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Biocontrol agents in the health management of capsicum nursery

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ABSTRACT

Bicontrol agents *viz*., *Trichoderma viride, Trichoderma harzianum*, *Pseudomonas fluorescens* and mixture of *Trichoderma harzianum* + *Pseudomonas fluorescens* were tested for the health management of capsicum nursery. Mixture of *T. harzianum* + *P. fluorescens, T. harzianum* both from Pantnagar and Ranichauri were found promising in improving the health of nursery over other bioagents used in the study. They were effective in improving seedling emergence and vigour index with significant reduction of damping-off. Hence, damping-off can be managed through the application of bioagents.

Key words: Seedling emergence, vigour index, damping-off, biocontrol agents.

INTRODUCTION

Bell Pepper (*Capsicum annuum* L.) belonging to the family Solanaceae is one of the important vegetables of hills providing essential nutrients for human diet. Its potential yield is not realized owing to various diseases *viz*., damping-off, anthracnose, alternaria rot. Currently, frequent and indiscriminate use of synthetic fungicides is being adopted for their management. These chemicals are leading to environmental pollution and resistant development (Whipps and Lumsden, 6). Therefore, the present study was undertaken to test efficacy of different BCAs for the management of damping-off disease so as to integrate it in the disease management schedule at farmer's fields.

MATERIALS AND METHODS

A field trial was conducted at Experimental Farm of VPKAS (ICAR) located at Hawalbagh (altitude 1250 m msl, latitude 29° 36' N, longitude 79° 40' E) during March (2006-07). The predominant soil type of the area is silty clay loam. The trial was laid out using a randomized block design with three replications. The capsicum seed was treated with different isolates of *T. viride*, *T. harzianum, P. fluorescens* and mixture of *T. harzianum* + *P. fluorescens* along with chemical fungicide maintaining an untreated check thus making a total of seven treatments. The treatments comprised seed treatment (ST), nursery drenching (ND) (two times) with bioagents [*Pseudomonas fluorescens* @ 1.0% (10^9 cfu/g), *Trichoderma viride* (Strain BIL 198, Biotech International Ltd., India) @ 0.4% (2×10^9 cfu/g). Mixture of *Trichoderma harzianum* + *Pseudomonas fluorescens* @ 1.0% (10^9 cfu/g)] and with thiram @ 0.2%. Untreated check was also maintained for comparison. For ST, one millilitre of distilled water was used to form a thin film on the seed surface so that BCAs and thiram could adhere to the seed surface and seeds were kept overnight. Sowing of nursery was done in plots size of $1.5 \times 1.0 \times 0.15$ m^3 in the first week of March during both the years. Observations were recorded on seedling emergence, seedling vigour (germination (%) × seedling length in (cm)) and incidence of damping-off. Incidence of pre-emergence rot was calculated by total number of seeds sown minus germinated seeds; post-emergence rot incidence as percentage of toppled plants out of total germinated.

RESULTS AND DISCUSSION

All the biocontrol agents were found significantly effective in increasing the seedling emergence and vigour index of capsicum seed under field condition. Maximum percent increase in seedling emergence was recorded in *T. harzianum* + *P. fluorescens* (Ranichauri isolate) (71.9) followed by *T. harzianum* (Ranichauri isolate) (63.2%), *T. harzianum* (Pantnagar isolate) (62.7%). Fungicidal check (thiram) recorded 129.7% increase in seedling emergence. The maximum increase in vigour index was recorded by *T. harzianum* (Ranichauri) (135.2%) followed by *T. harzianum* + *P. fluorescens* (Ranichauri) (134.7%), *P. fluorescens* (Pantnagar) (111.0%). Thiram treated seeds showed an improvement of 274.4% in vigour index over untreated check. In case of pre- and post-emergence damping-off of capsicum under field condition, maximum control of pre-emergence rot was recorded in treatment with *T. harzianum* + *P. fluorescens* (Ranichauri) (55.8%) followed by *T. harzianum* (Ranichauri) (48.6%), *T. harzianum* (Pantnagar) (48.5%). Thiram resulted in 64.6% disease reduction over untreated check. Maximum control of post-

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Table 1. Effect of bio-agents on the seedling emergence and seedling vigour of capsicum.

Treatment	Seedling emergence (%)				Vigour index			
	2006	2007	Mean	Increase in emergence (%)	2006	2007	Mean	Increase in vigour (%)
Trichoderma viride @ 0.4%	58.4 (50.0)*	54.5 (47.6)*	56.5	52.7	1886	1557	1722	91.8
Trichoderma harzianum (Th.) @ 1.0 % (Ranichauri)	62.5 (52.4)	58.3 (49.8)	60.4	63.2	2295	1928	2112	135.2
Trichoderma harzianum (Th.) @ 1.0% (Pantnagar)	62.5 (52.4)	57.8 (49.6)	60.2	62.7	1892	1795	1844	105.3
Pseudomonas fluorescens (Ps.) @ 1.0% (Ranichauri)	54.2 (47.4)	51.5 (45. 9)	52.9	43.0	1657	1612	1635	82.1
Pseudomonas fluorescens (Ps.) @ 1.0% (Pantnagar)	48.6 (44.3)	43.4 (41.2)	46	24.3	2040	1749	1895	111.0
Trichoderma harzianum + *Pseudomonas fluorescen*) @ 1.0% (Ranichauri)	65.3 (54.5)	61.8 (51.8)	63.6	71.9	2229	1986	2108	134.7
@ 0.2%	90.3 (72.4)	79.5 (63.1)	85.0	129.7	3884	2840	3362	274.4
Control	36.1 (36.9)	37.7 (17.9)	37.0	-	872	924	898	-
LSD (P = 0.05)	7.0	2.0			670.5	443.2		

*Figures in the parentheses are angular transformed values.

Table 2. Effect of bioagents on the pre-emergence rot of capsicum.

Treatments	Pre-emergence rot (%)				Post-emergence rot (%)			
	2006	2007	Mean	Disease control (%)	2006	2007	Mean	Disease control (%)
Trichoderma viride @ 0.4%	41.6 (40.1)*	45.5 (42.4)*	43.6	43.6	24.6 (29.6)*	31.8 (34.3)*	28.2	28.4
Trichoderma harzianum (Th.) @ % (Ranichauri)	37.5 (37.7)	41.8 (40.3)	39.7	48.6	26.6 (30.9)	31.1 (34.0)	28.9	26.6
Trichoderma harzianum (Th.) @ 1% *(Pantnagar)*	37.5 (37.7)	42.1 (40.5)	39.8	48.5	25.2 (29.3)	28.3 (32.2)	26.8	32.0
Pseudomonas fluorescens (Ps.) @ 1% (Ranichauri)	47.2 (43.4)	48.5 (44.2)	47.9	38.0	20.6 (26.4)	16.8 (24.1)	18.7	52.5
Pseudomonas fluorescens (Ps.) @ 1% *(Pantnagar)*	51.4 (45.4)	56.6 (48.8)	54.0	30.1	34.4 (35.4)	32.4 (34.7)	33.4	15.2
Trichoderma harzianum + *Pseudomonas fluorescens*) @ 1% (Ranichauri)	34.7 (35.5)	33.6 (35.3)	34.2	55.8	27.5 (31.2)	22.8 (28.5)	25.2	36.0
@ 0.2%	9.7 (17.6)	45.0 (44.2)	27.4	64.6	16.5 (23.9)	11.9 (20.2)	14.2	64.0
control	64 (53.2)	90.6 (72.2)	77.3	-	42.6 (40.4)	36.1 (36.9)	39.4	-
LSD (P = 0.05)	6.8	20.7			15.0	3.0		

*Figures in the parentheses are angular transformed values.

emergence rot was recorded in treatment with *P. fluorescens* (Ranichauri) (52.5%) followed by T. *harzianum* + *P. fluorescens* (Ranichauri) (36.0%), *T. harzianum* (Pantnagar) (32.0%). The superiority of *P. fluorescens* in the control of post-emergence rot may be an additive effect due to multiplication of bioagents already introduced in the rhizosphere through seed and drenching. Similar findings were reported by (Bunkar and Mathur, 1) where seedling mortality was reduced by using carbendazim and soil inoculation with *T. harzianum* + *T. viride.* Significant control of pre-emergence and post-emergence damping-off of vegetables has been observed through application of *T. viride* and *P. fluorescens* (Manorangithan *et al.,* 3; Ramesh, 4). The control of damping-off in the present study may also be attributed to induction of defense responses in seedlings by bioagents as reported by Howell *et al.* (2). Srivastava *et al.* (5) found the suppressing effect of phosphate solubilizing pseodomonads on damping-off of tomato in addition to growth promotion.

The study concludes that bioagents *viz*. *T. harzianum* + *P. fluorescens, T. harzianum* both from Pantnagar and Ranichauri were found promising in improving the health of nursery over other bioagents used in the study. Implication of the study is that the promising bioagents could be a good replacement of synthetic fungicides particularly for the management of soil borne pathogens.

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