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Performance of Some Cultivars of Tomato Against Tomato Leaf Curl Disease

[1]Afia Akhtar, [1]M. A. Rahman khokon, [2]Bimal Kumar Pramanik and [1]M. Ashrafuzzaman
[1]Department of Plant Pathology,
[2]Seed Pathology Laborator, Bangladesh Agricultural University, Mymensingh –2202, Bangladesh

Abstract: Eight cultivars of tomato were studied under field condition in insecticide treated and non treated plots to observe the performance of these varieties against leaf curl disease. The effect of this disease in percent plant infection, insect population per plant, percent leaf area diseased, number of fruits per plant, weight of individual fruit (g), yield per plant (kg) and yield loss due to leaf curl infection were investigated. None of the varieties was found to be resistant against viral leaf curl disease. But the cultivar Raton was found to be somewhat resistant both in controlled and treated plots. In controlled plots the second best performance was shown by Manik. The other varieties were more or less affected by leaf curl virus. In insecticide treated plots, second highest yield was observed in Manik and Roma-VF varieties indicating that the cultivar Roma-VF has the potential to perform as good as Manik when cultivated under insecticidal condition. The cultivar Anobic suffered more due to leaf curl viral disease in terms of yield parameters under both insecticide treated and non-treated plots. Vector management using Malathion, improved the growth and yield parameters of cultivars.

Key words: Leaf curl disease, tomato culivars, performance, vector management

Introduction

Tomato leaf curl disease is one of the most commonly occurring viral diseases affecting tomatoes throughout Bangladesh. The disease can appear at any growth stage of the plant. The loss due to leaf curl amounts up to 93.3 %, when the crop is infected at an early stage (Sastry and Singh, 1979). Tomato leaf curl virus is transmitted by an insect vector called white fly (*Bemisia tabaci*) (Singh 1989). The incidence and severity of tomato leaf curl disease is considered to be directly related to the availability of this insect vector and susceptibility of the host.

To derive maximum yield, it is essential to control the disease and select proper varieties. Immunity and high resistance against Tomato Leaf Curl Virus (TLCV) remains to be discovered as it is very rare (Loannou, 1992). In such case high field and yield performance with high response to vector control is the aim.

With the above consideration, the present study was designed to find out the difference in performance among eight selected tomato cultivars against TLCV infection and to assess the effect of insecticides on the selected cultivars in relation to protection against TLCV infection.

Materials and Methods

An experiment was conducted at the field laboratory of the Plant Pathology Department, Bangladesh Agricultural University, Mymensingh during rabi season of 1998-99. Seeds of eight tomato cultivars namely Anobic (V_1), Bina-3 (V_2), Manik (V_3), Bahar (V_4), E_6 (V_5), Roma (V_6), Bian-2(V_7) and Raton (V_8) were collected from Bangladesh Institute of Nuclear Agriculture (BINA) farm, Mymensingh. Eight seedbeds of size $5x5m^2$ were prepared at the site of the Plant Pathology field laboratory. The seeds were treated with vitavax200 to exclude other infection @ 2% of seed weight.

The land of main field was well prepared by ploughing and cross ploughing followed by laddering and was made weed free. The following manure and fertilizers were applied at rate cow dung: 10 ton/ha, Urea: 550kg/ha, T.S.P.: 450kg/ha and MP: 250kg/ha. The experiment in the main field was laid out in a Randomized Complete Block Design (RCBD) with three replications. The replicated plot was divided into sixteen plots. Each plot was 2.25 m^2 in size. Thirty days old healthy seedlings were drawn from the seed bed in the evening for transplanting to the experimental plots. The roots of the seedlings were treated with 1:5 diluted skimmed milk suspension. Six plants were transplanted per plot. The plant to plant and row to row spacing was maintained at 40 cm and 52 cm respectively. Weeding, mulching and other intercultural operations were done when necessary. Malathion I 57EC @ 2ml L^{-1} ha^{-1} (i.e. 0.2%) was applied first at 30DAP, in V_1I_1, V_2I_1, V_3I_1, V_4I_1, V_5I_1, V_6I_1, V_7I_1, V_8I_1 treatment combinations, randomly at 3 blocks. Two successive applications were given at 15 days intervals. Treated plots were thoroughly covered with the insecticidal materials and the control plots were left without any treatment. All the plots were exposed to natural infection of leaf curl virus. Insect population per plant were counted, before insecticide application at all plots.

Data were collected on the following parameters: Percent plant infection, insect population per plant, percent leaf area diseased (Randomly 5 leaves were counted from the top of the plant and one fully curled leaf = 20%), number of healthy fruits per plant, number of symptom bearing fruits per plant, individual fruit weight (g), total yield per plant (Kg), total yield per plot (Kg), yield per hectare (t/ha) and yield loss due to infection.

Data were analyzed by the analysis of variance (Gomez and Gomez, 1984). The treatment means were compared by Duncan's New Multiple Range Test (DMRT).

Results and Discussion

The incidence and severity of tomato leaf curl disease in the present experiment was significant on growth and yield parameters. Percent plant infection in the control plots of all the cultivars increased more or less, as monitored rapidly at 15 days interval, where it increased relatively slowly as the vector population was controlled (Table 1A). Percent plant infection at 30 days after planting (DAP) and 45 DAP in treated plots was found to be quite low (Table 1B).

For the purpose of assessing the varietal performance the results of the non-insecticide treated plots are to be considered. However, comparison of the results between plants of a cultivar grown without treatment and those which

Table 1A: Per cent plant infection at 30 DAP, 45 DAP and 60 DAP Insecticide non- treated plots

Cultivar	Per cent plant infection		
	30 DAP	45 DAP	60DAP
V1	11.11ab	16.67ab	27.78bc
V2	16.67a	27.77a	27.78bc
V3	16.67a	22.22ab	44.44ab
V4	22.22a	27.87a	44.44ab
V5	22.22a	35.89a	44.44ab
V6	22.22a	38.89a	49.99a
V7	11.11ab	22.22ab	38.89ab
V8	0.00	11.11b	16.67c
CV %	48.63	25.83	16.53

Table 1B: Per cent plant infection at 30 DAP, 45 DAP and 60 DAP Insecticide treated plots

Cultivar	Per cent plant infection		
	30 DAP	45 DAP	60DAP
V1	5.56	11.11	22.22d
V2	5.56	16.67	27.78c
V3	11.11	11.11	22.22d
V4	11.11	16.67	33.33b
V5	16.67	27.78	38.89a
V6	16.67	27.78	33.33b
V7	5.56	11.11	22.22d
V8	0.00	5.56	5.56e
CV %	NS	NS	27.37c

Figures having common letters in a column do not differ significantly in Table 1A and B. NS = non significant

Table 2A: Insect population at 30 DAP, 45DAP and 60 DAP in Insecticide non treated plots

Cultivar	Insect population		
	30 DAP	45 DAP	60 DAP
V_1	1.92ab	2.59ab	3.59ab
V_2	1.37bc	2.04b	3.04b
V_3	1.44bc	2.11b	3.11b
V_4	2.10ab	2.77ab	3.77a
V_5	2.45a	3.12a	3.92a
V_6	2.27ab	2.49a	3.94a
V_7	1.45bc	2.12b	3.12b
V_8	0.67c	1.34c	1.46c
CV%	21.42	11.59	7.30

Table 2B: Insect population at 30 DAP, 45DAP and 60 DAP in Insecticide treated plots

Cultivar	Insect population		
	30 DAP	45 DAP	60 DAP
V_1	1.70ab	1.48b	1.23ab
V_2	1.15ab	0.93c	0.73bc
V_3	1.01b	0.73c	0.90bc
V_4	1.67ab	1.48b	1.26ab
V_5	2.02a	1.83a	1.61a
V_6	1.60ab	1.38b	1.16ab
V_7	1.02b	0.86c	0.64bc
V_8	0.81b	0.32d	0.30c
CV%	26.51	6.83	25.13

Figures having the common letters in a column do not differ significantly. In Table 2A and B.

Table 3A: Per cent leaf area diseased at 30 DAP, 45 DAP, and 60 DAP in Insecticide non treated plots

Cultivar	Per cent leaf area diseased		
	30 DAP	45 DAP	60 DAP
V_1	40.10e	48.22c	52.22b
V_2	46.50d	50.07b	53.10b
V_3	34.43f	38.62d	41.10c
V_4	59.17a	63.03a	65.33a
V_5	51.37c	53.47b	53.46b
V_6	56.21b	59.38a	62.40a
V_7	46.50d	48.50c	52.33b
V_8	0.00h	10.21e	14.21d
CV%	0.80	0.65	0.37

Table 3B: Per cent leaf area diseased at 30 DAP, 45 DAP, and 60 DAP in Insecticide treated plots

Cultivar	Per cent leaf area diseased		
	30 DAP	45 DAP	60 DAP
V_1	20.30d	25.25d	27.48c
V_2	30.16c	33.25c	35.14b
V_3	29.35c	31.37c	34.03b
V_4	45.01a	47.61a	43.13a
V_5	42.18b	40.45b	42.20a
V_6	45.11a	46.20a	47.10a
V_7	27.31c	28.68d	30.00c
V_8	0.00e	7.36e	8.33d
CV%	0.95	0.82	1.01

Figures having the common letter (s) in a column do not differ significantly in table 3A and B.

were under insecticide cover may give us clue about the yield potential of a cultivar which is affected by the high incidence and severity of disease. V_8 (Raton) showed less infection both in treated and non- treated plots. In V_6 (Roma VF) the reaction of the infection appeared to be more pronounced (Table1A and 1B). Insect population per plant in non-treated plots were highest in varieties V_4, V_5, V_6 respectively. But insect population per plant in treated plot V_5 (E_6) had the highest insect population (Table 2A and 2B). Sastry and Singh (1973) reported that timely use of correct insecticide not only reduce the white fly population but also check the spread of disease to a greater extent. The present experimental results were in conformity to the results obtained by Sastry and Singh (1973). Percent leaf area diseased increased rapidly in non-treated plots among different cultivars at 15 days intervals whereas it increased in treated plots at an intermediate rate. In both cases V_8 (Raton) showed the best tolerance against the leaf curl disease (Table 3A and 3B).

Varieties V_3, V_4, V_6, V_7 gave comparatively less promising performance against the disease both in terms of incidence and severity. Among the cultivars Raton performed relatively better in these respects. Raton was found to give the highest significant number of fruits per plant, with lower number of symptom bearing fruits, more weight of individual fruits and thus higher yield per plant both in treated and non-treated plots. (Table 4A and 4B). The lowest performance against the disease was observed in V_5 in terms of number of fruits per plant, number of symptom bearing fruits per plant and yield per plant. Tomato yield was affected in V_1, V_2, V_3, V_4 and V_7 much more than in V_6 (Roma-

Table 4A: Effect of leaf curl disease on different yield parcameters of tomato in insecticide treated plot

Cultivar	Number of fruits per plant			Weight of individual fruit(g)			Yield per plant(Kg)			Yield per hectare (ton)		
	Healthy plant	Infected plant	calculated t- value	Healthy plant	Infected plant	calculated t- value	Healthy plant	Infected plant	calculated t- value	Healthy plant	Infected plant	calculated t- value
V_1	12.57g	9.60d	5.33*	45.00e	43.45e	5.64*	0.57f	0.41e	5.89*	15.09f	10.98e	6.06*
V_2	13.23f	9.90d	11.25**	74.00c	71.10c	2.79NS	0.97e	0.79d	13.48**	26.09e	18.78d	12.32**
V_3	25.00c	19.90b	8.35**	82.00b	80.08b	9.43**	2.05b	1.59b	10.04**	54.83b	42.44b	10.66**
V_4	17.00h	13.97c	3.42NS	98.37a	93.80a	1.47NS	1.79c	1.31c	3.68NS	47.80c	35.14c	3.48NS
V_5	11.50h	8.40d	6.28*	81.53b	69.23c	6.39*	0.93e	0.68d	8.46**	24.99e	15.45de	7.80**
V_6	25.75b	20.57b	4.08*	62.00d	57.20d	18.05**	1.59d	1.17c	5.20*	42.53d	31.30c	5.40*
V_7	21.17d	14.10c	8.48**	45.00e	44.15e	5.24*	0.95e	0.62d	7.98**	25.38e	16.56d	8.31**
V_8	29.77a	26.77a	9.01**	80.43b	77.30b	4.22*	2.39a	2.06a	19.40**	63.77a	55.10a	15.51**

* significant at 5% level **siginificant at 1% level. NS= non significant

Table 4B: Effect of leaf curl disease on different yield parameters of tomato in insecticide treated plot

Cultivar	Number of fruits per plant			Weight of individual fruit(g)			Yield per plant(Kg)			Yield per hectare (ton)		
	Healthy plant	Infected plant	calculated t- value	Healthy plant	Infected plant	calculated t- value	Healthy plant	Infected plant	calculated t- value	Healthy plant	Infected plant	calculated t- value
V_1	14.47e	12.23c	1.60NS	51.00f	47.45e	4.31*	0.73e	0.58c	2.52NS	19.66e	15.48e	2.39NS
V_2	14.75e	12.90e	2.24NS	90.00b	84.60b	3.79NS	1.32d	1.09bc	2.96NS	35.37d	29.11c	3.05NS
V_3	27.00b	25.10b	6.68*	82.07c	77.30b	6.21*	2.25b	2.12a	5.86*	60.17b	56.66a	5.77*
V_4	19.10d	16.90d	1.65NS	107.0a	98.80a	8.20**	2.14c	1.67ab	7.86**	54.40c	44.46b	5.10*
V_5	15.50e	12.10e	5.89*	89.20b	84.75c	16.77**	1.38d	0.93bc	8.85**	36.82d	24.88d	9.60**
V_6	30.63a	24.90b	9.05**	68.00d	65.20d	9.38**	2.15c	1.62ab	10.86**	57.58bc	43.24b	9.22**
V_7	25.00c	20.43c	3.43NS	55.00e	48.15e	20.31**	1.37d	0.98bc	5.48*	36.64d	26.16cd	5.67*
V_8	31.73a	28.57a	7.11**	83.87c	78.37c	5.08*	2.51a	2.23a	4.85*	66.92a	59.62a	4.97*

* significant at 5% level **siginificant at 1% level. NS= non significant

Table 5A: Respective yield loss due to leaf curl infection in non treated and treated plots in insecticide treated plots

Cultivars	Yield per healthy plant (Kg)	Yield per infected plant (Kg)	Yield loss due to infection (ton/ha)
V_1	0.57f	0.41e	4.11c
V_2	0.97e	0.70d	7.29bc
V_3	2.05b	1.59b	12.39ab
V_4	1.79c	1.32c	12.66a
V_5	0.93e	0.57d	9.55ab
V_6	1.57d	1.17c	11.24ab
V_7	0.95e	0.62d	8.82abc
V_8	2.39a	2.07a	8.67abc
CV%	5.19	6.80	29.03

Table 5B: Respective yield loss due to leaf curl infection in non treated and treated plots in insecticide treated plots

Cultivars	Yield per healthy plant(Kg)	Yield per infected plant(Kg)	Yield loss due to infection (ton/ha)
V_1	0.73 e	0.58 c	4.18 d
V_2	1.32 d	1.09 bc	6.26cd
V_3	2.25 b	2.12 a	3.52 d
V_4	2.14 c	1.67 ab	9.97 abc
V_5	1.38 d	0.93 bc	11.94 ab
V_6	2.15 c	2.15 a	14.26 a
V_7	1.37 d	0.97 bc	11.89 ab
V_8	2.51 a	2.23 a	7.31bcd
CV%	2.23	22.49	24.07

Figures having the same letter (s) in a column do not differ significantly in Table 5A and B.

VF). Yield loss due to infection was the highest in V_4 in insecticide non-treated plot and lowest in V_1. B. On the other hand in insecticide treated plots yield loss due to infection was the highest in V_8 and lowest in (Table 5A and 5B). But in both cases Raton showed high yield production but yield loss due to infection was moderate in this variety. The results of the present work indicate that though all of the eight cultivars used in the experiment produced pronounced influence on the incidence of leaf curl disease and yield of tomato, the cultivar Raton performed the best followed by Manik. Cultivar Roma-VF performed as good as cultivar Manik when vector control is ensured.

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