
Effect of different biotic and abiotic agents for the management of tomato leaf curl virus disease

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The effect of different biotic and abiotic agents on tomato leaf curl virus disease incidence like Dimethoate, Carbofuran, Skimmed milk, PGPR-1 (plant growth promoting rhizobacteria, Fluorescent pseudomonas isolated from chilli rhizosphere), PGPR-2 (plant growth promoting rhizobacteria, banana rhizosphere soil containing Fluorescent pseudomonas), Econeem (neem based product), and salicylic acid were studied in this experiment. Applications of Dimethoate significantly reduced the disease incidence (by 40%) as compared to the untreated check. The other compounds like salicylic acid and Econeem also reduced the disease incidence (29-33%). Among PGPRs, the effect was less pronounced and PGPR-2 was more effective than PGPR-1. In the effective treatments, the time taken for first appearance of disease symptoms was late i.e., 41 DAT in case of Dimethoate whereas 23 DAT for control treatment. Regarding yield, Dimethoate treated plots recorded highest fruit yield (233 q/ha) followed by PGPR-2 (228 q/ha).

Key words : White fly, tomato, Leaf curl, PGPR, salicylic acid

INTRODUCTION

One of the ancient vegetables in the world is tomato (*Lycopersicon esculentum* Mill.). It is the native of America especially in Peru and Mexico from where it has spread out to the different parts of the world. Now a day it is one of the most widely grown vegetable in India. Tomato belongs to the family Solanaceae. Tomato contains outstanding amount of Vitamin C, Vitamin A, Thiamin or Vitamin B1 and Riboflavin or Vitamin B2. Nearly 60-70% of the tomato is used as vegetable and the rest is used as Pure, Ketchup, Jam, Jelly and Sauce etc. In India, average yield is much lower than the expected yield. Loss in yield is mainly due to the incidence of several pests and diseases caused by fungi, bacteria, viruses and root knot nematodes. Vasudeva and Samraj (1948) have first reported the leaf curl disease of tomato. Both fundamental and applied researches of the tomato leaf curl disease have been conducted throughout the world. Various strategies have been pursued to control the

disease. Chemical control has been found ineffective and in addition, the vector has been shown to develop pesticide resistance (Pico *et al.*, 1996). To minimize this problem, developed countries have made restriction on the use of many chemicals. Therefore, in recent days, one of the major thrusts of agriculture has been on the restricted use of chemicals. In this context, emphasis has been given to manage the disease through eco friendly botanicals, PGPR inducing chemical, SAR inducing chemicals.

MATERIALS AND METHODS

The experiment on the effect of different biotic and abiotic agents on the incidence of tomato leaf curl virus disease was conducted at Pundibari Farm, U.B.K.V., Cooch Behar. The biotic agents were Fluorescent pseudomonas isolated from chilli rhizosphere and banana rhizosphere soil and maintained at Department of Plant Pathology, UBKV viz. PGPR-1 (Acpsm-1) and PGPR-2 (Bpf-1) respectively.

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The abiotic agent include skimmed milk, salicylic acid and a neem based product namely Econeem. The list of selected agents and their respective doses has been presented in the following table.

The different treatments used in this experiment were categorized as follow :

Treatment	Biotic and Abiotic agents	Doses
T ₁	Dimethoate	@ 1.5 ml/lit.
T ₂	Carbofuran 3G	@ soil-1.5 kg/ha.
T ₃	Milk	@ 0.5 lit/3 plot
T ₄	Salicylic acid	@ 1.5 g/lit.
T ₅	Eco neem (A neem based product)	@ 1.5 ml/lit.
T ₆	PGPR-1 (Acpsm)	@ plant-10 ⁸ cfu/ml + soil-10 ⁸ cfu/ml
T ₇	PGPR-2 (Bpf-1)	@ plant-10 ⁸ cfu/ml + soil-10 ⁸ cfu/ml
T ₈	Control	Untreated

Isolation and purification study of PGPR was done by following the serial dilution procedure and the

culture were maintained in Yeast-glucose-chalk agar (YGCA) medium. The composition (g/l) of the medium is Yeast extract, 10.0; Glucose 10.0; Chalk (CaCO₃) 20.0; Agar 20.0 and Distilled water 1L, pH 7.0

For application purpose this bacterial culture were maintained in nutrient broth. The compositions (g/l) of nutrient broth medium were listed below : Peptone, 10; Beef extract, 5; KNO₃ (nitrite free C.P.), 1; and Distilled water 1 L.

The experiment was carried out by following Randomized Block Design (RBD) with three (3) replications. The plot size was 5 m × 3 m. The cultivar BSS-422, collected from Pundibari local market was used in this experiment. The insecticide like Monocrotophos (commercially available as 'Rogor) was sprayed at 15 days interval and three sprays were done. Econeem was also applied as like Rogor. Carbofuran was added to the soil of main field with the recommended dose. A solution of recommended concentration of milk and salicylic acid was prepared in the beaker and the seedlings were immersed for a period of 3-4 hrs before

Table 1: Studies on different biotic and abiotic agent on the leaf curl viral disease of tomato

Treatment	Concentration	Percentage of infection (days after transplantin)					Time taken of 1 st appearance of symptoms (days)	Yield (q/ha)
		30	45	60	75	90		
Dimethoate	@ 1.5 ml/lit.	0.00 (0.00)*	4.00 (11.53)*	10.33 (18.74)	16.00 (23.57)	22.50 (28.31)	41	233.0
Carbofuran 3G	@ soil-1.5 kg/ha	0.00 (0.00)	8.33 (16.77)	15.66 (23.11)	22.33 (28.19)	27.77 (31.80)	33	223.0
Milk	@ 0.5 lit/3 plot	0.00 (0.00)	6.00 (14.17)	12.33 (20.55)	18.67 (25.60)	30.83 (33.72)	37	212.42
Salicylic acid	@ 1.4 ml/lit.	0.00 (0.00)	4.50 (12.24)	14.00 (21.97)	19.33 (26.08)	25.18 (30.11)	40	217.83
Econeem	@ 1.5 g/lit.	5.33 (13.34)	10.33 (18.74)	12.50 (20.70)	17.66 (24.84)	26.66 (31.08)	28	211.66
PGPR-1 (Acpsm)	@ plant-10 ⁸ cfu/ml+ soil-10 ⁸ cfu/ml	4.00 (11.53)	9.66 (18.10)	18.67 (25.60)	25.00 (30.00)	31.85 (34.35)	28	221.33
PGPR-2 (Bpf-1)	@ plant- 10 ⁸ cfu/ml+ soil-10 ⁸ cfu/ml	0.00 (0.00)	6.00 (14.17)	15.66 (23.31)	21.33 (27.50)	28.33 (32.15)	36	228.33
Control	Untreated	6.33 (14.57)	12.00 (20.26)	21.33 (27.50)	30.00 (33.21)	37.66 (37.85)	23	207.33
CD(P=0.05)		1.6085	3.0087	3.2758	3.7005	4.0155		6.2599
SEm(±)		0.5303	0.9919	1.0800	1.2200	1.3239		2.0638

*Figure in the parentheses indicates angular transformed value.

transplanting. The prepared broths of PGPR were kept in beaker and the seedlings were dipped for 3-4 hrs before transplanting.

The percentage of plant infected with leaf curl virus disease was recorded at fortnight interval, starting from 30 days after transplanting (DAT) up to 105 DAT. Each cultivar was replicated three times. The percentage of disease incidence was calculated by using the following formula : Percentage of disease infection = No. of infected plant/Total no. of plant observed \times 100

RESULTS AND DISCUSSION

The results presented in Table 1 indicated that applications of Dimethoate significantly reduced the disease incidence (by 40%) as compared to the untreated check. The other compounds like salicylic acid and Econeem also reduced the disease incidence (29-33%). Among PGPRs, the effect was less pronounced and PGPR-2 was more effective than PGPR-1. In the effective treatments, the time taken for first appearance of disease symptoms was late i.e., 41 DAT in case of Dimethoate whereas it was 23 DAT for control treatment. Regarding yield, Dimethoate treated plots recorded highest fruit yield (233 q/ha) followed by PGPR-2 (228 q/ha). Reduction in tomato leaf curl by treatment with salicylic acid and PGPR-2 showed special interest

as the only feasible method of disease reduction by application of pesticide which are not only costly but also hazardous. There are many reports that virus diseases of vegetable crops can be minimized by ISR and SAR compounds (Sticher *et al.*, 1977). Similar reports on induce resistance by SAR chemicals are available in asparagus bean against tobacco necrosis virus (Pennazio and Roggero, 1991); in bean against TNV (Cloud and Deverall, 1987), in tobacco against tobacco mosaic virus (Heitz *et al.*, 1994). However, this experiment needs further explorations.

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