Plant Archives Vol. 20, Supplement 1, 2020 pp. 2040-2044 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

IMPACT OF GROWTH REGULATION THROUGH SPACING AND PRUNING ON YIELD AND QUALITY OF TOMATO HYBRIDS *(LYCHOPERSICON ESCULENTUM* MILL.)

S. Krishnaprabu

Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar 608 002 (Tamilnadu) India.

Abstract

An experiment was conducted at farmers field at Trichy to study the effect of growth regulation through spacing and pruning on yield and quality of tomato hybrids *(Lychopersicon esculentum* Mill.) during 2019. Grown under control conditions. The results of present investigation revealed that tomato variety Sun 7611 (V_2) recorded the higher (7.42,7.90,4.63 and 1.85) number of flowers per cluster at all the stages of crop growth and differed significantly from Arka Abhijith (V_1). Where in pruning methods single stem (P_1) gave higher (6.74 and 7.09) number of flowers per cluster at 30 and 60 days after transplanting, which were significantly different from P_2 (double stem). Tomato grown on single-stem resulted in higher individual fruit weight (77.04 g) than double stemmed plants. Maximum yield of 2.23 kg/plant and 129.4 tonnes per hectare was recorded in plants having two stemmed plant, and the yield of 1.96 kg per plant and 114.38 tons per hectare was obtained from single - stemmed plants. Plants wider spacing gave the highest fruit weight (79.15 g) followed by medium spacing plants (73.92 g) and the least was recorded in closely spacing plants (69.07 g). Fruit yield per plant was significantly reduced under closer plant spacing (1.8 kg) and increased as spacing were increased.

Key words : Growth regulation, Spacing, Pruning, Quality, Tomato hybrids.

Introduction

Protected cultivation of vegetables in India has just started recording an annual growth rate of 30 per cent. Protected cultivation involves protection of different production stages mainly from adverse environmental conditions such as extreme temperature, hail storm, scorching sun, heavy rains, snow etc. Some studies on capsicum, tomato, cucumber have shown encouraging results. Vegetable production in open condition confronts with many limitations like climatic uncertainties, land scarcity, pest and disease infection. The proposition of protected cultivation has to be looked into in this backdrop. The basic idea behind green house cultivation is to get maximum yield within a limited area. Whole of the green house floor must be under cultivation for this purpose. However, there exists a critical limit for plant spacing and utilization of green house floor area. Pruning and training is one of the ways to improve the utilization of green house space and to improve crop production. The present investigation was, therefore, proposed on effect of growth regulation through spacing and pruning on yield and quality of tomatoes grown under control conditions.

***Author for correspondence :** E-mail : prabu1977krishna@gmail.com

Materials and Methods

An experiment was laid out in a low cost, naturally ventilated polyhouse (E-W orientation) of 137.5m^2 area. The polyhouse had the dimensions of 25 m length and 5.5 m width, having a side height of 2.5 m and central height of 3.7 m. An UV stabilized high density polyethylene film (HDPE) of (200µ) 800 guage was used as cladding material for the polyhouse. Both the sides of polyhouse were covered with rambo net (40 mesh) for natural ventilation and protection against pests. Shade net (50%) was also provided inside the polyhouse to reduce temperature and light intensity, whenever required. The experiment consisted of two different pruning methods (Single stem -P_1 and Double stem -P_2) and three spacing (S_1 :60 × 20cm, S_2: 60 × 30 cm and S_3: 60 × 40 cm). The experiment was laid out Factorial Randomized Complete Block Design. Raised beds of 1 m width and 20 cm height

were prepared with a walking space of 45 cm between the beds. Beds were incorporated with well decomposed farm yard manure and basal dose of inorganic fertilizers were mixed thoroughly (Anonymous, 1999). The analysis of one year data on qualitative and yield characters like number of flower per cluster, number of fruits per cluster, average fresh fruit weight, fruit yield per plant and fruit yield per hectare and the chlorophyll a and b in leaves were estimated, adopting the procedure outlined by Hiscox and Israelam (1979).

Results and Discussion

The findings of the present study as well as relevant discussion have been presented under following heads:

Effect of spacing and pruning on number of flowers per cluster in tomato hybrids

It was observed from table 1 that V_2 gave higher (7.42,7.90,4.63 and 1.85) number of flowers per-cluster at all the stages of crop growth, which were significantly different from V_1.

Between pruning methods P_1 gave higher (6.74 and 7.09) number of flowers per cluster at 30 and 60 days after transplanting, which were significantly different from P_2. However, P_1 and P_2 were at par at 90 days after transplanting and at final harvest.

Table 1: Effect of pruning and spacing on number of flowers per cluster at 30,60,90 days after transplanting and at final harvest.

Treatments	30 DAT	60 DAT	90 DAT	Final harvest
V_1	5.50	5.29	3.10	
v_2	7.42	7.90	4.63	1.85
F-test	*	*	*	f&
S.E.±	0.08	0.10	0.06	0.01
C.D. (P=0.05)	0.22	0.28	0.17	0.02
P_1	6.74	7.09	3.90	1.28
P_2	6.18	6.10	3.82	1.28
F-test	*	*	NS	NS
S.E.±	0.08	0.10	0.06	0.01
C.D. (P=0.05)	0.22	0.28		
S_1	6.22	6.59	3.95	1.26
S_2	6.56	6.49	3.86	1.28
S_3	6.58	6.71	3.78	1.29
F-test	*	NS	NS	NS
S.E.±	0.09	0.12	0.07	0.01
C.D. (P=0.05)	0.27	0.34		
V_1 : Arka Abhijith	v_2: Sun 7611			
P_1 : Single stem	P_2:Double stem			
S_1 : 60 × 20cm	S_2: 60 × 30cm			
S_3 : 60 × 40cm	-			

NS= Non-significant.

Number of flowers per cluster did not differ significantly among spacing treatments at all the stages of crop growth except at 30 days where S_3 gave the highest (6.58) number of flowers per cluster, which was significantly different from S_2 and S_1. The least number of flowers per cluster was recorded in S_1.

Number of flowers per cluster did not differ significantly with all interactions, at all the stages of crop growth. Though number of flowers per cluster varied initially, at 90 days after planting and at final harvest it did not differ significantly among pruning treatments. Lim and Chen (1988) also reported that there was no significant variation for number of flowers per cluster between single stemmed and double stemmed tomato plants. Rajewar and Patil (1979) also observed no statistical difference in the number of flowers per cluster between pruning treatments. Number of flowers per cluster did not differ significantly at 30 days after planting where wider spacing (60 × 40 cm) gave higher number of flowers per cluster (6.58). Number of flowers per cluster at 60, 90 days after planting and number of fruits per cluster did not differ significantly. Sun 7611 produced higher number of flowers per cluster (7.9 at 60 days after planting) which might be attributed to the varietal difference.

Interactions effects

There was no significant difference observed for number of flowers per cluster with all treatment interactions at all the stages of crop growth. Treatment interactions VS and PS did not differ significantly for the number of clusters per plant. However, interaction VP differed significantly (Table la).

Effect of spacing and pruning on number of fruits per cluster in tomato hybrids

Number of fruits per cluster differed significantly between hybrids. Sun 7611 produced more number of fruits per cluster at all the stages of crop growth. Arka Abhijith recorded significantly higher fruit weight (91.62 g). Less number of fruits per cluster, in Arka Abhijith could be a reason for higher fruit weight due to inverse relationship between fruit weight and number of fruits (Rasmussen, 1986). Single-stemmed plants produced higher number of fruits per cluster at all the stages of crop growth compared to double stemmed plants.

Interaction effects

Number of fruits per cluster did not differ significantly for treatment interactions VS and PS. However, treatment interaction VP differed significantly.

Effect of spacing and pruning on fresh fruit weight,

Table l a: Interaction effect of pruning and spacing on number of flowers per cluster at 30,60,90 DAT and at harvest.

Treatments	30 DAT	60 DAT	90 DAT	harvest
V_1p_1	5.87	5.73	3.13	0.71
V_1p_2	5.12	4.85	3.06	0.71
V_2P_1	7.60	8.45	4.67	1.85
V_2P_2	7.23	7.36	4.59	1.85
F-test	NS	NS	NS	NS
S.E.±	0.11	0.14	0.08	0.01
C.D. (P=0.05)				
V_1s_1	5.33	5.33	3.15	0.71
V_1s_2	5.51	5.26	3.12	0.71
V_1s_3	5.65	5.28	3.02	0.71
V_2s_1	7.12	7.85	4.74	1.82
V_2s_2	7.62	7.73	4.61	1.86
V_2s_3	7.52	8.14	4.53	1.87
F-test	NS	NS	NS	NS
S.E.±	0.13	0.17	0.10	0.01
C.D. (P=0.05)				%
P_1S_1	6.40	7.03	3.94	1.25
P_1S_2	6.91	6.92	3.93	1.29
P_1s_3	6.90	7.31	3.83	1.29
P_2S_3	6.05	6.14	3.96	1.27
P_2S_2	6.22	6.07	3.80	1.28
P_2s_3	6.27	6.10	3.72	1.29
F-test	NS	NS	NS	NS
S.E.±	0.13	0.17	0.10	0.01
C.D. (P=0.05)				

NS = Non-significant.

Table 2: Effect of pruning and spacing on number of fruits per cluster at different stages of crop growth in tomato hybrids grown under cover.

Treatments	30 DAT	60 DAT	90 DAT	harvest
V_1	3.72	3.58	1.33	0.71
V_2	4.84	5.07	2.23	1.33
F-test	*	*	*	*
S.E.±	0.06	0.06	0.06	0.01
C.D. (P=0.05)	0.19	0.16	0.17	0.02
P_1	4.64	4.78	1.90	1.02
P_2	3.93	3.87	1.65	1.01
F-test	*	*	*	*
S.E.±	0.06	0.06	0.06	0.01
C.D. (P=0.05)	0.19	0.16	0.17	0.02
S_1	4.15	4.33	1.86	1.01
S_2	4.34	4.25	1.85	1.02
S_3	4.35	4.39	1.62	1.02
F-test	NS	NS	*	NS
S.E.±	0.08	0.07	0.07	0.01 *
C.D. (P=0.05)			0.21	

NS= Non-significant.

Table 2a: Interaction effects of pruning and spacing in tomato hybrids at different stages of crop growth on number of fruits per cluster.

Treatments	30 DAT	60 DAT	90 DAT	harvest
V_1P_1	4.19	3.99	1.43	0.71
V_1P_2	3.25	3.17	1.23	0.71
V_2P_1	5.08	5.58	2.37	1.34
V_2P_2	4.60			1.31
F-test	*	NS	NS	*
S.E.±	0.09	0.08	0.08	0.01
C.D. (P=0.05)	0.26			0.02
V_1s_1	3.59	3.58	1.42	0.71
V_1s_2	3.72	3.56	1.33	0.71
V_1s_3	3.84	3.61	1.24	0.71
V_2s_1	4.70	5.09	2.31	1.31
V_2s_2	4.96	4.94	2.37	1.33
V_2s_3	4.86	5.18	2.00	1.34
F-test	NS	NS	NS	NS
S.E.±	0.11	0.10	0.10	0.01
C.D. (P=0.05)				
P_1S_1	4.34	4.76	1.99	1.01
P_1S_2	4.76	4.62	2.07	1.03
P_1S_3	4.81	4.97	1.64	1.03
P_2S_1,	3.95	3.90	1.74	1.01
P_2S_2	3.92	3.88	1.63	1.00
P_2S_3	3.90	3.81	1.60	1.01
F-test	NS	NS	NS	NS
S.E.±	0.11	0.10	0.10	0.01
C.D. (P=0.05)				

NS= Non-significant.

fruit yield per plant and fruit yield per hectare in tomato hybrids

Tomato grown on single stem resulted in higher individual fruit weight (77.04 g) than double stemmed plants. Takahashi and Sasaki (1981) reported that individual fruits from laterals from two or three stemmed plants weighed less than those from the single stemmed plants. The yield of tomato per plant and per hectare was found to differ significantly between pruning treatments. Maximum yield of 2.23 kg/plant and 129.4 tonnes per hectare was recorded in plants having two stemmed plant and the yield of 1.96 kg per plant and 114.38 tones per hectare was obtained from single stemmed plants.

It is likely that pruning of axillary shoots fad helped in diverting the flow of nutrients towards apical growing point, improving plant growth and ultimately more assimilation of material like carbohydrates and proteins (Mangal and Kasim, 1987) resulting in higher fruit yield. Reported that fruit weight generally decreased as plant

Table 3: Effect of pruning and spacing on average fresh fruit weight (g) of tomato hybrids grown under cover.

Varieties	Pruning				Spacing			
	P_1		P_2	S_1		S_2	S_3	Mean
V_1	93.57		86.67	84.76		92.35	97.76	91.62
V_2	57.52		55.42	53.38		55.48	60.55	56.47
Mean	77.04		71.05	69.07		73.92	79.15	
Spacing		P_1		Pruning	P_2			Mean
S_1		70.66			67.49			69.07
S_2		77.70			70.13			73.92
S_3		82.78			75.53			79.15
Mean		77.04			71.05			
	F-test			S.E.±				C.D. (P=0.05)
Varieties		*			0.98			2.88
Pruning		*			0.98			2.88
Spacing		*			1.20			3.53
VP		*			1.39			4.07
VS		NS			1.70			-
PS		NS			1.70			-

NS= Non-significant.

Table 4: Effect of pruning and spacing on fruit yield (kg) per plant of tomato hybrids grown under cover.

Spacing	Varieties		Pruning		
	V_1	V_2	P_1	P_2	Mean
S_1	1.56	2.06	1.72	1.89	1.81
S_2	1.72	2.34	1.91	2.15	2.03
S_3	1.98	2.91	2.25	2.64	2.44
Mean	1.75	2.44	1.96	2.23	
	Pruning				
Varieties					Mean
	P_1				P_2
V_1	1.69			1.82	1.75
V_2	2.23			2.64	2.44
Mean	1.96			2.23	
	F-test			S.E.±	C.D. (P=0.05)
Varieties	*			0.05	0.13
Pruning	*			0.05	0.13
Spacing	*			0.06	0.16
VP	*			0.07	0.19
VS	*			0.08	0.23
PS	NS			0.08	

population increased. Plants spaced wider gave the highest fruit weight (79.15 g) followed by medium spaced plants (73.92 g) and the least was recorded in closely spaced plants (69.07 g). Fruit yield per plant was significantly reduced under closer plant spacing (1.8 kg) and increased as in-row spacing increased. Maximum (2.44 kg) fruit yield per plant was recorded in plants with wider spacing. However, yield per hectare was significantly improved under closer spacing because of having more number of plants per unit area as compared to medium and wider plant spacing. The results are in agreement with the findings of Takahashi and Sasaki (1983) and Mangal and Kasim (1987).

Interaction effects

Fruit yield per plant differed significantly for interactions VP and VS interactions PS did not differ significantly. Among VP, V_2P_2 gave the highest (2.64 kg per plant) fruit yield and V_2S_3 gave the highest (2.91 kg per plant) fruit yield among treatment interactions VS. Significant difference was also observed in fruit yield per hectare in treatment interaction VP. V_2P_2 gave the highest (152.37 tonnes per hectare) yield. Mangal and Kasim (1987) reported significant interaction effect of varieties and pruning and varieties and spacing on fruit yield per plant and total yield.

Effect of spacing and pruning on chlorophyll a and b content in tomato hybrids

A significant difference was observed in chlorophyll a between hybrids. Highest (1.86 mg/g fresh weight) chlorophyll a was observed in V_2, which significantly different from V_1 (Arka Abhijith) chlorophyll a did not differ significantly between pruning treatments. Among

Table 5: Effect of pruning and spacing on fruit yield (tonnes) per hectare of tomato hybrids grown under cover.

Varieties	Pruning P_1	P_2	S_1		Spacing S_2	S_3	
V_1	98.94	106.42	129.90		95.64	82.49	102.68
V_2	129.83	152.37	172.04		130.04	121.22	141.10
Mean	114.38	129.40	150.97		112.84	101.85	
Spacing			Pruning				Mean
	P_1			P_2			
S_1	143.54			158.41			150.97
S_2	106.06			119.62			112.84
S_3	93.55			110.15			101.85
Mean	114.38			129.40			
	F-test			S.E.±			C.D. (P=0.05)
Varieties	*			2.08			6.09
Pruning	*			2.08			6.09
Spacing	*			2.55			7.46
VP	*			2.94			8.62
VS	NS			3.60			
PS	NS			3.60			

NS=Non-significant.

Table 6: Effect of pruning and spacing on chlorophyll a and b of tomato hybrids grown under cover.

Treatments	Chlorophyll a	Chlorophyll b
V_1	1.51	0.62
V_2	1.86	0.68
F-test	*	*
S.E.±	0.03	0.02
C.D. (P=0.05)	0.09	0.05
P_1	1.73	0.69
P_2	1.65	0.62
F-test	NS	NS
S.E.±	0.03	0.02
C.D. (P=0.05)		0.05
S_1	1.61	0.65
S_2	1.69	2.64
S_3	1.76	0.67
F-test	*	NS
S.E.±	0.04	0.02
C.D. (P=0.05)	0.11	

NS=Non-significant.

spacing treatments wider spacing (S_3) gave the highest (1.76 mg/g fr. Weight) chlorophyll a, which was significantly different from S_2 and S_1.S_1 and S_2 chlorophyll a were at par. Chlorophyll a did not differ significantly with all interactions.

Maximum (0.68 mg/g fresh weight) chlorophyll b and chlorophyll a/b was observed in V_2 which was significantly higher than V_1 (0.622 and 2.4344 mg/g fresh weight). Chlorophyll b was significantly higher (0.69 mg/ g fresh weight) in P_1 Chlorophyll b did not differ significantly among three different spacing treatments and with all interactions (Table 6).

References

Anonymous (1999). Savernate phase-II Progress Report for Period 1-1-99 to 30-9-99.

Hiscox, J.D. and Israelam (1979). Method for the extraction of chlorophyll from leaf tissue with out maceration., *J. Bot.,* **57:** 1332-1334.

Lim, E.S. and S.T. Chen (1988). Hydroponic production studies on low land tomato in Malaysia. The effect of pruning system and CHPA application on yield. *Proc. of the intenl. Symp. on integrated management practices,* AVRDC. Taiwan, 358-364.

Mangal, J.L. and A.M. Kasim (1987). Response of tomato varieties to pruning and plant spacing under plastic house. *Haryana. J. Hort. Sci.,* **16 (3-4):** 248-252.

Rajewar, S.R. and V.K. Patil (1979). Flowering and fruiting of some important varieties of tomato as affected by spacing, staking and pruning. *Indian J. Agric. Sci.,* **49(5):**358-360.

Rasmussen, K. (1986).Varietal trials with green house cucumbers. *Gartner Tidenole.,* **102 (38):** 1268-1271.

Takahashi, H. and S. Sasaki (1981). Studies with lateral tomato shoots. I experiments using semi- forcing conditions. *Bull. Akita Prefectual College Agric.,* **7:** 45-49.

Takahashi, H. and S. Sasaki (1983). Studies on the lateral shoot utilization of tomatoes. II influence of planting density and fruit thinning on fruit enlargement and yield in semi-forced cultivation. *Bull. Akita Prefectural College Agric.,* **9:** 35-41.