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Integrated disease management of damping-off and wilt disease of chilli (*Capsicum annuum* L.)

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ABSTRACT

Chilli (*Capsicum annuum* L.) is one of the most important vegetable among solanacious group like potato, tomato etc. Most of the promising chilli cultivars grown in nursery are under a great threat for profitable cultivation due to the attack of several abiotic and biotic factors *viz*., fungi, bacteria, virus and nematodes. The major losses of chilli in nursery stage are covered by fungi, in which damping-off and wilt disease of chilli caused by *Fusarium oxysporum* f.sp. *capiscum* is more important diseases. For the management of damping-off and wilt of chilli to produce healthy seedlings of Chilli free from damping-off and wilt disease, there was a need to develop new technology for better management in nursery stage an experiment was conducted at different places/ first at nursery and other in main field of Vegetable Research Farm for two years with ten treatments and three replications. The treatment of maximum seed germination (84.34%), root length (21.97cm), shoot length (16.19cm), viguor-index (3217.46), minimum damping-off disease incidence (6.49%), wilt disease incidence found in main field (0.00%) and maximum red ripe fruit yield 30.19 q/ha was recorded in (T_9) Fenamidone + mancozeb (0.25%) drenching, next best effective treatment were (T_6a) seed treatment with (Carbendazim + mancozeb) 1.5g/kg seed + drenching of nursery (0.1%) and (T_7) use of Pencycuron 1ml/lit. in drenching which were statistically at par in case of seed germination, disease intensity andred ripe fruit.

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INTRODUCTION

The domesticated chilli (*Capsicum annuum* L.) is one of the most important vegetable among Solanacious group like potato, tomato crop etc. Chilli is an annual herbaceous spice/ vegetable/ cash crop grown in both tropical and sub-tropical regions and belongs to family solanaceae. In India the production and productivity of chilli were 0.775 million ha. 1.492 million tonns and 1.9 MT/ha, respectively (NHB 2014). Chilli is best adopted to warm and dry environments but during the hot-wet season yield are low due to poor fruit-setting caused by

the high temperature as well as many severe disease problems. Some times chilli crop may be poorly damage due to attacked by various plant pathogens, among them Fusarium wilt and damping-off of chilli caused by *Fusarium oxysporum* f.sp. *capsicum* (Sacc.) Synder and Hansen and *Pithium affenidarmetum* is an economically important disease and is a destructive disease of chilli worldwide (Das *et al.*, 2000). Today it has an extensive presence in all continents. Substantial crop losses in infected field have given the disease international attention. The soil born pathogen, *Fusarium oxysporum* f.sp. *capsicum* (Sacc.) Synder and Hansen and *Pithium affenidarmetum* infected parts of collar, roots, yellowing, defoliation, wilting, seedling and finaly lead to death of the plant (Singh, 1984). As the pathogen is soil borne, it is very difficult to manage the disease with fungicide alone. As the produce is export oriented in recent years, clean produce in preferred to fetch high price in the international market. The management of the disease can be done through culture, chemical, biological and use of resistant varieties. But integrated nursery management is the most effective and widely recommended method of diseases management.

MATERIAL AND METHODS

The experiment was conducted at Vegetable Research Farm, of Chandra Shakhar Azad University of Agricultural and Technology, Kanpur (U.P.) during two years *i.e.* 2014-15 and 2015-16. The experiment was laid out in the month of July in Randomized Block Design (RBD) with three replications. The plot size was 100 x 75 x 15 cm in nursery and 3m x 3m in main field. Recommended agronomical practice were followed to raise the healthy crop and normal 30 days old seedlings of chilli variety "G-4 " was used in main field.

Seed treatment and drenching of chemical and bio-agents started at onset of the disease. The ten (10) treatments each seed treatment and drenching were taken as: (T_1) *Bacillus subtillis* (4g/kg) IIVR, (T_2) *Trichoderma viride*-i (4g/kg) IIVR, (T_3) *Trichoderma*

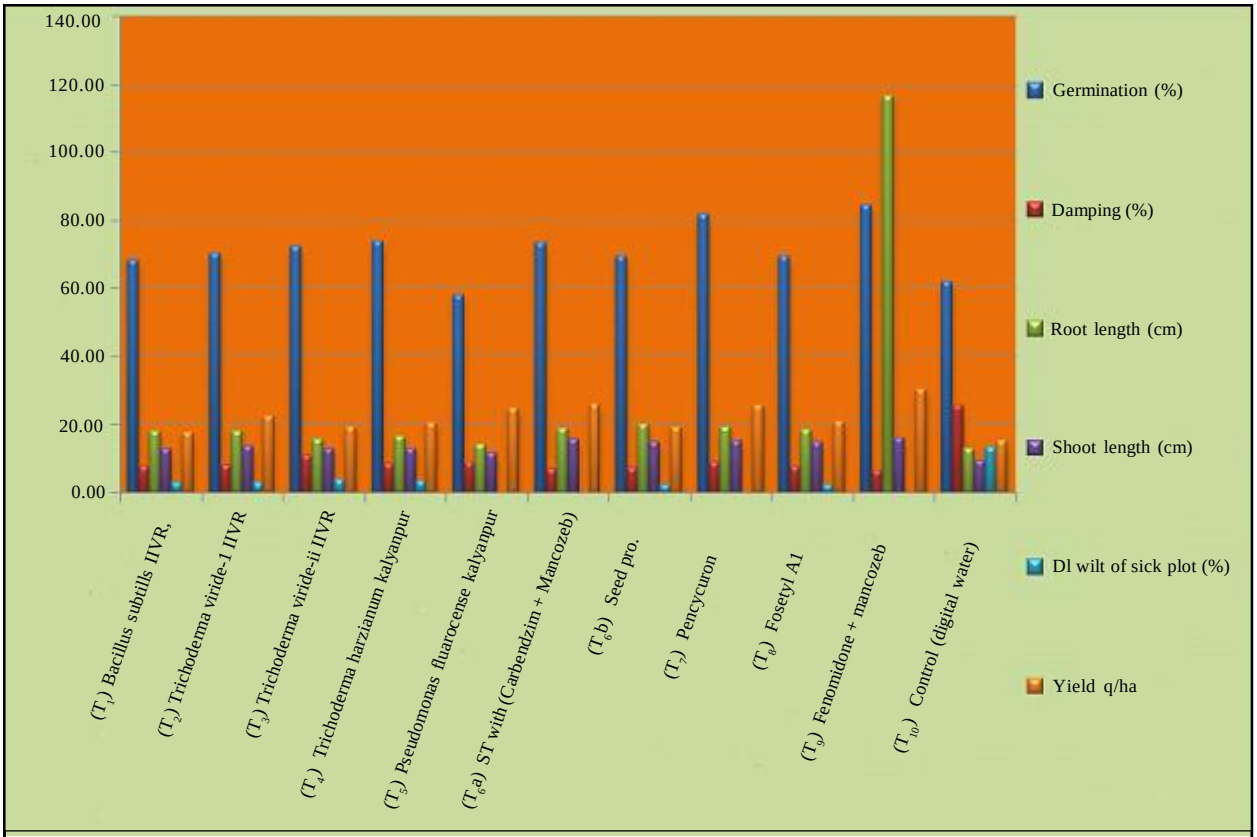

Fig. A : Treatment and drenching of fungicide, bio-agents on seed germination, damping-off and wilt diseases incidence, root length, shoot length, vingour index and grain yield

Table 1 : Effect of seed treatment and drenching of fungicide, bio-agents on seed germination, damping-off and wilt diseases incidence, root length, shoot length, vingour index and grain yield

Sr. No.	Treatments	Seed germination (%)			Damping off (%)			Root length (cm)			Shoot length (cm)			Vigour index-I			DI wilt of sick plot (%)			Yield q/ha		
		2014	2015	mean	2014	2015	mean	2014	2015	mean	2014	2015	mean	2014	2015	mean	2014	2015	mean	2014	2015	mean
1.	(T_1) *Bacillus subtills* (4g/kg) IIVR,	68.95	67.17	68.06	7.66	7.48	7.57	18.00	18.10	18.05	13.30	12.40	12.85	2158.14	2048.69	2103.42	3.15	2.88	3.02	19.86	15.15	17.51
2.	(T_2) Trichoderma viride-1 (4g/kg) IIVR	69.67	70.90	70.29	8.32	8.16	8.24	18.00	18.00	18.00	13.90	13.17	13.54	2222.47	2209.95	2216.21	2.76	3.08	2.92	25.81	18.73	22.27
3.	(T_3) *Trichoderma viride-ii* (4g/kg) IIVR	74.17	70.33	72.25	11.33	10.76	11.05	16.07	15.20	15.64	12.87	13.10	12.99	2146.48	1996.34	2071.41	3.51	4.03	3.77	20.80	17.70	19.25
4.	(T_4) *Trichoderma harzianum* (4g/kg) kalyanpr	74.33	71.33	72.83	8.32	8.64	8.48	16.57	16.23	16.40	13.07	13.10	13.09	2203.14	1990.34	2096.74	3.48	3.52	3.50	21.12	19.63	20.38
5.	(T_5) Pseudomonas floroscense (4g/kg) kalyanpur	59.83	55.70	57.77	8.67	8.91	8.79	14.20	13.70	13.95	10.77	12.60	11.69	1493.96	1464.91	1479.44	0.00	0.00	0.00	26.56	22.33	24.45
6.	(T_6 a) ST with (Carbendazim + Mancozeb) 1.5g/kg seed + drenching of nursery (0.1%)	78.00	77.00	77.50	6.98	7.21	7.10	20.03	17.60	18.82	16.00	15.13	15.57	2810.30	2655.69	2733.00	0.00	0.00	0.00	24.32	27.62	25.97
7.	(T_6 b) Seed pro.	69.33	69.67	69.50	7.32	7.39	7.36	20.53	19.67	20.10	14.53	15.00	14.77	2430.71	2415.46	2423.09	2.51	0.00	1.26	18.93	28.50	23.72
8.	(T_7) Pencycuron 1ml/lit. drenching	82.67	81.17	81.92	8.67	9.49	9.08	18.50	19.57	19.04	15.07	15.23	15.15	2775.23	2679.91	2727.57	0.00	0.00	0.00	19.36	31.65	25.51
9.	(T_8) Fosetyl A_l 0.1% drenching	70.00	69.00	69.50	7.66	7.48	7.57	18.43	18.20	18.32	14.87	14.60	14.74	2331.00	2263.20	2297.10	2.26	2.53	2.40	21.38	20.50	20.94
10.	(T_9) Fenamidone + mancozeb (0.25%) drenching	85.00	83.67	84.34	6.98	5.99	6.49	22.10	21.83	21.97	16.17	16.20	16.19	3252.95	3181.97	3217.46	0.00	0.00	0.00	28.37	32.00	30.19
11.	(T_{10}) Control (digital water)	62.00	61.67	61.84	27.00	23.97	25.49	12.90	13.07	12.99	10.00	8.93	9.47	1419.80	1356.74	1388.27	15.27	11.16	13.22	17.15	13.25	15.20
	C.V.	2.84	5.21		1.50	1.65		3.03	1.39		1.27	1.48					1.94	0.62		0.74	2.01	
	C.D. (P=0.05)	1.70	4.32		3.60	5.48		7.34	4.70		4.00	6.83					11.20	5.62		13.63	5.27	

viride-2 (4g/kg) IIVR, (T_4) Trichoderma harzianum (4g/kg) kalyanpr, (T_5) Pseudomonas fluoroscense (4g/kg) kanpur, (T_6 a) seed treatment with (Carbendzim + Mancozeb) 1.5g/kg seed + drenching of nursery (0.1%), (T_6 b) Seed pro, (T_7) Pencycuron 1ml/lit. drenching, (T_8) Fosetyl A_1 0.1 per cent drenching, (T_9) Fenamidone + Mancozeb (0.25%) drenching and (T_{10}) control (distilled water) were used for integrated management of disease (Fig. A). Disease incidence was calculated at every 10 days after nursery sowing using the following formula (Bliss, 1934):

$$\text{Disease incidence \%} = \frac{\text{Total number of diseased plant/plot}}{\text{Total plant population/plot}} \times 100$$

Data on wilt of disease intensity, germination of percent, root length (cm), shoot length (cm), vigorous index-I, Damping off of per cent and yield q/ha in main field was calculated.

RESULTS AND DISCUSSION

The experiment was carried out in nursery sick field at Vegetable Research Farm, Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur during two consecutive years *i.e*. 2014-15 to 2015-16. The average seed germination (%), root length (cm), shoot length (cm), vigour index-1 and two diseases (Damping-off and wilt of chilli) disease intensity and yield in main field were recorded and summarized in Table 1 showed that, all the treatment tested was significantly effective increasing seed germination, root length (cm) shoot, length (cm) and reducing diseases intensity percentage over control. The maximum seed germination (84.34%), root length (21.97cm), shoot length (16.19cm), viguor index (3217.46), minimum damping-off disease incidence (6.49%), wilt disease incidence (0.00%) and maximum yield 30.19 q/ha was recorded in (T_9) Fenamidone + Mancozeb (0.25%) drenching, next best effective treatment were (T_6 a) ST with (Carbendazim + Mancozeb) 1.5g/kg seed + drenching of nursery (0.1%) and (T_7). Pencycuron 1ml/lit. drenching which were statistically at par in case of seed germination disease intensity and red ripe fruit yield. Similar results have also been reported by Uddin *et al.*, 2011; Mahfuzul, 1997 and Kurucheve and Padmavathi, 1997.

Study concludes with remarks that damping-off and Wilt diseases of chilli nursery may be easily managed by drenching of Fenamidone + mancozeb (0.25%).

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