaneously cut down the use of chemical for disease management. It seems that carboxin provided initial protection of seeds and seedlings from the attack of the pathogen giving enough time to *T. harzianum* to get established and protect crop during remaining growing period of crop. The fungicide carboxin has been reported to loose its fungicidal activity within three weeks after application because of its conversion of sulfoxide, which is much less active (Kulka and Van Schemeling, 1987). Use of sub-lethal doses of chemicals weakens the pathogens and the antagonist becomes more effective to parasitize them (Mukhopadhyay *et al.*, 1992).

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