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Strategy for integrated management of Early and Late Blight diseases of tomato

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Tomato is very remunerative crop among vegetables which is largely affected by fungal, bacterial, nematode, phytoplasma and viral diseases. Among fungal diseases, early and late blight diseases are one of the most devastating causing yield losses. Therefore, keeping this in view an experiment was conducted during 2009-10 to 2011-12 with twelve treatments of chemicals and bio-pesticide for assessing yield, yield losses, disease intensity and C: B ratio. Results of three years experimentation indicated that lowest disease intensity of early blight (6.90%), late blight (10.35), highest fruit yield fresh (583.00q/ha) and lowest infected fruit yield (17.71 q/ha), lowest loss (3.04 %) and maximum C: B ratio 1:2.92 was found in three foliar spray of dimethomorph + mancozeb (0.1+0.2%) at 10 days interval from initiation of the disease.

Key word: Dimethomorph, C:B ratio, fungal diseases, *Alternaria solani, Phytophthora infestans, Trichoderma viride*

INTRODUCTION

Tomato (*Lycopersicon esculantum* Mill.) belonging to the family Solanaceae is one of the most important and widely grown vegetable crop in both tropics and sub tropics areas in the world. This is one of the rare crops which can be grown in a wide range of climatic conditions. India gain in an area 865.00 million ha and 16826.00 million tones production with 19.50 metric tones per ha in 2010-11 after China. (Mistry *el al.,* 2011) It is a rich source of carbohydrate (3.6 g) protein (1.9 g), sodium (45.8 mg), calcium (20.00 mg), magnesium (15.00 mg) and vitamin C (31.00 mg) in 100 g of ripe fruit (Singh, 2005). Tomato is affected by a large number of diseases causing substantial losses in yield of fruits. Beside viral, bacterial, nematodes and phytoplasma infection, crop is affected by large number of fungal diseases. Among fungal diseases, blight diseases (early and late blight) are gaining more importance in the recent years. The occurrence of these diseases are rising to alarming proportion in many tomato growing areas of the worlds. At present, most of all the cultivated varieties are found to be susceptible to these diseases. Yield losses due to early blight up to 78 per cent have been reported by Datar and Mayee (1981), and 22.6 to 80.00% due to late blight by Lung aho, (1998).

MATERIALS AND METHODS

The experiment was laid out at Research Farm of Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur in randomized block design with twelve treatments along with three replications. The tomato, variety Azad T-6 was taken for disease

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management. Crop was transplanted after thorough mixing of organic manure 120 q/ha, phosphatic fertilizer (60 kg P_2O_5 /ha), potasic fertilizer (60 kg K_2O /ha) and one third nitrogenous fertilizer (40 kg/ha) in the soil. Remaining dose of nitrogen fertilizer was applied as broadcast at 45 days and 90 days after transplanting. The soil of experimental plot was sandy loam in nature, well drained with low C:N ratio. The experiment was conducted during 2009-10 to 2011-12 (three years) with 28 days old seedling in 2.5 m X 2.4 m plot with spacing 60 cm X 50 cm. Before amendment of soil by FYM, it was amended with *Trichoderma viride* @ 1 kg for 100 kg FYM and before transplanting the nursery was treated with copper oxychloride @ 0.3 %. Foliar spray of chemicals and bio-agents were started at onset of the disease and repeated three times at 10 days intervals (Singh *et al.*, 2000). PDI was recorded before every sprays and 10 days after each spray. For yield data, at maturity fruits (fresh and infected) picked and weighted separately. The treatments of three foliar sprays viz., three foliar sprays of mancozeb @ 0.2% (T_1), three foliar sprays of chlorothalonil @ 0.2% (T_2), three foliar sprays of copper hydroxide @ 0.2 %(T_3), three foliar sprays of metiram @ 0.3% (T_4), three foliar sprays of metalaxyl + mancozeb @ 0.2% (T_5), three foliar sprays of dimethomorph + mancozeb @ 0.1+ 0.2% (T_6), three foliar sprays of fenamidione (Sectin) @ 0.3% (T_7), three foliar sprays of fosteyl A_1+ propineb @ 0.2% (T_8), three foliar sprays of *Pseudomonas fluorescence* @ 2.0% (T_9), three foliar sprays of cymoxnil + mancozeb @ 0.2% (T_{10}), three foliar sprays of *Trichodrama viride* @ 2.0% (T_{11}) and control (T_{12}) were used. Data on disease intensity, yield (fresh and infected), loss % were taken and C:B ratio were calculated. Data was analysed as per Snedecor and Cockran (1967).

RESULTS AND DISCUSSION

Disease intensity

The perusal of Table 1 revealed that significantly ($P< 0.05$) average lower early and late blight disease intensity 6.90% and 10.35% was recorded in three foliar sprays of dimethomorph + mancozeb @ (0.1 % + 0.2%) as compared to 9.14% early and 10.38% late blight in three foliar sprays of melataxyl + mancozeb (0.2%), 17.04% early and 11.52% late blight in three foliar sprays of metiram @ (0.3%), 18.92% early and 11.60% late blight in three foliar spray of mancozeb @ (0.2%), 10.11% early and 13.35% late blight in three foliar sprays of copper hydroxide (0.2%),18.76% early and 14.13% late blight in three foliar sprays of cymoxanil + mancozeb @ (0.2%), 15.02% early and 14.36% late blight in three foliar sprays of fenamidione @ (0.3%), 13.36% early and 14.83% late blight in three foliar sprays of chlorothalonil @ (0.2%), 17.25% early and 19.91% late blight in three foliar sprays of fosteyl A_1 + propineb @ (0.2%), 26.88% early and 22.46% late blight in three foliar sprays of *Pseudomonas fluorescens* @ (2.0%), 30.28% early and 24.53% late blight in three foliar sprays of *Trichoderma viride* @ (2.0%) and 37.59% early and 32.40% late blight in control plot in which only fresh water was used in spray, respectively. Lower disease intensity in dimethomorph found due to protectant, systemic and anti-sporulant activity. Its antisporulation activity stopped disease spread . It work on the fungal cell wall and control all activity stage in fungal life cycle except zoospore formation and mortality. Use of dimethomorph minimized the risk of resistant development. The present investigation is in conformity of findings reported by Basu *et al.,* (2003),Tofoli *et al.,* (2003), Tarlazzi *et al.,* (2008), Zhu *et al.,* (2008), and Patel and Chaudhary (2010).

Yield

As depicted in Table 2 that the average yield of fresh tomato was 583.00 q/ ha, 547.91 q/ha, 504.59q/ha, 489.58q/ha, 458.53q/ha, 455.23q/ha, 445.61q/ha, 438.45q/ha, 430.77q/ha, 399.71q/ha, 391.25q/ha, 270.99q/ha, and yield of infected fruits was 17.71q/ ha, 22.12q/ha, 23.08 q/ha, 24.75 q/ ha, 25.82 q/ha, 26.99 q/ha, 31.72 q/ha, 35.73 q/ ha, 29.36 q/ha, 36.70 q/ha, 48.37 q/ha, 54.64 q/ ha in T6, T5, T4, T1, T2, T7, T8, T10, T3, T9, T11, and T12, respectively. The maximum fresh fruits yields 583.00q/ ha and minimum infected fruits yields 17.71q/ha was recorded in three foliar sprays of dimethomorph + mancozeb (0.1+0.2) (T6). The loss due to disease infection was 3.04%, 4.04 %, 4.57%, 5.06%, 5.63%, 5.93%, 7.12% 8.15%, 6.82%, 9.18% 12.36% and 20.21% in T6, T5, T4, T1, T2, T7, T8, T10, T3, T9, T11, and T12 respectively. Lower losses due to both fungal infection was observed in treatment (T6). Higher C:B ratio

Table 1 : Average disease intensity for three years

S. No.	Treatment	Disease intensity (%)						Mean	
		2009-10		2010-11		2011-12			
		Early	Late	Early	Late	Early	Late	Early	Late
T_1	Mancozeb @ (0.2%)	18.50 (25.46)	12.40 (20.62)	16.65 (24.08)	12.60 (20.79)	21.61 (27.70)	9.80 (18.23)	18.92	11.60
T_2	Chlorothalonil @ (0.2%)	12.42 (20.62)	18.10 (25.17)	11.11 (19.47)	16.21 (23.74)	16.55 (24.00)	10.20 (18.62)	13.36	14.83
T_3	Copper hydroxide @ (0.2%)	10.22 (18.74)	14.40 (22.27)	8.91 (17.37)	14.47 (22.36)	11.20 (19.54)	11.20 (19.54)	10.11	13.35
T_4	Metiram @ (0.3%)	16.25 (2376)	12.75 (20.87)	14.74 (22.58)	12.25 (20.49)	20.15 (26.67)	9.55 (18.00)	17.04	11.52
T_5	Metalaxyl + Mancozeb @ (0.2%)	8.50 (16.93)	11.00 (19.32)	8.07 (16.50)	11.04 (19.41)	10.85 (19.18)	9.10 (17.50)	9.14	10.38
T_6	Dimethomorph + Mancozeb @ (0.1% + 0.2%)	6.40 (14.65)	10.80 (19.17)	6.20 (14.42)	10.42 (18.83)	8.10 (16.50)	9.85 (18.29)	6.90	10.35
T_7	Fenamidione (Sectin) @ (0.3%)	14.50 (22.36)	16.40 (23.88)	12.41 (20.63)	16.34 (23.84)	18.15 (25.21)	10.34 (18.75)	15.02	14.36
T_8	Fosteyl A_1 + Propineb @ (0.2%)	16.90 (24.27)	21.00 (27.22)	14.86 (22.67)	20.51 (26.93)	20.00 (26.56)	18.21 (25.26)	17.25	19.91
T_9	*Pseudomonas fluorescens* @ (2%)	26.00 (30.65)	24.00 (29.33)	24.55 (29.70)	23.37 (28.91)	30.11 (33.28)	20.00 (26.56)	26.88	22.46
T_{10}	Cymoxanil + Mancozeb @ (0.2%)	17.90 (25.02)	15.40 (23.11)	16.88 (24.26)	14.44 (22.33)	21.50 (27.62)	12.55 (20.74)	18.76	14.13
T_{11}	*Trichodermaviride* @ (2%)	30.10 (33.27)	25.60 (30.39)	29.14 (32.67)	25.65 (30.43)	31.62 (34.24)	22.35 (28.21)	30.28	24.53
T_{12}	Control	34.40 (35.83)	41.00 (39.80)	36.22 (37.00)	29.66 (39.03)	42.15 (40.48)	26.55 (30.10)	37.59	32.40
	CD (P= 0.05)	2.67	3.44	3.05	2.95	2.29	2.27		
	CV %	4.78	5.96	5.65	4.20	3.72	4.55		

Table 2 : Average yield for three years with average loss and B: C ratio

S.No.	Treatment	Yield q /ha						Mean		Loss %	B:C ratio
		2009-10		2010-11		2011-12					
		Fresh	infected	Fresh	Infected	Fresh	Infected	Fresh	Infected		
T_1	Mancozeb @ (0.2%)	486.76	18.06	508.67	18.66	473.33	37.53	489.58	24.75	5.06	1:2.55
T_2	Chlorothalonil @ (0.2%)	455.92	19.45	471.33	18.66	448.34	39.36	458.53	25.82	5.63	1:2.29
T_3	Copper hydroxide @ (0.2%)	434.81	23.89	455.83	22.50	401.67	41.70	430.77	29.36	6.82	1:2.14
T_4	Metiram @ (0.3%)	501.77	17.23	512.00	16.83	500.00	35.19	504.59	23.08	4.57	1:2.64
T_5	Metalaxyl + Mancozeb @ (0.2%)	548.72	16.67	574.17	17.17	520.84	32.53	547.91	22.12	4.04	1:2.90
T_6	Dimethomorph + Mancozeb @ (0.1% + 0.2%)	582.34	14.45	606.33	14.50	560.34	24.19	583.00	17.71	3.04	1:2.92
T_7	Fenamidione (Sectin) @ (0.3%)	460.37	21.12	472.83	21.50	432.50	38.36	455.23	26.99	5.93	1:2.03
T_8	Fosteyl A_1 + Propineb @ (0.2%)	450.65	22.78	468.67	26.67	417.50	45.70	445.61	31.72	7.12	1:1.69
T_9	*Pseudomonas fluorescens* @ (2%)	403.14	29.73	426.17	30.33	370.00	50.04	399.71	36.70	9.18	1:1.72
T_{10}	Cymoxanil + Mancozeb @ (0.2%)	449.53	27.17	450.00	35.83	415.83	44.20	438.45	35.73	8.15	1:1.95
T_{11}	*Trichodermaviride* @ (2%)	390.08	36.40	410.33	37.00	373.33	71.72	391.25	48.37	12.36	1:1.72
T_{12}	Control	267.28	40.01	277.83	44.67	265.83	79.23	270.31	54.64	20.21	1:1.01
	CD (P= 0.05)	53.60	4.02	16.68	3.54	40.84	13.84				
	CV %	5.14	7.31	4.29	13.14	4.10	13.37				

was observed in T6(1:2.92) followed by 1:2.90, 1:2.64., 1:2.55, 1:2.29, 1:2.03, 1:1.69, 1:1.95, 1:2.14, 1:1.72, 1:1.72, and 1:1.01 in T6, T5, T4, T1, T2, T7, T8, T10, T3, T9,T11, and T12, respectively. (Okasha *et al.,* 1989; Basu *et al.,* 2003; Tofoli *et al.,* 2003; and Hossain and Hossain, 2009).

Study concludes with remarks that early and late blight diseases of tomato may be easily managed by three foliar sprays of dimethomorph + mancozeb (0.1+0.2%).

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