Environment & Ecology 29 (3B) : 1615—1617, 2011
 ISSN 0970-0420

Effect of Different Nutrient Combinations on Leaf Curl Virus Disease of Tomato (*Lycopersicon esculentum* Mill.) under Field Condition

Ak. SOMORJIT* AND P. S. NATH

Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya
Mohanpur 741252, India
E-mail : somoagri@gmail.com
**Correspondence*

Abstract

Studies were carried out on the effect of 11 nutrient combinations (organic and inorganic) on the leaf curl virus disease of tomato during *rabi* seasons of 2007 and 2008. The variety used for the experiment was F_1 hybrid Shaktiman. The most susceptible period of the tomato was found to be between 40 and 100 DAT. The treatment F_1OM_2 where the N, P, K, OM, and VC at the rate of 150 kg/ha, 60 kg/ha, 60 kg/ha, 64 q/ha FYM + 34 q/ha VC respectively combinations reduced the disease severity (21.50%) than the control.

Key words : Disease severity, Leaf curl virus, Nutrient combinations, Shaktiman, Tomato.

Tomato (*Lycopersicon esculentum* Mill.) is the most important warm season fruit vegetables grown throughout the world. Tomato still remains as a choice crop of scientists because of its short duration nature, easiness in cultivation, large number of seeds in a fruit, easiness in hybridization and cytology works, grown worldwide under outdoor and indoor conditions. Tomato belongs to the family Solanaceace, genus *Lycopersicon* and a true diploid with 2n=24. Tomato yellow leaf curl virus was first identified in 1930 and since then it became the most notorious disease in the world. The first identified virus TYLCV was named after the disease it causes in Israel (1). There are various predisposal factors such as age of plant, soil reactions, environmental factors, air pollution, wind velocity, host nutrition. Among these, nutritional factor of plant plays a major role, which affects the rate of growth and state of readiness of plants to defend themselves against pathogen attack. Nutrition of a host determines its resistance or susceptibility to disease in a particular host or its particular organ because kinds and quantities of nutrients required by the pathogen are available there. Highly resistant plants are less affected by alteration in nutrition and highly susceptible plants greatly increase the resistance like tolerant plants. So, infectious plant disease is the result of a host, pathogen, environment and nutrition factor over time (2). A disease can be reduced by application of different nutrients, but the severity of much disease is reduced by specific levels of gradient arranged by soil treatment with different nitrogen, phosphorus, potassium, farmyard manure and vermicompost before cultivation. So, knowledge of host nutrition in relation to disease development provides a basis for modifying current agriculture practices to reduce disease severity and it should be considered as important cultural weapon in our arsenal for controlling disease in an integrated crop production system. Therefore the present experiment was conducted to assess the effect of different levels of nitrogen, phosphorus, potassium farmyard manure and vermicompost on the disease incidence along with disease severity of leaf curl virus disease of tomato.

Methods

The experiment was conducted at Regional Research Station, Gayeshpur, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal for two consecutive *rabi* seasons (2007-2008 and 2008-2009). The research station is situated at an elevation of 9.75 meter above sea level and the latitude and longitude are 23.5°N and 88.5°E, respectively. The climate of this

Table 1. Different nutrient combinations (organic and inorganic).

C	Control
F_1	$N_{150} : P_{60} : K_{60}$
F_2	$N_{180} : P_{90} : K_{90}$
F_3	$N_{220} : P_{110} : K_{110}$
OM_1	128 q/ha FYM
OM_2	64 q/ha FYM + 34 q/ha VC
F_1OM_1	$N_{150} : P_{60} : K_{60}$ + 128 q/ha FYM
F_2OM_1	$N_{180} : P_{90} : K_{90}$ + 128 q/ha FYM
F_3OM_1	$N_{220} : P_{110} : K_{110}$ + 128 q/ha FYM
F_1OM_2	$N_{150} : P_{60} : K_{60}$ + 64 q/ha FYM + 34 q/ha VC
F_2OM_2	$N_{180} : P_{90} : K_{90}$ + 64 q/ha FYM + 34 q/ha VC
F_3OM_2	$N_{220} : P_{110} : K_{110}$ + 64 q/ha FYM + 34 q/ha VC

N_{150}=150 kg/ha N P_{60}=60 kg/ha P_2O_5 K_{60}=60 kg/ha K_2O
N_{180}=180 kg/ha N P_{90}=90 kg/ha P_2O_5 K_{90}=90 kg/ha K_2O
N_{220}=220 kg/ha N P_{110}=110 kg/ha P_2O_5 K_{110}=110 kg/ha K_2O

region is subtropical humid and the soil is sandy loam in texture. Tomato (*Lycopersicon esculentum* Mill.) variety Shaktiman. Seeds were sown in September (22 September), in the raised seed bed and transplanted during October (22 October).

Tomato were planted in a randomized block design with three replications and 12 treatments were assigned in one main plots and it is divided into 36 plots covering an area of 25 m^2 (5m × 5 m). Gross plot area under the 36 plots is 1075 m^2, bunds of 0.5 m wide were kept between two plots to prevent lateral seepage of water and for convenient during investigation. Water channel of 0.75 m were kept for irrigation. Eleven nutrient treatments with different combinations of nitrogen, phosphorus, potassium, farmyard manure and vermicompost and one control were allocated in three replications. The different nutrient combinations were given in (Table 1). The amount of fertilizers required per plot was calculated and weighed for 36 plots in terms of g respectively. Urea, single super phosphate and muriate of potash were applied equally in three splits i.e. first at basal second 30 DAT and third 60 DAT at the rate 270, 324 and 396 g/plot for urea, 313, 469 and 573 g/plot for SSP and 84, 125 and 153 g/plot respectively. Farmyard manure and vermicompost were applied as basal application. The inter row and plant spacing were 80 and 80 cm respectively. The disease tomato yellow leaf curl virus was observed and incidence and severity of each disease were calculated by the following formula :

Table 2. Disease severity rating scale.

Percent plant area covered	Severity scale
0 (no disease)	0
1—10%	1
11—20%	3
21—40%	5
41—60%	7
>61%	9

$$\text{Disease incidence (\%)} = \frac{\text{Number of plants infected}}{\text{Number of plants observed}} \times 100$$

The severity of disease or percentage of disease index (PDI) of the scale (0—9). The scale used for assessment of disease severity is given in Table 2. The percent disease index (PDI) was calculated using the formula (3).

$$\text{Disease severity (\%)} = \frac{\sum \text{All numerical ratings}}{\text{Total number of plants observed} \times \text{Maximum rating}} \times 100$$

The incidence and severity of disease were recorded at 15 days interval commencing from the appearance of the disease on plants in field up to maturity. The data were statistically interpreted through calculation of analysis of variance by standard methods (4) and the significance of different treatments was tested by error mean square by Fisher and Snedicor's *F* test at probability level 0.05.

Results and Discussion

Disease Incidence

The lowest disease incidence was found in control plot from 40 to 130 DAT. Two years pooled mean showed the maximum disease incidence was observed in F_3OM_2 (43.79%), followed by F_2 (40.28%), F_2OM_2 (39.84%), F_3OM_1 (37.42%) and F_2OM_1 (35.12%) here all the treatment combinations increased the disease incidence over the control. The significant minimum disease incidence was observed in C (23.15%), where no fertilizer was applied followed by OM_2 (26.87%), OM_1 (28.70%), F_1OM_1 (29.17%) and F_1OM_2 (31.02%) (Table 3). Czosnek and Laterrot (1) concluded that N fertilizers increased the susceptibility of the plant to the disease, *Dreschleraincurvata* leaf spot of coco-

Table 3. Effect of different nutrient treatments on disease incidence and severity (130 DAT) of leaf curl virus disease of tomato during 2007 and 2008. C=Control, F_1=$N_{150}P_{60}K_{60}$ kg/ha, F_2=$N_{180}P_{90}K_{90}$ kg/ha, F_3=$N_{220}P_{110}K_{110}$ kg/ha, OM_1=128 q/ha FYM, OM_2=64 q/ha FYM + 34 q/ha (VC). DAT=Days after transplanting.

Treatments	Disease incidence				Disease severity (PDI)			
	2007	2008	Pooled		2007	2008	Pooled	
C	25.00	21.29	23.15		7.63	13.96	10.79	
F_1	35.18	34.25	34.72		10.90	19.84	15.37	
F_2	39.82	40.73	40.28		10.18	19.96	15.07	
F_3	32.41	37.03	34.72		12.65	31.17	21.91	
OM_1	25.92	31.48	28.70		4.62	22.01	13.32	
OM_2	30.56	23.18	26.87		3.80	19.56	11.88	
F_1OM_1	28.71	29.63	29.17		3.59	22.84	13.22	
F_2OM_1	31.48	38.75	35.12		7.09	15.11	11.10	
F_3OM_1	33.33	41.50	37.42		10.28	20.69	15.49	
F_1OM_2	25.00	37.03	31.02		3.16	13.78	8.47	
F_2OM_2	29.63	50.05	39.84		7.09	15.18	11.14	
F_3OM_2	33.33	54.25	43.79		9.25	16.64	12.94	
	Replication	Treatment (T)	Year (Y)	T × Y	Replication	Treatment (T)	Year (Y)	T × Y
SE (±)	0.626	1.253	0.511	1.772	0.273	0.547	0.223	0.774
CD P = 0.05	NS	3.572	1.458	5.051	NS	1.560	0.637	2.206

nut seedlings.

Disease Severity (PDI)

In contrary to the disease incidence, the lowest disease severity was found in F_1OM_2 treated plot.Two years pooled mean showed the significant minimum disease severity was observed in F_1OM_2 (8.47%) followed by C (10.79%), F_2OM_1 (11.10%), and F_2OM_2 (11.14%). The maximum disease severity was observed in F_3 (21.91%) followed by F_2OM_1 (15.49%), F_1 (15.37%) and F_2 (15.07%). The treatment F_1OM_2 was reduced in disease severity (21.50%) than control plots (Table 3). Mckinney (5) studied the effects of N, P and K on the incidence of yellow mosaic virus, leaf crinckle and root rot on mungbean CV k-181 and found that the increase rate in N rates increased the severity of yellow mosaic virus. Ali et al. (6) reported that disease incidence and severity was low in the plots in which additional nutrients were applied. It was found that the incidence and severity of the disease was increased with the increase of the age of the plant, the most susceptible period was between 40 and 100 DAT. Therefore, it is concluded that the treatment F_1OM_2 where the N, P, K, OM, and VC at the rate of 150 kg/ha, 60 kg/ha, 60 kg/ha, 64 q/ha FYM + 34 q/ha respectively are the most effective nutrient combinations reduced disease severity and cost of cultivation.

References

1. Czosnek H. and H. Laterrot. 1997. A world-wide survey of tomato yellow leaf curl viruses. *Arch. Virol.* 142 : 1391—1406.
2. Agrios G. N. 1988. *Plant pathology.* Academic Press, New York, USA. 803 pp.
3. Gomez K. A. and A. A. Gomez. 1984. *Statistical procedure for agricultural research.* John. Wiley and Sons, New York, USA.
4. Gallasch H. 1987. Effect of nutrition on the incidence of *Dreschleraincurvata* leaf spot of Coconuts. *Papua New Guinea Agric. J. Konedolu,* 3-4 : 38—50.
5. Mckinney H. H. 1923. Influence of soil temperature and moisture on infection of wheat seedling by *Helminthosporiun sativum. J. Agric. Res.* 26 : 195—217.
6. Ali M. A., B. K. Pramanik and T. Khann. 2001. Influence of additional nutrition on the growth and yield of leaf curl infected tomato plant. *Pak. J. Biol. Sci.* 4 : 799—801.