

Original Research Article

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Performance of Parents and F₁ Hybrids for Quality Parameters in Tomato (*Solanum lycopersicum* L.)

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ABSTRACT

An experiment was conducted to study the performance of parents and F₁ hybrids along with two checks viz., Arka Rakshak and Arka Samrat for quality parameters. An experiment was conducted at College of Horticulture, Bagalkot, University of Horticulture Sciences, Bagalkot during *kharif*, 2018 in Randomized Block Design with three replications. Twelve diverse lines of tomato were crossed with four testers in line x tester mating design. The resultant 48 F₁ hybrids along with 16 parents and two checks were evaluated for quality traits in tomato. The experiment results revealed that hybrid, L4 X T3 performed best for characters viz., fruit firmness (6.17 kg/cm²) and ascorbic acid content (29.98 mg/100g), L8 X T4 for pericarp thickness (7.48 mm), L5 X T3 (5.46 °B) for total soluble solids, L12 X T4 for ascorbic acid content (31.37 mg/100 g) lastly for lycopene content the cross, L8 X T4 (11.91mg/100 g) were showed superior performance.

Keywords

Evaluation, Hybrid,
Tomato, Quality

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Introduction

Tomato (*Solanum lycopersicum* L.) is an important vegetable crop and particularly now a commercial crop widely grown all over tropical, sub-tropical and temperate regions of the world for both fresh and processing purpose. It ranks second only after potato (Bose *et al.*, 2002). The optimum temperature for tomato growth and development is 20–24 °C. In India it occupies an area of about 0.78 million hectares with the production of 19.37 million tons and an average productivity of

28.10 tonnes per ha. Karnataka, occupies an area of 0.63 lakh hectares with a production of 21.38 lakh tons with an average productivity of 33.55 tonnes per ha (Anon., 2017). Tomato stands unique among vegetables because of its high nutritive values and myriad uses. Tomato is a gregarious vegetable, which fits comfortably with almost all the culinary items of the kitchen.

Tomato is consumed fresh, cooked or processed into various products. The acid sweet taste and unique flavours of tomato

attract more and more consumers because of its versatility of uses in domestic cooking and also in commercial production of processed products.

Three major processed products are: (i) tomato preserves (e.g. whole peeled tomatoes, tomato juice, tomato pulp, tomato puree, tomato paste and pickled tomatoes); (ii) dried tomatoes (tomato powder, tomato flakes and dried tomato fruits); and (iii) tomato-based foods (e.g. tomato soup, tomato sauces and ketchup). Thus, today tomato is one of the important raw materials for multimillion food industries. Therefore development of tomatoes for fresh market and for processing purpose need improvement of quality traits like colour, fruit pH, acidity, total soluble solids and viscosity which helps in value addition and prevention of post-harvest losses. Therefore, there is a need for breeding tomato to improve traits pertaining to fresh and processed forms with high nutritive value.

Materials and Methods

The experimental material consists of 12 diverse genotypes of tomato *viz.*, L-24 (L1), L-206 (L2), L-240 (L3), L-98 (L4), L-177 (L5), L-116 (L6), L-207 (L7), L-115 (L8), L-110 (L9), L-143 (L10), L-129 (L11) and L-93 (L12), which were crossed with four testers *viz.*, Pusa Ruby (T1), PKM-1 (T2), Arka Meghali and DMT-2 (T4) in line x tester mating design to obtain 48 F₁ cross combinations. The 48 F₁ hybrids along with parents and two standard checks (Arka Rakshak and Arka Samrat) were sown during *Kharif*, 2018 in the pro-trays with coco peat as potting media to get healthy and uniform seedlings for nursery production and then four week old seedlings were transplanted into the main field. The plots were irrigated immediately after transplanting. All cultural operations were followed to raise the healthy seedlings. The experiment was conducted in

Haveli campus, College of Horticulture, Bagalkot and University of Horticulture Sciences, Bagalkot. The experiment was laid out in a Randomized Block Design with three replications. The performance for quality parameters *viz.*, Fruit firmness (kg/cm²), Pericarp thickness (mm), Number of locules per fruit, fruit length (cm), fruit width (cm), Fruit size (cm²), fruit colour (*L**, *a**, *b**), pH of juice, Total soluble solids (° Brix), Titratable acidity (%), Ascorbic acid content (mg/100 g), Lycopene content (mg/100 g) and Total carotenoids (mg/100 g). The data was statistically analysed as per the Panse and Sukhatme, 1985.

Results and Discussion

The mean performance of the parents and hybrids for various characters under investigation are presented in Table 1a and Table 1b, respectively and the results are presented as follows.

Fruits with higher firmness can withstand physical and mechanical shock during shipping and remain healthy and nonperishable for more number of days as compared to fruits with lesser firmness. The firmness of fruits was determined by using penetrometer. The present study revealed that tomato had a wide and significant variation in fruit firmness (kg/cm²) among the different parents and hybrids. Fruit firmness for parents ranged from 2.81 to 5.90 kg per cm² (Table 1a). The maximum fruit firmness was recorded line L4 (5.90 kg per cm²) followed by the line L6 (5.79 kg per cm²). Among the crosses, Maximum fruit firmness was recorded in the cross L4 X T3 (6.17 kg per cm²) followed by L4 X T4 (6.12 kg per cm²) as compared to general mean value of all the crosses (4.26 kg per cm²). Similar results were supported by the Renuka *et al.*, (2014) and Bharathkumar *et al.*, (2017).

Table.1a Performance of lines, testers and crosses for fruit p quality parameters in tomato

Sl. No.	Genotypes/F ₁	FRF	PT	LN	FRL	FR D	FRS	pH	L*	a*	b*
1	L1	2.81	4.54	3.33	3.75	4.07	15.26	4.22	45.63	24.26	35.09
2	L2	3.82	4.35	3.67	4.25	4.42	18.77	4.23	45.54	37.15	33.53
3	L3	3.16	4.24	3.33	4.43	4.11	18.20	4.43	44.92	38.76	32.30
4	L4	5.90	6.14	7.33	4.76	4.44	21.14	5.27	36.56	34.34	26.59
5	L5	4.53	5.60	5.33	4.56	6.10	25.49	4.37	43.78	33.81	28.14
6	L6	5.79	6.05	2.67	5.64	5.82	32.83	5.14	44.76	41.41	30.55
7	L7	3.07	4.28	3.33	4.16	4.77	19.84	4.85	42.44	36.73	32.86
8	L8	4.86	6.03	2.33	5.07	4.47	22.72	4.91	45.34	41.72	34.04
9	L9	4.24	4.02	2.67	3.96	3.57	14.14	4.87	42.56	34.83	29.91
10	L10	3.29	4.02	2.67	3.24	3.80	12.34	5.11	41.58	36.61	30.75
11	L11	4.17	3.99	2.00	3.28	3.74	12.25	4.83	47.13	40.74	37.78
12	L12	5.34	5.50	5.67	4.22	5.78	24.41	4.46	42.55	36.34	33.22
13	T1	3.52	4.63	3.67	3.58	3.88	14.02	4.61	45.11	38.89	33.78
14	T2	4.40	5.50	4.33	3.59	4.19	15.00	4.27	39.68	33.91	27.22
15	T3	4.43	4.02	3.67	3.97	4.43	17.58	5.12	42.30	33.64	29.83
16	T4	4.72	5.23	3.67	4.16	4.51	18.80	4.74	41.88	36.51	32.20
17	L1 X T1	3.07	5.11	3.33	3.75	4.16	15.60	4.42	43.74	33.79	31.86
18	L1 X T2	3.26	5.34	3.33	3.90	4.46	17.37	4.53	41.62	32.69	31.46
19	L1 X T3	3.19	5.48	3.67	3.75	4.26	16.01	4.45	47.47	36.73	34.65
20	L1 X T4	3.25	5.37	3.67	3.61	4.16	15.02	4.50	39.68	37.69	28.61
21	L2 X T1	4.14	5.03	2.67	4.46	4.76	21.23	4.50	44.47	33.80	32.31
22	L2 X T2	3.77	5.02	2.67	4.66	5.27	24.60	4.55	45.49	34.56	32.72
23	L2 X T3	4.04	5.12	2.67	4.22	5.43	22.93	4.55	41.63	33.24	27.52
24	L2 X T4	3.68	5.52	2.67	3.61	4.25	15.38	4.83	39.71	35.27	28.39
25	L3 X T1	3.46	4.35	3.33	4.14	3.94	16.34	4.75	40.73	39.16	30.19
26	L3 X T2	3.53	4.72	3.67	4.28	4.09	17.49	5.15	38.44	37.89	30.71
27	L3 X T3	3.61	5.13	3.67	3.86	4.02	15.53	4.57	46.23	38.32	36.48
28	L3 X T4	3.90	4.38	3.67	3.63	3.81	13.82	4.53	47.62	37.46	32.34
29	L4 X T1	4.65	6.74	6.33	4.67	6.20	28.99	4.56	38.88	33.78	27.91
30	L4 X T2	6.06	6.88	6.00	4.49	5.84	26.26	4.74	41.55	33.76	29.64
31	L4 X T3	6.17	6.65	6.67	4.47	6.05	27.07	4.53	41.81	34.47	29.30
32	L4 X T4	6.12	6.94	6.67	4.58	6.18	28.28	4.62	40.81	34.46	29.84
33	L5 X T1	4.43	6.74	5.33	3.69	4.46	16.46	4.43	41.43	32.95	27.47
34	L5 X T2	4.47	6.95	6.33	4.15	5.23	21.71	5.17	41.24	37.27	33.73
35	L5 X T3	4.53	6.57	5.67	3.67	4.81	17.68	4.75	41.20	42.65	31.06
36	L5 X T4	4.56	6.84	5.67	3.57	4.19	14.96	4.54	47.29	36.55	34.93
37	L6 X T1	4.62	6.11	3.33	4.18	4.11	17.16	4.26	47.90	42.68	38.73

Contd.....

Sl. No.	Genotypes/F ₁	FRF	PT	LN	FRL	FR D	FRS	pH	L*	a*	b*
38	L6 X T2	5.26	6.81	3.33	4.48	3.96	17.75	4.38	44.89	40.02	32.86
39	L6 X T3	5.94	6.46	3.67	4.23	3.75	15.85	4.23	43.66	41.76	34.64
40	L6 X T4	5.62	6.95	3.67	4.21	3.72	15.64	4.35	41.47	38.28	29.49
41	L7 X T1	3.72	4.79	2.67	3.74	4.32	16.17	4.55	47.27	38.25	34.32
42	L7 X T2	4.23	4.75	2.67	4.16	4.83	20.11	4.46	39.69	29.65	25.46
43	L7 X T3	4.08	4.55	2.67	3.69	4.28	15.82	4.87	51.18	34.56	40.43
44	L7 X T4	4.46	4.74	2.67	3.73	4.25	15.84	4.76	39.82	34.80	26.07
45	L8 X T1	4.42	6.56	3.33	4.19	4.11	17.19	4.20	44.07	39.77	33.64
46	L8 X T2	4.89	7.22	3.67	4.41	3.89	11.98	4.54	46.59	42.14	34.49
47	L8 X T3	5.28	7.17	3.67	4.24	3.75	15.90	4.35	47.75	42.34	32.19
48	L8 X T4	5.59	7.48	3.33	4.23	3.65	15.43	4.73	45.86	40.83	31.64
49	L9 X T1	3.05	4.98	3.33	3.73	3.91	14.62	4.16	40.82	34.16	28.22
50	L9 X T2	3.24	4.72	3.33	4.17	4.57	19.06	4.34	41.74	34.11	27.84
51	L9 X T3	3.02	4.61	3.67	4.32	4.34	18.72	4.35	37.67	37.76	35.72
52	L9 X T4	3.13	4.66	3.67	3.83	4.74	18.14	4.46	46.76	35.35	33.24
53	L10 X T1	3.22	4.38	2.33	3.24	3.71	12.04	4.54	51.49	39.87	32.52
54	L10 X T2	3.04	4.57	2.67	3.33	3.82	12.72	4.60	42.16	35.72	35.70
55	L10 X T3	3.36	4.87	2.33	3.76	4.18	15.72	4.51	45.76	38.29	36.17
56	L10 X T4	2.98	4.83	2.67	3.26	3.75	12.22	4.52	46.16	37.87	35.74
57	L11 X T1	3.80	5.54	3.67	3.37	3.97	13.38	4.42	47.78	41.12	32.42
58	L11 X T2	4.14	5.74	3.33	3.45	4.23	14.59	4.87	40.86	38.57	27.50
59	L11 X T3	3.69	5.74	3.33	3.13	3.68	11.51	4.45	47.26	39.45	34.84
60	L11 X T4	3.98	5.70	3.67	3.64	4.27	15.58	4.76	47.27	39.68	31.86
61	L12 X T1	4.80	6.15	5.33	4.23	4.83	20.45	4.74	40.67	36.68	30.90
62	L12 X T2	5.16	6.29	5.00	4.26	4.83	20.59	4.66	44.51	34.30	32.30
63	L12 X T3	5.24	5.87	5.67	3.79	4.86	18.39	4.45	45.42	34.94	32.77
64	L12 X T4	5.55	6.93	5.67	4.31	5.13	22.13	4.42	43.13	34.76	29.63
65	C1	6.86	7.28	3.33	6.17	5.17	31.87	4.26	50.33	38.61	36.88
66	C2	6.23	5.66	3.67	4.30	5.17	22.24	4.65	50.50	37.00	31.12
	Mean	4.26	5.54	3.82	4.07	4.48	18.40	4.59	43.99	36.80	32.15
	CV (%)	3.88	3.04	15.42	3.68	4.00	9.48	2.39	2.62	3.29	3.72
	SEm±	0.10	0.10	0.34	0.09	0.10	1.01	0.06	0.67	0.70	0.69
	CD @ 5%	0.34	0.35	1.24	0.31	0.37	3.67	0.23	2.42	2.55	2.51
	CD @ 1%	0.26	0.27	0.94	0.24	0.28	2.79	0.17	1.84	1.94	1.91

FRF = Fruit firmness (kg/cm²)
 PT = Pericarp thickness (mm)
 LN = Number of locules per fruit

FRL = Fruit length (cm)
 FRD = Fruit diameter (cm)
 FRS = Fruit size (cm²)

pH of fruit
 L*, a* and b* = Colour values

Table.1b Performance of lines, testers and crosses for fruit quality parameters in tomato

Sl. No.	Genotypes/F ₁	TSS	AC	TAR	AA	LYCO	CARO
1	L1	4.43	0.37	12.15	20.46	5.35	14.70
2	L2	5.06	0.35	14.33	18.13	3.88	11.45
3	L3	5.23	0.36	14.56	14.95	3.75	12.30
4	L4	5.43	0.44	12.28	24.03	6.72	11.76
5	L5	5.45	0.43	12.60	21.40	5.62	12.78
6	L6	4.35	0.35	12.61	15.92	5.42	12.54
7	L7	5.19	0.44	11.91	21.77	3.03	9.42
8	L8	4.13	0.32	12.78	12.83	5.89	15.24
9	L9	3.84	0.43	8.94	28.41	5.87	13.96
10	L10	4.71	0.36	13.23	13.34	3.28	8.57
11	L11	4.17	0.51	8.13	25.30	3.24	10.22
12	L12	4.65	0.61	7.65	17.94	7.00	12.93
13	T1	4.58	0.62	7.70	19.20	5.68	9.26
14	T2	5.37	0.57	9.44	16.53	4.63	7.52
15	T3	4.68	0.54	8.77	23.93	4.37	8.74
16	T4	4.02	0.42	10.09	20.28	4.67	8.63
17	L1 X T1	4.84	0.37	13.09	26.65	4.68	12.56
18	L1 X T2	4.55	0.29	15.54	25.82	4.60	12.56
19	L1 X T3	4.53	0.34	13.21	21.65	3.88	11.98
20	L1 X T4	4.37	0.38	11.61	24.15	4.33	13.29
21	L2 X T1	4.30	0.42	10.26	25.82	5.13	13.44
22	L2 X T2	4.55	0.37	12.41	21.65	3.80	9.93
23	L2 X T3	4.34	0.44	9.87	19.15	3.84	10.51
24	L2 X T4	4.46	0.51	8.68	24.15	4.41	12.27
25	L3 X T1	3.87	0.51	7.56	22.49	4.04	9.35
26	L3 X T2	4.45	0.41	10.78	20.26	3.96	10.81
27	L3 X T3	4.16	0.54	7.75	24.15	3.66	10.37
28	L3 X T4	4.76	0.48	9.91	25.82	3.82	11.98
29	L4 X T1	4.95	0.60	8.30	27.48	4.05	10.66
30	L4 X T2	5.10	0.52	9.81	26.65	4.22	11.54
31	L4 X T3	4.88	0.47	10.46	29.98	4.89	10.51
32	L4 X T4	4.63	0.54	8.58	24.99	4.20	11.83
33	L5 X T1	5.22	0.48	10.87	22.49	4.83	9.78
34	L5 X T2	5.35	0.46	11.63	28.32	5.40	10.37
35	L5 X T3	5.46	0.48	13.31	26.93	7.70	9.35
36	L5 X T4	5.27	0.51	10.33	25.54	5.22	8.61
37	L6 X T1	4.28	0.40	10.61	23.32	7.93	8.18

Contd.....

Sl. No.	Genotypes/F ₁	TSS	AC	TAR	AA	LYCO	CARO
38	L6 X T2	3.86	0.36	10.64	27.21	7.70	7.88
39	L6 X T3	4.43	0.33	13.43	27.48	7.65	7.59
40	L6 X T4	4.33	0.36	12.02	26.37	8.15	8.61
41	L7 X T1	4.56	0.37	12.33	25.26	2.85	8.03
42	L7 X T2	4.95	0.34	14.58	21.65	2.67	7.45
43	L7 X T3	4.46	0.49	9.11	23.32	2.83	9.35
44	L7 X T4	4.24	0.48	8.85	19.15	3.20	8.76
45	L8 X T1	4.30	0.44	10.04	27.48	9.58	11.39
46	L8 X T2	4.49	0.40	11.31	27.76	11.78	11.98
47	L8 X T3	4.46	0.36	12.39	20.54	11.15	11.59
48	L8 X T4	4.28	0.33	12.96	25.26	11.91	11.98
49	L9 X T1	4.08	0.57	7.14	18.88	5.43	8.32
50	L9 X T2	4.21	0.56	7.58	20.82	5.60	8.76
51	L9 X T3	3.94	0.41	9.54	22.49	4.67	9.20
52	L9 X T4	4.35	0.37	11.76	16.66	4.28	9.93
53	L10 X T1	4.73	0.63	7.52	13.60	3.88	8.91
54	L10 X T2	4.56	0.54	8.44	15.82	3.93	8.03
55	L10 X T3	4.56	0.51	8.89	18.32	5.16	8.18
56	L10 X T4	4.33	0.49	8.85	21.38	3.70	8.47
57	L11 X T1	4.76	0.59	8.03	25.54	4.84	9.49
58	L11 X T2	4.95	0.64	7.75	23.87	5.40	7.89
59	L11 X T3	5.24	0.59	8.94	29.15	5.60	8.33
60	L11 X T4	5.15	0.59	8.72	31.65	5.35	8.91
61	L12 X T1	4.34	0.55	7.89	34.98	7.22	13.44
62	L12 X T2	4.55	0.58	7.84	30.82	4.47	12.41
63	L12 X T3	4.63	0.72	6.43	30.82	4.27	11.59
64	L12 X T4	4.84	0.69	7.01	31.37	5.63	11.68
65	C1	5.58	0.36	15.52	19.99	7.18	11.32
66	C2	5.03	0.48	10.51	25.82	4.99	11.25
	Mean	4.62	0.47	10.29	23.22	5.28	10.49
	CV (%)	2.59	5.05	5.70	8.35	4.70	4.71
	SEm±	0.08	0.01	0.35	1.10	0.14	0.28
	CD 5%	0.25	0.05	1.23	4.07	0.52	1.04
	CD 1%	0.19	0.03	0.94	3.10	0.39	0.79

TSS = Total Soluble Solids (⁰B)

AC = Acidity (mg/100 gm)

TAR = TSS and acidity ratio

AA = Ascorbic acid (mg/100 gm)

LYCO = Lycopene (mg/100 gm)

CARO = Carotenoids (mg/100 gm)

The maximum number of locules per fruit was found in line L4 (7.33) followed by L12 (5.67). Among crosses, the number of locules per fruit was found high in L4 X T3 and L4 X T4 (6.67 each). The increase in number of locules per

fruit was reported by Ahmad *et al.*, (2011) and Farzane *et al.*, (2012).

Among the different genotypes significant differences were observed with respect to the

polar diameter of fruits. It ranged of 3.24 to 5.64 cm (Table 1a). The maximum fruit length of the fruit was recorded in line L6 (5.64 cm) followed by L8 (5.07 cm). Among the crosses, the maximum fruit length was observed in the crosses, L4 X T1 (4.67 cm) closely followed by L2 X T1 (4.66 cm) in comparison to general mean (4.07 cm). Among 48 crosses studied ten have significantly more polar diameter than standard checks Arka Rakshak and Arka Samrat (6.17 cm and 4.30 cm, respectively). The significantly higher fruit diameter of the fruit was recorded in line L5 (6.10 cm) followed by L6 (5.82 cm). In the crosses, L4 X T1 (6.20 cm) followed by L4 X T4 (6.18 cm) have higher fruit diameter as compared to general mean (4.48 cm). Only eight crosses's fruit diameter was on par with the standard checks, Arka Rakshak and Arka Samrat (5.17 cm and 5.17 cm, respectively). The mean fruit size for parents ranged from 12.25 cm² (L11) to 32.83 cm² (L6). The line L6 (32.83 cm²) followed by line L5 (25.49 cm²) which had larger fruit size (Table 1b). Among F₁s the mean performance was found in the range of 11.51 to 28.99 cm². The maximum fruit size was observed in the cross L4 X T1 (28.99 cm²) followed by L4 X T4 (28.28 cm²). The general mean for fruit size of all crosses was 18.40 cm². Only six crosses have shown significance in fruit size compared to commercial check Arka Samrat. These results are suggested by Chattopadhyay *et al.*, 2013 and Bharathkumar *et al.*, 2017 in tomato crop.

The genotypes were noticed to have significant differences with respect to pH of fruit juice (Table 1a). Among parents L4 (5.27) followed by L6 (5.14) have shown higher level of pH of fruit juice. Out of 48 F₁ hybrids evaluated, the cross, L5 X T2 (5.17) followed by L3 X T2 (5.15) have shown highest pH of juice compared to general mean (4.59). The highest TSS was noted in line L5 (5.45⁰ B) followed by L4 (5.43) and tester, T2 (5.37⁰ B). Among crosses, the cross L5 X T3

(5.46⁰ B) recorded the highest TSS. Among the 48 crosses, seven were noted to have higher TSS than commercial check, Arka Samrat (5.03⁰ B) but none of the crosses have surpassed the commercial check, Arka Rakshak (5.58⁰ B). Higher TSS content was in conformity with the earlier results of Singh *et al.*, (2008), Kumari and Sharma, (2011) and Droka *et al.*, (2012).

The highest titrable acidity of fruits was noticed in the cross L12 X T3 (0.72 %). Out of 48 crosses, 43 have recorded the more acidity than the standard check, Arka Rakshak (0.36 %) and 27 crosses have registered more acidity than Arka Samrat (0.48 %). High acidity of fruits is important for processing purposes, while the fruits with low acidity are preferred for fresh table purpose (Table 1b). Hence, the fruits of both kinds have commercial value in the market. TSS to acidity ratio of fruits is important in maintaining balanced taste for fresh table use as well as for processing. In the present study, higher TSS to acidity ratio was registered in the cross L1 X T2 (15.54). High acidity of fruits was also revealed by Kanthaswamy and Balkrishnan (1989), Kurian and Peter (1995) and Droka *et al.*, (2012). The ascorbic acid content of tomato fruits varied between 12.83 to 28.41 mg per 100 g (Table 1b). In lines, the highest value for ascorbic acid content was observed for L9 (28.52 mg/100 g). Among the crosses, the highest amount of ascorbic acid was exhibited in L12 X T1 (34.98 mg/100 g) and most of the cross combinations have recorded higher ascorbic acid content over the standard checks, Arka Rakshak and Arka Samrat (19.99 mg/100 g and 25.82 mg/100 g). Ascorbic acid is much important from nutrition point of view. The findings are suggested by Kumari and Sharma, (2011) and Droka *et al.*, (2012), Renuka *et al.*, 2014 and Bharathkumar *et al.*, 2017 in tomato crop.

Lycopene content of the fruit varied significantly among all the parents and F₁

hybrids. The maximum lycopene content was observed in L12 (7.00 mg/100 g) and the lowest in L7 (3.03 mg/100 g). The present findings are acknowledged by the results supported by in Renuka *et al.*, (2014) and Bharathkumar *et al.*, (2017). Colour value L^* content was found highest in line L4 (36.56) and was least in the line L11 (47.13). For color value a^* the line L8 (41.76) was found high (Table 1a). In the same way for color value b^* it was high for the line L11 (37.82) and least for line L4 (26.63). For character pH of the fruit juice, the highest value was registered in the cross L5 X T2 (5.17) followed by L3 X T2 (5.12). In general, mean performance of crosses for all the characters was higher than that of the parents suggesting the presence of overall heterosis. These findings are supported by Nagamani, (2017) in tomato.

From the present findings, it can be summarized that based on mean performance, the following hybrids *viz.*, L4 X T3, L4 X T4 for fruit firmness, L8 X T4 for pericarp thickness, L5 X T3 for total soluble solids, L12 X T4 for ascorbic acid and finally for lycopene L8 X T4 were found to be superior. Hence, these should be utilized for future breeding programmes for desirable trait improvement.

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