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Efficacy of bio-agents against damping off in solanaceous crops under nursery conditions

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ABSTRACT

The study was conducted to assess efficacy of *Trichoderma harzianum* and *Pseudomonas fluorescens* against damping off in tomato and brinjal seedlings during *Kharif* season. The investigation was performed as on farm trials on farmers' field over three years *viz.*, 2013-14, 2014-15 and 2015-16. *T. harzianum* and *P. fluorescens* were applied in combination of soil+seed treatment. Talc based formulation of both bio control agents were used @ 10 g kg^{-1} in seed treatment and 100 g m^{-2} in soil treatment. Results indicated that the combination of soil+seed treatment with *T. harzianum* was gives maximum seedling stands (84.15%) with minimum mortality (15.85%) in brinjal followed by soil+seed treatment with mixture of *T. harzianum* and *P. fluorescens* (78.30%) and soil+seed treatment with *P. fluorescens* alone (69.68%) whereas, in control plot treated with Carbendazim 50 WP (soil+seed) recorded less seedling stand (41.50%). In case of tomato, application of *T. harzianum* as soil+seed gave the maximum seedling stand (80.32%) followed by soil+seed treatment with combination of *T. harzianum* and *P. fluorescens* (73.45%) and *P. fluorescens* alone (58.64%) while seed+soil treatment with Carbendazim 50 WP given minimum seedling stand (42.01%). *Consortium of T. harzianum* and *P. fluorescens* significantly increased the growth and yield attributes of brinjal and tomato crops *i.e.* plant height, number of branches $plant^{-1}$, number of fruit $plant^{-1}$ and fruit yield ha^{-1} followed by along *Trichoderma* and *Pseudomonas*. The study showed that *T. harzianum* and *P. fluorescens* are the potential bio control agents as compare to Carbendazim 50 WP and can be used effectively for the management of damping off in seedlings in nursery.

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INTRODUCTION

Tomato and brinjal are most popular, highly productive and economic vegetable crops grown throughout India in different seasons. Both vegetables

are quite popular in poor man crops and regular income source of small and marginal farmers (Gargi and Kalita, 2012). Brinjal and tomato are occupying an area of 1723 and 7260 ha, respectively in Bilaspur district of Chhattisgarh, India.

They are attacked by several serious biotic stresses in different crop stages under different climate conditions. With changing weather conditions, the vegetable growing by small and marginal farmer's facing more difficulty in obtaining vigorous, healthy and good quantity of seedlings of tomato and brinjal due to infection by soil borne pathogens such as *Rhizoctonia solani*, *Fusarium oxysporum*, *Phytophthora* and *Pithium sp*. causing damping off disease in tomato and brinjal. Damping off disease causes significantly mortality in nursery (Jena, 2012). About 80 per cent seedlings of tomato and 90 per cent seedlings of brinjal were lost due to soil born diseases in nursery (Pandey *et al.*, 2003 and Gholve *et al.*, 2014). According to Pandey and Pandey (2002), severity of damping off is as high as 85 per cent in many vegetable crops like tomato. The soil borne diseases can be managed by using chemical treatment but the method is costly and most importantly it destroys beneficial microorganisms and disturbs the microbial diversity in soil. On other hand, biological methods can be economical, long lasting, and free from residual side effects and eco-friendly. The application of bio-control agents in the form of microorganisms for the control of soil borne diseases in vegetable crops can promote in organic farming system because they maintain beneficial microbial activity over the period of time in the soil. *Trichoderma* sp. is considered as a potential bio-control and plant growth promoting agents for many crops (Verma *et al.*, 2007; Bai *et al.*, 2008; Savazzini *et al.*, 2009 and Srivastava *et al.*, 2016). The competition with pathogens, parasitism and the production of antifungal compounds are the most important mechanisms involve in bio-control activity against several pathogens (Verma *et al.*, 2007 and Savazzini *et al*., 2009). *T. harzianum* populations can be multiplied relatively easily in different soil types and can continue to persist at detectable levels for months. Hence, the study was aimed with keeping of above facts in mind to optimize and demonstrate the best biological treatment for reducing the seedling mortality and obtaining vigorous and healthy seedlings of tomato and brinjal.

MATERIAL AND METHODS

An experiment was carried out at farmer's field located at Nirtu Village of Bilaspur district, Chhattisgarh state in India (22°09' 51'' N, 82°06' 49''E), during *Kharif* season of 2013-14, 2014-15 and 2015-16. The selection of farmers was done randomly and experiments were conducted at six different farmer's nursery. *Trichoderma harzianum and Pseudomonas florescence* were selected for assessing their efficacy alone and in combination as seed+soil application, while control keep as traditional farmer's practice *i.e.* seed treatment with Carbendazim. The treatment details were given in Table A. The talc based *Trichoderma harzianum and Pseudomonas fluoresces* were obtained from State Bio-Control Laboratory (SBCL), BTC College of Agriculture and Research Station, Chorbhatti, Bilaspur (Chhattisgarh), India. Nursery beds of size were 2×1 m^2 prepared at six different locations as replications. These beds were sufficiently moistened manually using sprinkler bucket. Treatments were done as per recommendations given by Pandey *et al*. (2004) *i.e*. seed treatment @ 10 g kg^{-1} of seed using talc based bio-agents (directly) and soil treatment using talc based bio-agents multiplied in FYM @100 g FYM m^{-2} area. The number of germinated seeds m^{-2} and number of seedling stand m^{-2} were recorded to calculate seedling stand (%) and mortality (%). The observations were taken at 10, 20 and 30 days after sowing (DAS). Plant height, number of branches $plant^{-1}$, number of fruits $plant^{-1}$ and fruit yield ha^{-1} were

Table A: Treatments detail

Sr. No.	Treatments	Dose of bio-agents and chemical
1.	Seed and soil treatment with Carbendazim 50 WP (Control)	3 g kg^{-1} of seed and 3 g kg^{-1} FYM based formulation for soil treatment
2.	Seed and soil treatment with *Trichoderma harzianum* 10% WP (CFUs 10^{10} g^{-1})	10 g kg^{-1} of seed and 100 g m^{-2} FYM based formulation for soil treatment
3.	Seed and soil treatment with *Pseudomonas fluoresces* 10% WP (CFUs 10^{14} g^{-1})	10 g kg^{-1} of seed and 100 g m^{-2} FYM based formulation for soil treatment
4.	Seed and soil treatment with *Trichoderma harzianum* and *Pseudomonas fluoresces*	10 g kg^{-1} of seed and 100 g m^{-2} FYM based formulation for soil treatment

calculated at the end of the growing season. The obtained data was subjected to Randomized Block Design (RBD) for statistical analysis.

RESULTS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under the following heads:

Effect of bio-control agents against damping off brinjal :

Efficacy of *T. harzianum* and *P. fluoresces* were assessed at farmers' field as experimental^{-1} design given in materials and methods. Experimental data parting to seedling stand revealed that the seedling stand was observed highest (82.25, 86.63 and 83.56%) in plots treated with soil+seed application of *T. harzianum* alone during 2013-14, 2014-15 and 2015-16, respectively with pooled mean of 84.15 per cent which is at par with soil+seed treatment with combination of *T. harzianum* and *P. fluoresces* (seedling stands 78.38%) and significantly superior over soil+seed treatment with *P. fluoresces* (69.68% seedling stand). Moreover all treatments were found to be significantly more effective in protecting seedlings as compare to soil+seed treatment with Carbendazim (Farmer's practice-48.15%) have been presented in Table 1. Data on seedling mortality have been illustrated that the least mortality was observed during all the years (17.75, 13.37 and 16.44%, respectively) with pooled mean of 15.85 per cent in *T. harzianum* treatment followed by combination of *T. harzianum* and *P. fluoresces* (21.62%), *P. fluoresces* (30.32%) and control (51.85%).

Effect on growth parameters:

Efficacy of *T. harzianum* and *P. fluoresces* were tested individually and in combination, significantly increased the growth parameter *i.e.* plant height and number of branches plant^{-1} compared with the Carbendazim treated treatment in all the three

Table 1 : Efficacy of *T. harzianum* and *P. fluoresces* against on damping off of seedling in brinjal

Sr. No.	Treatments	Seedling stand (%)				Mortality (%)			
		2013-14	2014-15	2015-16	Pooled mean	2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	48.75 (44.28)	49.25 (44.55)	46.45 (43.02)	48.15 (43.95)	51.25 (45.71)	50.75 (45.44)	53.55 (46.98)	51.85 (46.04)
2.	Soil+seed treatment with *Trichoderma harzianum*	82.25 (65.67)	86.63 (69.14)	83.56 (66.95)	84.15 (67.25)	17.75 (24.32)	13.37 (20.85)	16.44 (23.04)	15.85 (22.73)
3.	Soil+seed treatment with *Pseudomonas fluoresces*	67.87 (55.89)	71.82 (58.04)	69.34 (56.55)	69.68 (56.82)	32.13 (34.10)	28.18 (31.95)	30.66 (33.44)	30.32 (33.16)
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	75.56 (60.72)	78.92 (62.91)	80.67 (64.74)	78.38 (62.79)	24.44 (29.27)	21.08 (27.08)	19.33 (25.25)	21.62 (81.60)
	S.E.±	3.81	3.93	4.49	4.07	3.81	3.93	4.49	4.07
	C.D. (P=0.05)	8.63	8.89	10.16	9.22	8.63	8.89	10.16	9.22
	CV %	9.52	9.48	10.99	10.00	16.18	17.75	19.74	17.89

Table 2 : Effect of *T. harzianum* and *P. fluoresces* against on plant height of brinjal

Sr. No.	Treatments	Plant height (cm)			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	82.75	79.65	83.21	81.87
2.	Soil+seed treatment with *Trichoderma harzianum*	96.74	94.25	98.45	96.48
3.	Soil+seed treatment with *Pseudomonas fluoresces*	92.45	93.05	93.25	92.92
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	98.45	97.45	100.12	98.67
	S.E.±	0.75	0.98	1.16	0.96
	C.D. (P=0.05)	1.7	2.22	2.63	2.18
	CV %	7.45	8.25	9.45	8.38

assessment years. Consortium treatment T_4 showed the most effective one for increasing plant height 98.67 cm compared to carbendazim (Farmers practice) 81.87 followed by *Trichoderma* along (T_2) 96.48 and *Pseudomonas* along (T_3) 92.92 cm. All the treatment showed significantly differ with each other, treatment T_2 and T_4 showed marginal differ with each other (Table 2). Similar trend was also observed in case of number of branches plant^{-1}, T_4 treatment recorded the highest 23.94 compare to the farmer's treatment T_1 18.06 followed by T_2 22.47and T_3 19.95 number of branches plant^{-1} (Table 3).

Effect on yield parameters :

Data recorded in the Table 4, 5 revealed a decrease in the yield parameters of brinjal plant *i.e.* number of fruits in brinjal plant^{-1} and fruit yield of brinjal by Cardendazim treated farmers practice treatment. However, significantly increase was determined with the *Trichoderma* and *Pseudomonas* treatment in all the experimental years. The most effective treatment was found in treatment T_4 for both the parameters number of fruit plant^{-1} and fruit yield ha^{-1} (22.08 and 21.32) compared to farmers practices (13.63 and 13.72) followed by T_2 (19.92 and 19.19), T_3 (16.0 and 16.06), respectively.

Efficacy of *T. harzianum* and *P. fluoresces* against damping off of tomato seedling:

The data obtained from the experiments in tomato

Table 3 : Effect of *T. harzianum* and *P. fluoresces* against on number of branches in brinjal

Sr. No.	Treatments	No. of branches per plant			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	18.45	18.32	17.42	18.06
2.	Soil+seed treatment with *Trichoderma harzianum*	22.26	21.86	23.29	22.47
3.	Soil+seed treatment with *Pseudomonas fluoresces*	19.86	20.23	19.76	19.95
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	22.86	23.60	25.35	23.94
	S.E.±	0.53	0.45	0.55	0.51
	C.D. (P=0.05)	1.20	1.02	1.25	1.16
	CV %	12.32	10.25	12.65	11.74

Table 4 : Effect of *T. harzianum* and *P. fluoresces* against on number of fruits in brinjal

Sr. No.	Treatments	No. of fruit per plant			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	13.65	11.62	15.62	13.63
2.	Soil+seed treatment with *Trichoderma harzianum*	18.25	19.15	22.35	19.92
3.	Soil+seed treatment with *Pseudomonas fluoresces*	15.75	14.35	17.91	16.00
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	20.45	21.67	24.13	22.08
	S.E.±	0.43	0.40	0.57	0.47
	C.D. (P=0.05)	0.97	0.91	1.29	1.06
	CV %	10.45	11.63	12.78	11.62

Table 5 : Effect of *T. harzianum* and *P. fluoresces* against on fruits yield of brinjal

Sr. No.	Treatments	Fruit yield (Ton ha^{-1})			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	13.65	11.83	15.67	13.72
2.	Soil+seed treatment with *Trichoderma harzianum*	18.25	17.56	21.75	19.19
3.	Soil+seed treatment with *Pseudomonas fluoresces*	15.75	13.47	18.95	16.06
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	20.45	19.26	24.26	21.32
	S.E.±	0.43	0.35	0.65	0.48
	C.D. (P=0.05)	0.97	0.79	1.48	1.08
	CV %	10.45	12.62	13.45	12.17

nursery showed that maximum seedling strand (%) was observed from soil+seed treatment with *T. harzianum* alone during all three years of demonstrations (79.25, 82.95 and 78.76%, respectively). It was at par with soil+seed treatment with combination of *T. harzianum* and *P. fluoresces* (73.45%). While soil+seed treatment with *P. fluoresces* was having less seedling stand (58.64%) compared to *T. harzianum* and combination of *T. harzianum* and *P. fluoresces*. Moreover all treatments was having significantly higher seedling stand as compared to farmers practice *i.e.* Carbendazim (42.01%) Table 6. In case of seedling mortality minimum mortality was observed in soil+seed treatment with *T. harzianum* (19.68%) followed by combination of *T. harzianum* and *P. fluoresces* (26.55%), *P. fluoresces* (41.36%) and maximum mortality (57.99%) was recorded in control plot.

Effect on growth parameters:

Efficacy of *T. harzianum* and *P. fluoresces* were

Table 6: Effect of *T. harzianum* and *P. fluoresces* on damping off of tomato seedling in nursery

Sr. No.	Treatments	Seedling stand (%)				Mortality (%)			
		2013-14	2014-15	2015-16	Pooled mean	2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	41.50 (39.95)	39.43 (38.87)	45.12 (42.32)	42.01 (40.38)	58.50 (50.03)	60.57 (51.13)	54.88 (47.67)	57.99 (49.61)
2.	Soil+seed treatment with *Trichoderma harzianum*	79.25 (63.16)	82.95 (66.02)	78.76 (63.05)	80.32 (64.07)	20.75 (26.84)	17.05 (23.98)	21.24 (26.95)	19.68 (25.92)
3.	Soil+seed treatment with *Pseudomonas fluoresces*	57.25 (49.20)	63.32 (52.93)	55.36 (48.11)	58.64 (50.08)	42.75 (40.79)	36.68 (37.06)	44.64 (41.89)	41.36 (39.91)
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	70.48 (57.70)	76.43 (61.10)	73.45 (58.53)	73.45 (59.11)	29.52 (32.29)	23.57 (28.89)	26.55 (31.46)	26.55 (30.88)
	S.E.±	3.99	4.07	3.42	3.82	3.99	4.07	3.42	3.99
	C.D. (P=0.05)	9.04	9.22	7.75	8.67	9.03	9.22	7.75	9.03
	CV (%)	10.72	10.53	9.14	10.13	15.07	16.34	13.09	14.83

Table 7 : Effect of *T. harzianum* and *P. fluoresces* against on plant height in tomato

Sr. No.	Treatments	Plant height (cm)			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	68.23	70.62	70.26	69.70
2.	Soil+seed treatment with *Trichoderma harzianum*	74.20	78.35	76.56	76.37
3.	Soil+seed treatment with *Pseudomonas fluoresces*	71.45	73.41	72.28	72.38
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	76.56	83.45	83.11	81.04
	S.E.±	0.65	0.71	0.83	0.73
	C.D. (P=0.05)	1.48	1.61	1.88	1.66
	CV %	8.45	12.67	14.21	11.78

Table 8 : Effect of *T. harzianum* and *P. fluoresces* against on number of branches in tomato

Sr. No.	Treatments	No. of branches per plant			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	7.55	7.03	8.35	7.64
2.	Soil+seed treatment with *Trichoderma harzianum*	9.25	8.87	10.13	9.42
3.	Soil+seed treatment with *Pseudomonas fluoresces*	8.12	7.93	8.98	8.34
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	9.67	9.23	12.32	10.41
	S.E.±	0.45	0.35	0.61	0.47
	C.D. (P=0.05)	1.02	0.79	1.38	1.06
	CV %	13.65	10.62	15.45	13.24

also tested against the tomato crop for assessing the growth parameters. Almost similar trend was also recorded as find in brinjal crop, in respective all the three assessment years. Consortium treatment T_4 showed the most effective one for increasing plant height 81.04 cm compared to carbendazim (Farmers practice) 69.70 followed by *Trichoderma* along (T_2) 76.37 and *Pseudomonas* along (T_3) 72.38 cm. All the treatment showed significantly differs with each other (Table 7). Similar trend was also observed in case of number of branches plant^{-1}, T_4 treatment recorded the highest 10.41 compare to the farmer's treatment T_1 7.64 followed by T_2 9.42 and T_3 8.34 number of branches plant^{-1}. Treatment T_2 and T_3 showed marginal differ with each other (Table 7 and 8).

Effect on yield parameters:

Similar yield attributes result was observed also in case of tomato, *i.e.* number of fruits plant $^{-1}$ and fruit yield ha^{-1}. However, significantly increase was determined with the *Trichoderma* and *Pseudomonas* treatment in all the experimental years. The most effective treatment was found in treatment T_4 for both the parameters number of fruit plant $^{-1}$ and fruit yield ha^{-1} (55.06 and 38.71) compared to farmers practices (39.92 and 23.49) followed by T_2 (48.84 and 34.18), T_3 (43.65 and 26.26), respectively (Table 9 and10) .

Significantly better trend of *T. harzianum* and combination of *T. harzianum* and *P. fluoresces* on seedling stand (%) and mortality (%) might be due to one or more antagonistic activities against plant pathogen like *Pythium*, *Sclerotina* and *Rhizoctonia* which were responsible for damping off. *T. harzianum* and *P. fluoresces* were also known to promote plant growth and induce resistance in host, which might be another factors for better seedling stand and less mortality (Muthukumar *et al.*, 2011 and Gomathi *et al.*, 2011). Antagonistic effects of *Trichoderma* sp. against *Pythium* sp. and *P. aphanidermatum* was reported by several researchers that rhizosphere competent isolate produces number of metabolites in the rhizosphere which are responsible for *Trichoderma* colonization, plant growth promotion and reduction in damping-off. Application of compatible *Trichoderma* isolates both singly or in combination effectively suppressed the disease severity and increased percent disease reduction. It has been also reported that *Trichoderma* penetrate into root cortex which increase the lignifications and induce the resistance level in treated plants against the pathogen attack and also increases the hydrolytic enzymes that stimulates the

Table 9: Effect of *T. harzianum* and *P. fluoresces* against on number of fruits in tomato

Sr. No.	Treatments	No. of fruit per plant			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	38.46	35.67	45.62	39.92
2.	Soil+seed treatment with *Trichoderma harzianum*	48.76	44.12	53.64	48.84
3.	Soil+seed treatment with *Pseudomonas fluoresces*	43.45	38.26	49.23	43.65
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	55.45	50.36	59.36	55.06
	S.E.±	1.45	1.23	1.67	1.45
	C.D. (P=0.05)	3.29	2.79	3.79	3.29
	CV %	11.45	15.65	13.25	13.45

Table 10: Effect of *T. harzianum* and *P. fluoresces* against on fruit yield in tomato

Sr. No.	Treatments	Fruit yield (Ton ha^{-1})			
		2013-14	2014-15	2015-16	Pooled mean
1.	Soil+seed treatment with Carbendazim	23.65	21.16	25.65	23.49
2.	Soil+seed treatment with *Trichoderma harzianum*	33.45	30.45	38.64	34.18
3.	Soil+seed treatment with *Pseudomonas fluoresces*	26.22	23.62	28.93	26.26
4.	Soil+seed treatment with combination of *T. harzianum* and *P. fluoresces*	37.73	33.85	44.56	38.71
	S.E.±	1.26	1.33	1.85	1.48
	C.D. (P=0.05)	2.86	3.02	4.20	3.36
	C.V. %	13.45	10.67	15.46	13.19

plant defense mechanism (Harman, 2011 and Singh *et al.,* 2011).

Consortium of *Pseudomonas* sp. and *T. harzianum* displayed a significant increase in plant height, number of branches, number of fruits plant and fruit yield, although *Trichoderma* sp. significantly improve yield and growth attributes followed by single *Pseudomonas* (Singh *et al.*, 2013).

As reported in chilli (Muthukumar *et al.*, 2011 and Gomathi *et al*., 2011) and tomato (Karpagavalli and Ramabadran, 2001). Zagade *et al*. (2012) also observed that *Trichoderma* sp. superiorly reducing the seed rotting and increasing germination per cent significantly in chilli, whereas lowest for carbendazim which was confirmed from results in brinjal and tomato. Significantly less seedling stand and higher mortality per cent in carbendazim treated beds might be due to least effect of Carbendazim against Pythaceaus fungi and *Sclerotium rolfsii*. The findings of seedling stand and reduction of mortality are may be due to the ability of *Trichoderma* isolates to survive and colonize in the root and rhizosphere (Harman *et al*., 2004). The similar findings by Harman *et al.* (2004) showed greater influence of *Trichoderma* sp. in seed germination and seedling vigor which increases growth of shoot and root. The seed and soil treatment using *T. harzianum* in chilli and potato decreases damping off (Uddin *et al.*, 2011). In brinjal and other solanaceous vegetable crops, Gholve *et al*. (2014) reported that that soil application of *T. viride* was the most effective in management of damping off disease. *Trichoderma viride* isolate TK1, *T. harzianum* isolate TK8, *Pseudomonas fluorescens* isolate PS1 and *Bacillus* sp. isolate B1 were most effective in inhibiting the mycelia growth of pathogens for the management of wilt/root rot and damping-off diseases in chilli (*Capsicum annuum*) (Dar *et al.,* 2015). Seedlings of sweet pepper treated with both *Trichoderma atroviride* and *Trichoderma harzianum* had higher emergence percentage than the untreated seedlings (Olawumi *et al.,* 2016).

In the present study, it was observed that combination of bio-agents was more effective than *P. florescence* alone treatment was reported that the bio-priming of seeds with *T. harzianum* and *P. florescence* increased seed germination and reduced the incidence of disease (Srivastava *et al.,* 2010; Singh and Singh, 2006 and Subhash *et al*., 2013). Greater response of combination of *T. harzianum* and *P. fluoresces* than *P. fluoresces* alone may be due to synergistic antagonistic effect against plant pathogen and induce resistance. The reason behind effectiveness of combination of bio-agents may be because of volatile and non-volatile antibiotics produced by *Trichoderma* sp. and myco-parasitism might be responsible for the suppression of *P. aphanidermatum* leading to lysis (El-Katatny *et al.*, 2001 and Ghildiyal and Pandey, 2008).

Similar findings have been also reported by Champawat and Sharma (2003); Stephan *et al*. (2003); Srivastava (2004); Shabir and Rubina (2010) and Muddin *et al.* (2011) and suggested the growth rate of vegetables is increased in *Trichoderma* treated nursery beds but Jena (2012) recorded differ result and find combination of bio-agents *Trichoderma* and *Pseudomonas* showed better result in later stage of crops and in initially stage the individual bio-agents specially *Trichoderma* have better performance.

Conclusion:

Seed treatment with *Trichoderma harzianum* along and soil application of *Trichoderma harzianum* enriched FYM offered better strength to enhance the vigorousness of tomato and brinjal seedlings and better performance to reducing the mortality of seedling due to damping off disease in tomato and Brinjal followed by combination of *Trichoderma harzianum+Pseudomonas fluoresces* as seed and soil treatment. Consortium and along of bioagents also increased the growth and yield parameters.

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