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Research Article

Growth and yield performance of diverse genotypes of tomato (*Solanum lycopersicum* L.)

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Abstract
A field experiment was carried out in the Vegetable Experimental Field, SKUAST-K, Shalimar, Srinagar during *kharif*-2018 with twenty seven genotypes of tomato (*Solanum lycopersicum* L.). They were evaluated to estimate the performance of genotypes on various traits like plant height, plant spread, the number of primary branches per plant, days to first flowering, days to 50% flowering, fruit length, fruit diameter, the number of fruits per plant, fruit yield per plot. Analysis of Variance revealed significant differences among the genotypes for all the characters studied. Days to first flowering and days to first fruit set was early in the Jawahar-99, Shalimar Tomato Hybrid-1, Roma, VRT-13, Kashi Hemanth and Kashi Anupam genotypes. Maximum fruit length and diameter was exhibited by Roma, 2016/TODVAR-3, 2016/TODVAR-11. The highest fruit yield per plot was exhibited by Kashi Sharad and Sel-07.

Key words
Mean performance, tomato, fruit length, average fruit weight, fruit yield

INTRODUCTION

India occupies the prime position in vegetable production and it is the second largest producer of vegetables in the world. The nutritional security of the country is achieved only when enough vegetables are consumed because these are cheaper sources of proteins, vitamins, minerals and carbohydrates. Tomato is the world's largest vegetable crop after potato and onion. India ranks second in the area and production of tomato after china. In India, Madhya Pradesh leads in production followed by Karnataka, Andhra Pradesh, Tamil Nadu and Gujarat. During 2018-19, India produced 20.51 million metric tonnes of tomato in an area of about 0.81 million hectares (NHB, 1st Advance estimates, 2018-19).

Tomato (*Soalanum Lycopersicum* L.) is an important member of the Solanaceae family having a chromosome number of 2n=2x=24. The probable ancestor of tomato is *Solanum lycopersicum var. cerasiforme* Bailey. It is originated in the wild form in the Peru Equador region of the Andes (South America). India is the source of a large amount of tomato germplasm. The genotypes selected on the basis of *per se* performance of fruit yield, yield contributing and quality traits can be used in the tomato improvement programme as elite germplasm lines or maybe recommended as such for commercial cultivation after testing them for several years and locations.

MATERIALS AND METHODS

The present investigation was carried out at the Vegetable Experimental Farm of Division of Vegetable Science, SKUAST-Kashmir, Shalimar, Srinagar during *kharif*-2018. Twenty seven diverse genotypes of tomato were evaluated in a Randomized Complete Block Design (RCBD) with three replications. Details of genotypes along with their source are given in **Table 1**. The spacing followed was 60 x 35 cm. The experimental field was well prepared and standard cultural and plant protection measures were followed to raise a healthy crop. Analysis

of variance was carried out as per the procedure given by Panse and Sukhatme (1985). The significance of varietal differences was tested by F-test.

Table 1. List of genotypes of tomato (Solanum lycopersicum L.) used in the experimental design

S.No.	Genotype/variety	Source
1.	Kashi Hemanth	IIVR (Varanasi)
2.	Kashi Amrit	IIVR (Varanasi)
3.	Kashi Sharad	IIVR (Varanasi)
4.	Kashi Vishesh	IIVR (Varanasi)
5.	Kashi Chayan	IIVR (Varanasi)
6.	Kashi Aman	IIVR (Varanasi)
7.	Kashi Anupam	IIVR (Varanasi)
8.	TOLCV-16	IIVR (Varanasi)
9.	TOLCV-28	IIVR (Varanasi)
10.	TOLCV-32	IIVR (Varanasi)
11.	VRT-01	IIVR (Varanasi)
12.	VRT-19	IIVR (Varanasi)
13.	VRT-13	IIVR (Varanasi)
14.	Sel-7	IIVR (Varanasi)
15.	Jawahar-99	IIVR (Varanasi)
16.	2016/TOVDVAR-12	AICRP, IIVR (Varanasi)
17.	2016/TODVAR-11	AICRP, IIVR (Varanasi)
18.	2016/TODVAR-1	AICRP, IIVR (Varanasi)
19.	2016/TODVAR-3	AICRP, IIVR (Varanasi)
20.	2016/TODVAR-10	AICRP, IIVR (Varanasi)
21.	2016/TODVAR-5	AICRP, IIVR (Varanasi)
22.	2016/TODVAR-2	AICRP, IIVR (Varanasi)
23.	2015/TODHYB-4	AICRP, IIVR (Varanasi)
24.	2015/TODBYB-1	AICRP, IIVR (Varanasi)
25.	Roma	SKUAST-K, Shalimar
26.	Shalimar Hybrid Tomato-1	SKUAST-K, Shalimar
27.	Marglobe	SKUAST-K, Shalimar

Table 2. Analysis of variance for the nine traits in tomato (*Solanum lycopersicum* L.)

S. No.	Character	Mean sum of squares		
		Replication	Treatment	Error
	d. f	2	26	52
1	Plant height	0.84	342.57**	2.33
2	Plant spread	5.93	552.55**	8.36
3	Number of primary branches per plant	0.89	7.92**	0.32
4	Days to first flowering	0.29	28.88**	0.20
5	Days to 50% flowering	0.31	19.10**	0.12
6	Fruit length	0.01	3.54**	0.06
7	Fruit diameter	0.15	3.44**	0.06
8	Number of fruits per plant	0.59	444.84**	4.70
9	Fruit yield per plot	0.00	20.01**	0.11

** Significant at 1 per cent level

RESULTS AND DISCUSSION

Analysis of variance presented in **Table 2** showed that the mean square due to genotypes was highly significant for all the characters. The mean performance of the various genotypes for the growth and yield attributing traits in tomato are presented in **Tables 3a and 3b**.

Table 3a. Mean performance of the genotypes for the different traits in tomato

S. No.	Genotypes	Plant height (cm)	Plant spread (cm)	Number of primary branches per plant	Days to first flowering	Days to 50% flowering
1.	Kashi Hemanth	69.00	88.16	4.50	19.60	31.26
2.	Kashi Aman	74.96	78.80	6.50	20.86	30.40
3.	Kashi Amrit	90.90	102.63	5.50	22.40	31.80
4.	Kashi Vishesh	58.60	62.66	5.50	20.86	27.80
5.	Kashi Anupam	74.40	75.00	3.50	20.50	29.66
6.	Kashi Chayan	78.93	87.56	2.83	20.06	29.66
7.	Kashi Sharad	69.00	88.83	6.50	20.53	29.60
8.	VRT-01	47.66	49.66	6.50	18.90	29.80
9.	VRT-13	88.66	82.00	4.50	18.83	26.86
10.	VRT-01	47.66	49.66	6.50	18.90	29.80
11.	Tolcv-16	75.90	96.50	5.50	20.60	29.86
12.	Tolcv-28	71.50	79.16	6.50	21.60	30.66
13.	Tolcv-32	58.33	67.40	5.50	20.60	29.60
14.	Sel-7	81.76	90.66	5.50	19.00	30.23
15.	Jawahar-99	80.06	101.00	6.83	18.23	28.20
16.	2016/TODVAR-1	83.40	85.80	1.83	24.50	33.53
17.	2016/TODVAR-2	57.33	87.00	2.83	27.00	33.46
18.	2016/TODVAR-3	70.60	87.06	3.83	24.83	33.20
19.	2016/TODVAR-5	75.00	77.40	3.83	25.50	34.00
20.	2016/TODVAR-10	75.56	58.00	2.50	24.50	33.73
21.	2016/TODVAR-11	64.26	83.66	3.50	26.50	33.33
22.	2016/TODVAR-12	67.83	76.23	4.83	27.50	35.26
23.	2015/TODHYB-1	59.86	69.00	6.83	27.93	33.80
24.	2015/TODHYB-4	83.50	80.00	2.50	27.46	33.40
25.	Shalimar Hybrid Tomato-1	70.03	59.66	7.50	18.60	30.20
26.	Roma	85.50	83.50	6.50	20.66	28.40
27.	Marglobe	70.16	92.86	6.83	22.13	31.80
	Mean	**72.95**	**81.22**	**4.94**	**22.23**	**31.11**
	CV	2.09	3.56	11.46	2.01	1.18
	C.D. 5%	2.50	4.73	0.92	0.73	0.60
	C.D. 1%	3.33	6.31	1.23	0.97	0.80

The plant height ranged from 47.66 cm (VRT-01) to 90.90 cm (Kashi Amrit) with a mean value of 72.95 cm. The high plant height exhibited by the genotypes VRT-19 (87.13 cm), Selection-07 (81.76 cm), Kashi Chayan (78.93 cm) TOLCV-16 (75.90 cm) and Kashi Aman (74.96 cm), as compared to the general mean. The genotypes VRT-01 (47.66 cm), TOLCV-32 (58.33 cm), 2015/TODHYB-1 (59.86 cm) and 2016/TODVAR-11 (64.26 cm) were shorter as compared to the general mean. The range of plant spread varied from 49.66 cm (VRT-01) to 102.66 cm (Kashi Amrit) with a mean value of 81.22 cm. The genotypes TOLCV-16 (96.50 cm), Kashi Sharad (88.83 cm), Kashi Hemanth (88.16 cm), Kashi Chayan (87.56 cm), and 2016/TODVAR-3 (87.06 cm) had higher plant spread as compared to the general mean whereas VRT-01 (49.66 cm), TOLCV-32 (67.40 cm), 2015/TODHYB-1 (69.00 cm) and 2016/TODVAR-12 (76.23 cm) were having lower plant spread. The number of primary branches in different genotypes ranged from 1.83 (2016/TODVAR-2) to 7.50 (Shalimar Hybrid Tomato-1) with an average value of 4.94. The genotypes TOLCV-28, Kashi Aman, Kashi Sharad (6.50) and Kashi Vishesh (5.50) were showed

a higher number of primary branches per plant[1] as compared to the general mean whereas, Kashi Anupam (3.50), Kashi Chayan (2.83) and 2015/TODHYB-2 (2.50) had showed a lower number of primary branches per plan[1]. The results obtained are in agreement with the findings of Pradeep Kumar *et al.* (2001) and Gonzalez-Cebrino *et al.* (2011).

In general, early flowering provides the early harvesting of the crop and also avoid different biotic and abiotic stresses during the crop period. The data ranged from 18.23 days (Jawahar-99) to 27.93 days (2015/TODHYB-1) with a mean value of 22.23 days. The genotypes *viz*., Jawahar-99 (18.23), VRT-13 (18.83), Kashi Hemanth (19.60), Kashi Anupam (20.50) were early to flower while 2015/TODHYB-4 (27.46), 2016/TODVAR-2 (27.00), 2016/TODVAR-5 (25.50) and 2016/TODVAR-3 (24.83) took more number of days for first flowering. Days to 50% flowering ranged from 46.40 days (Shalimar Hybrid Tomato-1) to 55.00 days (2016/TODVAR-10) with a mean value of 48.80. The genotypes Kashi Hemanth, VRT-13 and 2015/TODHYB-1 (46.60) and Kashi Anupam (46.40) were earlier whereas the genotypes, 2016/TODVAR-1 (54.33), Kashi Sharad (50.60), 2016/TODVAR-10 (50.20), 2015/TODHYB-4 (49.20) were late. The results obtained are in agreement with the findings of Pradeep Kumar *et al.* (2001), Singh *et al.* (2010) and George *et al.* (2004).

The maximum (8.50) and minimum (3.60) length of fruit was recorded in Roma and Kashi Amrit respectively with an overall mean value of 4.93 cm. The genotypes namely

Table 3b. Mean performance of the genotypes for the different traits in tomato

S. No.	Genotypes	Fruit length (cm)	Fruit diameter (cm)	Number of fruits per plant	Fruit yield per plot (kg)
1.	Kashi Hemanth	5.23	5.20	42.00	8.16
2.	Kashi Aman	4.60	4.70	41.66	8.80
3.	Kashi Amrit	3.60	3.60	37.33	8.93
4.	Kashi Vishesh	5.36	5.10	38.66	8.50
5.	Kashi Anupam	5.46	5.43	44.33	9.36
6.	Kashi Chayan	4.70	4.56	36.66	7.56
7.	Kashi Sharad	4.46	4.46	56.33	16.13
8.	VRT-01	4.43	4.43	55.00	12.90
9.	VRT-13	4.23	4.30	46.00	8.70
10.	VRT-01	4.43	4.43	55.00	12.90
11.	Tolcv-16	3.70	3.53	51.66	8.83
12.	Tolcv-28	3.60	3.53	55.00	12.90
13.	Tolcv-32	4.33	4.36	41.33	9.46
14.	Sel-7	4.66	4.70	65.33	14.90
15.	Jawahar-99	3.70	3.80	40.33	9.30
16.	2016/TODVAR-1	5.56	5.60	43.00	9.23
17.	2016/TODVAR-2	5.46	5.50	25.00	7.16
18.	2016/TODVAR-3	6.36	6.26	42.33	8.43
19.	2016/TODVAR-5	4.73	4.80	18.00	6.60
20.	2016/TODVAR-10	5.30	5.43	51.66	12.90
21.	2016/TODVAR-11	6.30	6.40	15.00	5.66
22.	2016/TODVAR-12	6.20	6.23	13.66	5.36
23.	2015/TODHYB-1	5.63	5.66	34.33	9.23
24.	2015/TODHYB-4	4.56	4.56	42.33	9.06
25.	Shalimar Hybrid Tomato-1	3.60	3.80	43.66	12.43
26.	Roma	8.50	8.40	46.66	10.80
27.	Marglobe	4.76	4.80	41.66	9.80
	Mean	**4.93**	**4.94**	**41.33**	**9.63**
	CV	5.26	4.99	5.24	3.53
	C.D. 5%	0.42	0.40	3.55	0.55
	C.D. 1%	0.56	0.53	4.73	0.74

2016/TODVAR-3 (6.36 cm), 2015/TODHYB-1 (5.63 cm), Kashi Anupam (5.46) and Kashi Vishesh (5.36) had long fruits whereas the genotypes, 2016/TODVAR-5 (4.73 cm), Kashi Chayan (4.70 cm), VRT-01 (4.43 cm), VRT-19 (4.23 cm) and TOLCV-16 (3.70 cm) were having short fruit. The variation for the diameter of the fruit ranged from 3.53 cm (TOLCV-16, TOLCV-28) to 8.40 cm (Roma) with a mean value of 4.94 cm. The genotypes namely, 2016/TODVAR-11 (6.40 cm), 2015/TODHYB-1 (5.66 cm), Kashi Anupam (5.43 cm) and Kashi Vishesh (5.10 cm) had a higher fruit diameter whereas the genotypes, 2016/TODVAR-5 (4.80 cm), Sel.07 (4.70 cm) and Jawahar-99 (3.80 cm) were showed lower fruit diameter than the general mean.

The genotype Sel.7 had a maximum number of fruits (65.33) followed by Kashi Sharad (56.33) (**Table 3b**). The lowest value for this trait was recorded for the genotype 2016/TODVAR-12 (13.66). The general mean was 41.33. The genotypes TOLCV-32, VRT-01 (55.00), 2015/TODHYB-4 (42.33), 2016/TODVAR-10 (51.66) had more number of fruits per plant as compared to the general mean. The genotypes *viz*., 2016/TODVAR-11 (15.00), 2016/TODVAR-2 (25.00), Kashi Amrit (37.33), Kashi Vishesh (38.66) had less number fruits per plant. Fruit yield per plot varied from 5.36 kg (2016/TODVAR-12) to 16.13 kg (Kashi Sharad) with a general mean of 9.63 kg. The genotypes namely, Sel.7 (14.90 kg), TOLCV-28 (12.90 kg), VRT-01 (12.90 kg), 2016/TODVAR-10 (12.90 kg) were showing significantly higher fruit yield per plant as compared to the general mean. 2016/TODVAR-11 (5.66 kg), Kashi Chayan (7.56 kg), Kashi Hemanth (8.16 kg) and Kashi Aman (8.80 kg) genotypes were showed a significantly lower fruit yield per plot. The results obtained are in agreement with the findings of Pradeep Kumar *et al.* (2001), Gonzalez-Cebrino *et al.* (2011), Singh *et al.* (2010), George *et al.* (2004), Kaur *et al.* (2002), Pemba sherpa *et al.* (2014) and Venkadeswaran *et al.* (2020).

The genotypes namely, Kashi Sharad, Sel-7, VRT-01, Shalimar Hybrid-1, 2016/TODVAR-10 and TOLCV-28 produced a higher fruit yield per plot. These genotypes also exhibited average mean performance for the number of fruits per plant. The genotypes Jawahar-99, Shalimar Hybrid-1, Roma, VRT-13, Kashi Hemanth, Kashi Anupam, TOLCV-28 were earlier to first flowering and days to 50% flowering. The genotypes Roma, 2016/TODVAR-3, 2016/TODVAR-11, 2016/TODVAR-1, 2015/TODHYB-1, Kashi Vishesh, Kashi Hemanth was exhibited the best performance for fruit length and fruit diameter. The genotypes/ varieties which showed the best *per se* performance for the traits can be used as such in the promotion of the tomato production programme as elite germplasm lines/varieties or may be recommended for commercial cultivation after testing them over years and locations.

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