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Heterosis studies in cherry tomato for various quality traits in open and protected environment

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Abstract

Heterosis breeding is mainly used to improve quality of cherry tomato because traditional methods cannot be used to achieve this goal. A half diallel design was used to estimate the magnitude of heterosis for yield and its attributing traits in cherry tomato. Fifty-seven treatments comprising of 45 F₁'s, 10 parents and 2 checks were evaluated for various yield and its component traits at Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar during the *Kharif* season, 2019 in Augmented Block Design. The maximum heterosis over standard checks was exhibited by the cross Sun Cherry x VRT-02 in E₁ and cross WIR-5032 x VRT-02 in E₂ for ascorbic acid content and cross EC-914092 x EC-914097 in E₁ and cross EC-914115 x EC-520078 in E₂ for lycopene content. Hence, these crosses exhibited commercial potential to replace the checks after further testing.

Keywords: Heterosis, quality, check, cherry tomato, trait, yield

Introduction

Cherry tomato, one of the important botanical variety of the cultivated tomato (*Solanum lycopersicum* L.) is a member of nightshade family 'Solanaceae'. It is a warm season crop generally characterized by high dry matter content and soluble solids levels than normal-sized fresh tomato cultivars; these differences are due to their higher content of sugars (fructose and glucose) and organic acids (citric and malic), which, in turn, are major factors in determining their greater sweetness, sourness, and overall flavor intensity (Muttappanavar *et al.*, 2014)^[11]. It is native to the Andean region encompassing Ecuador and Peru of South America and thereafter it spread around the world following the Spanish colonization of the Americas (Rick, 1976; Smith, 1994; Grandillo *et al.*, 2011)^[15, 20, 5]. It is highly rich in vitamins like vitamin A, vitamin B₉, vitamin C (>57 mg 100g⁻¹) (Aguirre *et al.*, 2012)^[1] and other minerals like phosphorus, calcium, potassium, manganese, sodium, magnesium and iron (Oyetayo *et al.*, 2012 and Ramya *et al.*, 2016)^[13, 14]. It is also considered as a 'Protective Food' because of its special nutraceutical value and high level of antioxidants like β-carotene, vitamin C, carotenoids, polyphenols, phenolics, ascorbate, free amino acids and flavonoids (Lenucci *et al.*, 2006; Kavitha *et al.*, 2014)^[10, 6].

The present demand of cherry tomato is based on the consumer's preference, fresh market demand and industrial requirement. Being nutritionally rich (antioxidants and phytochemical compounds), as compared to the normal tomatoes, nevertheless less work has been done in respect of quality improvement in cherry tomatoes. There has been no breeding programme targeted towards its nutritive values in India. Hence, the non-availability of high yielding hybrids in India, particularly in Kashmir valley is a major constraint in horizontal expansion and popularization of this newly introduced high value crop. However, being a self-pollinated crop, it provides enormous potential for heterosis breeding due to high seed number fruit⁻¹. As a result, the scenario of cherry tomato production changed tremendously with the increasing popularity of F₁ hybrids on account of several privileges as compared to purelines. The exploitation of hybrid vigour has been the salient breeding approach in its crop improvement programmes.

Materials and Methods

The study of heterosis in cherry tomato was carried out at Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar, India during *Kharif* season, 2020 in two environments namely open environment (E₁) and protected environment (E₂).

Fifty-seven treatments comprising of 45 F₁'s, 10 parents and 2 checks were evaluated for various yield and its component traits in Augmented Block Design. The seeds of all accessions and their crosses were first sown in nursery and then transplanted to the main field at a spacing of 60 x 60 cm between rows and plants respectively. Recommended package of practices were followed to raise a healthy crop. The observations were recorded on dry matter content, total soluble solids, titratable acidity, ascorbic acid content, lycopene content, total sugars, reducing sugar, non-reducing sugar and juice to pulp ratio by selecting fresh red-ripe fruits from five random plants and the average was worked out.

Results and Discussion

In the present investigation, the heterosis was estimated over standard varieties/ checks (economic heterosis) for each trait in the individual as well as data pooled over environments (Table 1-5). Perusal of the findings indicated a wide range of heterotic patterns for different traits.

For dry matter content, the highest positive heterosis was remarked in the cross WIR-5032 x VRT-02 (49.83 and 72.20) followed by WIR-5032 x EC-914097 (46.02 and 67.82 in E₁; cross WIR-5032 x EC-520074 (108.40 and 324.86) followed by WIR-5032 x EC-914115 (99.32 and 306.35) in E₂ and cross WIR-5032 x EC-914115 (61.93 and 131.87) followed by WIR-5032 x EC-520074 (55.36 and 122.48) in pooled data over environments.

For total soluble solids (⁰Brix), the highest positive heterosis was remarked in the cross EC-914115 x EC-914097 (18.28 and 19.57) followed by EC-914115 x VRT-02 (17.20 and 18.48) in E₁; cross Sun Cherry x EC-914115 (31.71 and 25.58) followed by WIR-5032 x EC-914097 (29.27 and 23.26) in E₂ and cross Sun Cherry x EC-914115 (21.14 and 19.10) followed by WIR-5032 x EC-914097 (20.00 and 17.98) in pooled data over environments.

For titratable acidity (%), the highest positive heterosis was remarked in the cross EC-165690 x EC-914092 and WIR-3957 x VRT-02 (62.86 and 39.02) followed by EC-914092 x EC-914097 (48.57 and 26.83) in E₁; cross WIR-3957 x VRT-02 (32.00 and 17.86) followed by Sun Cherry x WIR-5032 (28.00 and 14.29) in E₂ and cross WIR-3957 x VRT-02 (50.00 and 30.43) in followed by EC-914115 x EC-165690 (23.33 and 7.25) in pooled data over environments

For ascorbic acid content (mg100g⁻¹), the highest positive heterosis was remarked in the cross Sun Cherry x VRT-02 (229.41 and 211.11) followed by EC-520074 x EC-914115 (217.65 and 200.00) in E₁; cross WIR-5032 x VRT-02 (40.63 and 80.00) followed by Sun Cherry x EC-520078 (25.00 and

16.00) in E₂ and cross WIR-5032 x VRT-02 (67.30 and 92.17) followed by EC-520074 x EC-914115 (65.78 and 90.43) in pooled data over environments.

For lycopene content (mg100g⁻¹), the highest positive heterosis was remarked in the cross EC-914092 x EC-914097 (213.92 and 60.49) followed by WIR-5032 x WIR-3957 (211.72 and 59.36) in E₁; cross EC-914115 x EC-520078 (110.20 and 39.40) followed by EC-914115 x EC-914097 (109.02 and 38.62) in E₂ and cross EC-914115 x EC-914097 (112.52 and 27.71) followed by WIR-3957 x EC-914097 (95.66 and 17.57) in pooled data over environments.

For total sugars (%), the highest positive heterosis was remarked in the cross Sun Cherry x EC-914097 (151.93 and 71.14) followed by Sun Cherry x EC-165690 (145.92 and 67.06) in E₁; cross EC-165690 x VRT-02 followed by EC-914092 x WIR-3957 and EC-914092 x EC-914097 (0.17 and 10.60) in E₂ and cross Sun Cherry x EC-914097 (43.92 and 34.57) followed by WIR-5032 x WIR-3957 (40.45 and 31.32) in pooled data over environments.

For reducing sugar (%), the highest positive heterosis was remarked in the cross Sun Cherry x EC-914097 (160.96 and 85.55) followed by WIR-5032 x WIR-3957 (159.89 and 84.79) in E₁; cross Sun Cherry x VRT-02 (6.34 and 20.33) followed by WIR-5032 x EC-520078 (1.69 and 15.07) in E₂ and cross Sun Cherry x EC-914097 (45.76 and 41.26) followed by WIR-5032 x WIR-3957 (43.94 and 39.50) in pooled data over environments.

For non – reducing sugar (%), the highest positive heterosis was remarked in the cross Sun Cherry x EC-914092 (119.57 and 27.85) followed by Sun Cherry x EC-914097, WIR-5032 x EC-520074, WIR-5032 x EC-520078 and EC-165690 x EC-914092 (115.22 and 25.32) in E₁ and cross Sun Cherry x EC-914092 (37.59 and 12.21) followed by Sun Cherry x EC-914097 (35.41 and 10.42) in pooled data over environments.

For juice to pulp ratio, the highest positive heterosis was remarked in the cross EC-520074 x EC-914092 (87.04 and 57.04) followed by WIR-5032 x EC-520074 (71.66 and 57.04) in E₁; cross WIR-5032 x EC-914115 (41.71 and 38.55) followed by WIR-5032 x VRT-02 (40.00 and 36.87) in E₂ and cross EC-520074 x EC-914092 (61.37 and 51.67) followed by WIR-5032 x EC-914092 (43.60 and 34.97) in pooled data over environments.

Similar findings with respect to heterosis were also reported by Bhatt *et al.* (2001b), Singh *et al.* (2005) [18], Kumar *et al.* (2006) [8], Asati *et al.* (2007) [2], Singh *et al.* (2007) [19], Saleem *et al.* (2009) [17], Khareba *et al.* (2011) [7], Droka *et al.* (2012) [4], Nosser *et al.* (2012) [12], Muttappanavar *et al.* (2014) [11], Kumar *et al.* (2019) [9] and Sah *et al.* (2020) [16].

Table 1: Estimation of heterosis (%) over checks for quality traits in Cherry tomato

S. No	Crosses	Dry matter content (%)						Total Soluble Solids (⁰ Brix)					
		E ₁		E ₂		Pooled		E ₁		E ₂		Pooled	
		C ₁	C ₂	C ₁	C ₂	C ₁	C ₂	C ₁	C ₂	C ₁	C ₂	C ₁	C ₂
1	Sun Cherry x WIR - 5032	-39.31**	-30.24**	16.40	137.29	-14.10	23.00	6.45**	7.61**	2.44	-2.33	4.57 **	2.81 **
2	Sun Cherry x EC - 520074	1.79**	16.99**	45.12	195.86	21.40	73.84	11.83**	13.04**	26.83	20.93	18.86 **	16.85 **
3	Sun Cherry x EC - 914115	24.75**	43.37**	34.15	173.48	29.00	84.72	11.83**	13.04**	31.71	25.58	21.14 **	19.10 **
4	Sun Cherry x EC - 165690	11.65**	28.31**	-40.24	21.82	-11.83	26.25	-6.45**	-5.43**	-30.49	-33.72	-17.71 **	-19.10 **
5	Sun Cherry x EC - 914092	-16.69**	-4.25**	-21.41	60.22	-18.82	16.24	-4.30**	-3.26 **	-26.83	-30.23	-14.86 **	-16.29 **
6	Sun Cherry x EC - 520078	-14.56**	-1.80**	-27.10	48.62	-20.23	14.22	-5.38**	-4.35 **	13.41	8.14	3.43 **	1.69 **
7	Sun Cherry x WIR - 3957	-16.46**	-3.99**	-28.32	46.13	-21.83	11.94	2.15 **	3.26 **	-25.61	-29.07	-10.86 **	-12.36 **
8	Sun Cherry x EC - 914097	-30.68**	-20.33**	-60.98	-20.44	-44.39	-20.37	-1.08**	0.00	6.10	1.16	2.29 **	0.56 **
9	Sun Cherry x VRT - 02	2.13**	17.37**	18.29	141.16	9.44	56.72	3.23 **	4.35 **	26.83	20.93	14.29 **	12.36 **
10	WIR - 5032 x EC - 520074	11.53**	28.19**	108.40	324.86 *	55.36	122.48	10.75**	11.96 **	28.05	22.09	18.86 **	16.85 **
11	WIR - 5032 x EC - 914115	31.02**	50.58**	99.32	306.35 *	61.93	131.87	8.60 **	9.78 **	26.83	20.93	17.14 **	15.17 **
12	WIR - 5032 x EC - 165690	-15.34**	-2.70**	9.08	122.38	-4.29	37.05	6.45 **	7.61 **	8.54	3.49	7.43 **	5.62 **
13	WIR - 5032 x EC - 914092	30.46**	49.94**	46.75	199.17	37.83	97.37	9.68 **	10.87 **	19.51	13.95	14.29 **	12.36 **
14	WIR - 5032 x EC - 520078	10.53**	27.03**	4.61	113.26	7.85	54.43	8.60 **	9.78 **	20.73	15.12	14.29 **	12.36 **

15	WIR – 5032 x WIR – 3957	-0.67**	14.16**	-73.71	-46.41	-33.72	-5.09	6.45 **	7.61 **	0.00	-4.65	3.43 **	1.69 **
16	WIR – 5032 x EC – 914097	46.02**	67.82**	26.69	158.29	37.28	96.58	11.83**	13.04 **	29.27	23.26	20.00 **	17.98 **
17	WIR – 5032 x VRT - 02	49.83**	72.20**	-8.94	85.64	23.24	76.47	15.05**	16.30 **	23.17	17.44	18.86 **	16.85 **
18	EC- 520074 x EC – 914115	33.26**	53.15**	12.60	129.56	23.91	77.44	12.90**	14.13 **	-1.22	-5.81	6.29 **	4.49 **
19	EC- 520074 x EC – 165690	8.85**	25.10**	11.65	127.62	10.12	57.68	11.83**	13.04 **	21.95	16.28	16.57 **	14.61 **
20	EC- 520074 x EC – 914092	19.82**	37.71**	39.16	183.70	28.57	84.11	15.05**	16.30 **	25.61	19.77	20.00 **	17.98 **
21	EC- 520074 x EC – 520078	17.36**	34.88**	7.45	119.06	12.88	61.63	8.60 **	9.78 **	17.07	11.63	12.57 **	10.67 **
22	EC- 520074 x WIR - 3957	37.29**	57.79**	50.68	207.18	43.35	105.27	12.90 **	14.13 **	-20.73	-24.42	-2.86 **	-4.49 **
23	EC- 520074 x EC – 914097	-27.10**	-16.22**	-38.89	24.59	-32.43	-3.25	3.23 **	4.35 **	-7.32	-11.63	-1.71 **	-3.37 **
24	EC- 520074 x VRT - 02	13.44 **	30.37**	-65.58	-29.83	-22.32	11.24	2.15 **	3.26 **	25.61	19.77	13.14 **	11.24 **
25	EC-914115 x EC – 165690	-25.20**	-14.03 **	-33.60	35.36	-29.00	1.67	-3.23 **	-2.17 **	-20.73	-24.42	-11.43 **	-12.92 **
26	EC- 914115 x EC – 914092	1.79 **	16.99 **	-50.68	0.55	-21.95	11.76	-5.38 **	-4.35 **	-31.71	-34.88	-17.71 **	-19.10 **
27	EC- 914115 x EC – 520078	17.58 **	35.14 **	11.25	126.80	14.71	64.27	16.13 **	17.39 **	17.07	11.63	16.57 **	14.61 **
28	EC- 914115 x WIR – 3957	14.33 **	31.40 **	39.02	183.43	25.51	79.72	12.90 **	14.13 **	19.51	13.95	16.00 **	14.04 **
29	EC- 914115 x EC – 914097	28.22 **	47.36 **	-29.40	43.92	2.15	46.27	18.28 **	19.57 **	20.73	15.12	19.43 **	17.42 **
30	EC- 914115 x VRT - 02	10.97 **	27.54 **	-27.64	47.51	-6.50	33.89	17.20 **	18.48 **	21.95	16.28	19.43 **	17.42 **
31	EC-165690 x EC- 914092	5.71 **	21.49 **	-48.10	5.80	-18.64	16.51	7.53 **	8.70 **	-15.85	-19.77	-3.43 **	-5.06 **
32	EC-165690 x EC- 520078	-26.88 **	-15.96 **	-41.19	19.89	-33.35	-4.57	7.53 **	8.70 **	-36.59	-39.53	-13.14 **	-14.61 **
33	EC-165690 x WIR – 3957	17.36 **	34.88 **	-42.95	16.30	-9.93	28.97	-1.08 **	0.00	-31.71	-34.88	-15.43 **	-16.85 **
34	EC-165690 x EC-914097	-24.08 **	-12.74 **	-50.41	1.10	-35.99	-8.34	3.23 **	4.35 **	-34.15	-37.21	-14.29 **	-15.73 **
35	EC-165690 x VRT - 02	8.29 **	24.45 **	-27.51	47.79	-7.91	31.87	6.45 **	7.61 **	-15.85	-19.77	-4.00 **	-5.62 **
36	EC-914092 x EC-520078	-37.29 **	-27.93 **	-47.43	7.18	-41.88	-16.77	-7.53 **	-6.52 **	-36.59	-39.53	-21.14 **	-22.47 **
37	EC- 914092 x WIR – 3957	-28.44 **	-17.76 **	14.63	133.70	-8.95	30.38	2.15 **	3.26 **	-17.07	-20.93	-6.86 **	-8.43 **
38	EC-914092 x EC-914097	-23.18 **	-11.71 **	-48.51	4.97	-34.64	-6.41	-9.68 **	-8.70 **	-29.27	-32.56	-18.86 **	-20.22 **
39	EC-914092 x VRT - 02	4.26 **	19.82 **	4.74	113.54	4.48	49.60	-2.15 **	-1.09 **	-10.98	-15.12	-6.29 **	-7.87 **
40	EC-520078 x WIR-3957	2.46 **	17.76 **	-23.71	55.52	-9.38	29.76	7.53 **	8.70 **	25.61	19.77	16.00 **	14.04 **
41	EC-520078 x EC - 914097	22.51 **	40.80**	57.18	220.44	38.20	97.89	2.15 **	3.26 **	24.39	18.60	12.57 **	10.67**
42	EC-520078 x VRT - 02	-29.23 **	-18.66**	-8.94	85.64	-20.05	14.49	-10.75 **	-9.78 **	-1.22	-5.81	-6.29 **	-7.87 **
43	WIR – 3957 x EC - 914097	-39.64 **	-30.63**	-60.57	-19.61	-49.11	-27.13	3.23 **	4.35 **	-40.24	-43.02	-17.14 **	-18.54**
44	WIR – 3957 x VRT - 02	-22.73 **	-11.20**	-18.97	65.19	-21.03	13.08	10.75 **	11.96 **	-20.73	-24.42	-4.00 **	-5.62**
45	EC – 914097 x VRT - 02	-3.47 **	10.94 **	-48.10	5.80	-23.67	9.31	6.45 **	7.61 **	-32.93	-36.05	-12.00 **	-13.48**
Range	Min	-39.64**	-30.63**	-73.71	-46.41	-49.11	-27.13	-10.75**	-9.78**	-40.24	-43.02	-21.14**	-22.47**
	Max	49.83**	72.20**	108.40	324.86*	61.93	131.87	18.28 **	19.57**	31.71	25.58	21.14**	19.10 **

*, ** Significant at 5 and 1 per cent levels, respectively.

Table 2: Estimation of heterosis (%) over checks for quality traits in Cherry tomato

S. No	Crosses	Titratable acidity (%)						Ascorbic acid content (mg100g-1)					
		E1		E2		Pooled		E1		E2		Pooled	
		C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2
1	Sun Cherry x WIR - 5032	-57.14 **	-63.41 **	28.00 **	14.29 **	-21.67 **	-31.88**	58.82 **	50.00 **	-6.25 **	20.00 **	14.69 **	31.74 **
2	Sun Cherry x EC – 520074	-62.86 **	-68.29 **	-44.00 **	-50.00 **	-55.00 **	-60.87**	29.41 **	22.22 **	-12.50 **	12.00 **	0.98 **	16.00 **
3	Sun Cherry x EC – 914115	-60.00 **	-65.85 **	-56.00 **	-60.71 **	-58.33 **	-63.77**	11.76 **	5.56 **	3.13 **	32.00 **	5.90 **	21.65 **
4	Sun Cherry x EC – 165690	-8.57 **	-21.95 **	12.00 **	-21.43 **	-10.00 **	-21.74**	176.47**	161.11 **	-3.12 **	24.00 **	54.66 **	77.65 **
5	Sun Cherry x EC – 914092	-5.71 **	-19.51 **	-28.00 **	-35.71 **	-15.00 **	-26.09**	41.18**	33.33 **	-6.25 **	20.00 **	9.01 **	25.22 **
6	Sun Cherry x EC – 520078	-62.86 **	-68.29 **	-32.00 **	-39.29 **	-50.00 **	-56.52**	17.65**	11.11 **	25.00 **	60.00 **	22.63 **	40.87 **
7	Sun Cherry x WIR – 3957	-22.86 **	-34.15 **	-40.00 **	-46.43 **	-30.00 **	-39.13**	11.76**	5.56 **	-6.25 **	20.00 **	-0.45 **	14.35 **
8	Sun Cherry x EC – 914097	-51.43 **	-58.54 **	-56.00 **	-60.71 **	-53.33 **	-59.42**	200.00**	183.33**	0.00	28.00 **	64.35 **	88.78 **
9	Sun Cherry x VRT - 02	-40.00 **	-48.78 **	-40.00 **	-46.43 **	-40.00 **	-47.83**	229.4**	211.11**	-17.50 **	5.60 **	61.94 **	86.02 **
10	WIR – 5032 x EC – 520074	-25.71 **	-36.59 **	-28.00 **	-35.71 **	-26.67 **	-36.23**	94.12 **	83.33 **	0.00	28.00 **	30.28 **	49.65 **
11	WIR – 5032 x EC – 914115	-37.14 **	-46.34 **	-40.00 **	-46.43 **	-38.33 **	-46.38**	88.24 **	77.78 **	-3.12 **	24.00 **	26.27 **	45.04 **
12	WIR – 5032 x EC – 165690	-62.86 **	-68.29 **	-20.00 **	-28.57 **	-45.00 **	-52.17**	70.59**	61.11 **	-34.38 **	-16.00 **	-0.61 **	14.17 **
13	WIR – 5032 x EC – 914092	-42.86 **	-51.22 **	-68.00 **	-71.43 **	-53.33 **	-59.42**	-11.76**	-16.67 **	-21.88 **	0.00	-18.62 **	-6.52 **
14	WIR – 5032 x EC – 520078	22.86 **	4.88 **	-36.00 **	-42.86 **	-1.67 **	-14.49**	23.53**	16.67 **	-18.75 **	4.00 **	-5.15 **	8.96 **
15	WIR – 5032 x WIR – 3957	-2.86 **	-17.07 **	-28.00 **	-35.71 **	-13.33 **	-24.64**	94.12**	83.33 **	-37.50 **	-20.00 **	4.84 **	20.43 **
16	WIR – 5032 x EC – 914097	-34.29 **	-43.90 **	-24.00 **	-32.14 **	-30.00 **	-39.13**	5.88 *	0.00	3.13 **	32.00 **	4.01 **	19.48 **
17	WIR – 5032 x VRT - 02	-17.14 **	-29.27 **	56.00 **	-60.71 **	-33.33 **	-42.03**	123.53**	111.11 **	40.63 **	80.00 **	67.30 **	92.17 **
18	EC- 520074 x EC – 914115	-11.43 **	-24.39 **	4.00 **	-7.14 **	-5.00 **	-17.39**	217.65**	200.00 **	-6.25 **	20.00 **	65.78 **	90.43 **
19	EC- 520074 x EC – 165690	25.71 **	7.32 **	-8.00 **	-17.86 **	11.67 **	-2.90**	70.59**	61.11 **	-3.12 **	24.00 **	20.59 **	38.52 **
20	EC- 520074 x EC – 914092	-28.57 **	-39.02 **	-8.00 **	-17.86 **	-20.00 **	-30.43**	135.29**	122.22**	15.63 **	48.00 **	54.13 **	77.04 **
21	EC- 520074 x EC – 520078	0.00	-14.63 **	-40.00 **	-46.43 **	-16.67 **	-27.54 **	129.41 **	116.67 **	18.75 **	52.00 **	54.35 **	77.30 **
22	EC- 520074 x WIR - 3957	20.00 **	2.44 **	-16.00 **	-25.00 **	5.00 **	-8.70 **	0.00	-5.56 **	-12.50 **	12.00 **	-8.48 **	5.13 **
23	EC- 520074 x EC – 914097	-17.14 **	-29.27 **	-20.00 **	-28.57 **	-18.33 **	-28.99 **	11.76 **	5.56 **	-18.75 **	4.00 **	-8.93 **	4.61 **
24	EC- 520074 x VRT - 02	-2.86 **	-17.07 **	-20.00 **	-28.57 **	-10.00 **	-21.74 **	-17.65 **	-22.22 **	-12.50 **	12.00 **	-14.16 **	-1.39 **
25	EC- 914115 x EC – 165690	28.57 **	9.76 **	16.00 **	3.57 **	23.33 **	7.25 **	-11.76 **	-16.67 **	15.63 **	48.00 **	6.81 **	22.70 **
26	EC- 914115 x EC – 914092	31.43 **	12.20 **	-24.00 **	-32.14 **	8.33 **	-5.80 **	23.53 **	16.67 **	-3.12 **	24.00 **	5.45 **	21.13 **
27	EC- 914115 x EC – 520078	31.43 **	12.20 **	-28.00 **	-35.71 **	6.67 **	-7.25 **	176.47 **	161.11 **	-15.63 **	8.00 **	46.18 **	67.91 **
28	EC- 914115 x WIR – 3957	-37.14 **	-46.34 **	-32.00 **	-39.29 **	-35.00 **	-43.48 **	170.59 **	155.56 **	-21.88 **	0.00	40.05 **	60.87 **
29	EC- 914115 x EC – 914097	-17.14 **	-29.27 **	-40.00 **	-46.43 **	-26.67 **	-36.23 **	176.47 **	161.11 **	-34.38 **	-16.00 **	33.46 **	53.30 **
30	EC- 914115 x VRT - 02	-37.14 **	-46.34 **	-28.00 **	-35.71 **	-33.33 **	-42.03 **	-35.29 **	-38.89 **	-3.12 **	24.00 **	-13.47 **	-0.61 **
31	EC-165690 x EC- 914092	62.86 **	39.02 **	-52.00 **	-57.14 **	15.00 **	0.00	52.94 **	44.44 **	-6.25 **	20.00 **	12.79 **	29.57 **
32	EC-165690 x EC- 520078	17.14 **	0.00	-48.00 **	-53.57 **	-10.00 **	-21.74 **	70.59 **	61.11 **	-15.63 **	8.00 **	12.11 **	28.78 **
33	EC-165690 x WIR – 3957	-17.14 **	-29.27 **	0.00	-10.71 **	-10.00 **	-21.74 **	29.41 **	22.22 **	-15.63 **	8.00 **	-1.14 **	13.57 **
34	EC-165690 x EC-914097	-22.86 **	-34.15 **	12.00 **	0.00	-8.33 **	-20.29 **	-5.88 **	-11.11 **	-3.12 **	24.00 **	-4.01 **	10.26 **
35	EC-165690 x VRT - 02	-22.86 **	-34.15 **	-24.00 **	-32.14 **	-23.33 **	-33.33 **	58.82 **	50.00 **	-34.38 **	-16.00 **	-4.39 **	9.83 **
36	EC-914092 x EC-520078	11.43 **	-4.88 **	-32.00 **	-39.29 **	-6.67 **	-18.84 **	-29.41 **	-33.33 **	9.38 **	40.00 **	-3.10 **	11.30 **

37	EC-914092 x WIR – 3957	-14.29 **	-26.83 **	-4.00 **	-14.29 **	-10.00 **	-21.74 **	-5.88 **	-11.11 **	-37.50 **	-20.00 **	-27.33 **	-16.52 **
38	EC-914092 x EC-914097	48.57 **	26.83 **	-20.00 **	-28.57 **	20.00 **	4.35 **	5.88 **	0.00	0.00	28.00 **	1.89 **	17.04 **
39	EC-914092 x VRT - 02	-17.14 **	-29.27 **	-52.00 **	-57.14 **	-31.67 **	-40.58 **	135.29 **	122.22 **	-25.00 **	-4.00 **	26.57 **	45.39 **
40	EC-520078 x WIR-3957	-54.29 **	-60.98 **	-40.00 **	-46.43 **	-48.33 **	-55.07 **	-11.76 **	-16.67 **	-21.88 **	0.00	-18.62 **	-6.52 **
41	EC-520078 x EC - 914097	-14.29 **	-26.83 **	-36.00 **	-42.86 **	-23.33 **	-33.33 **	-17.65**	-22.22**	-12.50**	12.00 **	-14.16**	-1.39 **
42	EC-520078 x VRT - 02	5.71 **	-9.76 **	-44.00 **	-50.00 **	-15.00 **	-26.09 **	-5.88 **	-11.11**	-6.25 **	20.00 **	-6.13 **	7.83 **
43	WIR – 3957 x EC - 914097	-40.00 **	-48.78 **	-32.00 **	-39.29 **	-36.67 **	-44.93 **	-17.65**	-22.22**	-6.25 **	20.00 **	-9.92 **	3.48 **
44	WIR – 3957 x VRT - 02	62.86 **	39.02 **	32.00 **	17.86 **	50.00 **	30.43 **	-17.65**	-22.22**	12.50 **	44.00 **	2.80 **	18.09 **
45	EC - 914097 x VRT - 02	-20.00 **	-31.71 **	-20.00 **	-28.57 **	-20.00 **	-30.43 **	5.88 **	0.00	-25.00**	-4.00 **	-15.06**	-2.43 **
Range	Min	-62.86 **	-68.29 **	-68.00 **	-71.43 **	-58.33 **	-63.77 **	-35.29**	-38.89**	-37.50**	-20.00**	-27.33**	-16.52**
	Max	62.86 **	39.02 **	32.00 **	17.86 **	50.00 **	30.43 **	229.41**	211.11**	40.63 **	80.00 **	67.30 **	92.17 **

*, ** Significant at 5 and 1 per cent levels, respectively.

Table 3: Estimation of heterosis (%) over checks for quality traits in Cherry tomato.

S. No	Crosses	Lycopene content (mg100g-1)						Total sugars (%)					
		E1		E2		Pooled		E1		E2		Pooled	
		C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2
1	Sun Cherry x WIR - 5032	35.90 **	-30.52**	72.35 **	14.30 **	59.64 **	-4.07 **	86.70 **	26.82 **	-28.97 **	-21.58 **	4.47 **	-2.32 **
2	Sun Cherry x EC – 520074	128.57 **	16.85 **	39.22 **	-7.67 **	70.37 **	2.38 **	38.20 **	-6.12 **	0.00	10.40 **	11.04 **	3.83 **
3	Sun Cherry x EC – 914115	85.35 **	-5.24 **	27.25 **	-15.60 **	47.51 **	-11.36 **	85.41 **	25.95 **	0.00	10.40 **	24.69 **	16.59 **
4	Sun Cherry x EC – 165690	56.41 **	-20.04**	-24.51 **	-49.93 **	3.70 **	-37.68 **	145.92**	67.06 **	-29.14 **	-21.77 **	21.46 **	13.57 **
5	Sun Cherry x EC – 914092	88.64 **	-3.56 **	74.12 **	15.47 **	79.18 **	7.67 **	102.15**	37.32 **	-6.98 **	2.70 **	24.57 **	16.47 **
6	Sun Cherry x EC – 520078	51.65 **	-22.47**	19.80 **	-20.55 **	30.91 **	-21.34 **	102.15**	37.32 **	-8.38 **	1.16 **	23.57 **	15.55 **
7	Sun Cherry x WIR – 3957	65.57 **	-15.36**	17.45 **	-22.11 **	34.23 **	-19.34 **	99.14 **	35.28 **	0.00	10.40 **	28.66 **	20.30 **
8	Sun Cherry x EC – 914097	64.10 **	-16.10**	43.14 **	-5.07 **	50.45 **	-9.59 **	151.93**	71.14 **	0.00	10.40 **	43.92 **	34.57 **
9	Sun Cherry x VRT - 02	53.11 **	-21.72**	11.76 **	-25.88 **	26.18 **	-24.17 **	106.87**	40.52 **	-0.35 **	10.02 **	30.65 **	22.16 **
10	WIR – 5032 x EC – 520074	77.29 **	-9.36 **	-18.63 **	-46.03 **	14.81 **	-31.01 **	117.17**	47.52 **	0.00	10.40 **	33.87 **	25.17 **
11	WIR – 5032 x EC – 914115	31.87 **	-32.58**	10.78 **	-26.53 **	18.14 **	-29.01 **	109.01**	41.98 **	-81.68 **	-79.77 **	-26.55 **	-31.32 **
12	WIR – 5032 x EC – 165690	78.02 **	-8.99 **	-30.78 **	-54.10 **	7.15 **	-35.61 **	77.25 **	20.41 **	-33.33 **	-26.40 **	-1.36 **	-7.77 **
13	WIR – 5032 x EC – 914092	13.19 **	-42.13**	12.55 **	-25.36 **	12.77 **	-32.23 **	86.70 **	26.82 **	-79.23 **	-77.07 **	-31.27 **	-35.73 **
14	WIR – 5032 x EC – 520078	-11.92 **	-55.99**	33.14 **	-11.70 **	16.73 **	-29.85 **	90.99 **	29.74 **	0.00	10.40 **	26.30 **	18.10 **
15	WIR – 5032 x WIR – 3957	233.72 **	59.36 **	9.41 **	-27.44 **	79.95 **	8.14 **	143.78**	65.60 **	-1.57 **	8.67 **	40.45 **	31.32 **
16	WIR – 5032 x EC – 914097	79.12 **	-8.43 **	16.47 **	-22.76 **	38.31 **	-16.88 **	-23.61 **	-48.10 **	-40.49 **	-34.30 **	-35.61 **	-39.79 **
17	WIR – 5032 x VRT - 02	-7.33 **	-52.62**	43.33 **	-4.94 **	25.67 **	-24.48 **	127.90**	54.81 **	0.00	10.40 **	36.97 **	28.07 **
18	EC- 520074 x EC – 914115	76.19 **	-30.52**	6.08 **	-29.65 **	30.52 **	-21.57 **	-55.36 **	-69.68 **	-0.17 **	10.21 **	-16.13 **	-21.58 **
19	EC- 520074 x EC – 165690	73.63 **	16.85 **	46.27 **	-2.99 **	55.81 **	-6.37 **	-51.07 **	-66.76 **	-0.35 **	10.02 **	-15.01 **	-20.53 **
20	EC- 520074 x EC – 914092	119.05 **	-5.24 **	31.96 **	-12.48 **	62.32 **	-2.46 **	32.19 **	-10.20 **	-0.17 **	10.21 **	9.18 **	2.09 **
21	EC- 520074 x EC – 520078	10.26 **	-43.63 **	-43.92 **	-62.81 **	-25.03 **	-54.95 **	130.47 **	56.56 **	-44.85 **	-39.11 **	5.83 **	-1.04 **
22	EC- 520074 x WIR – 3957	159.71 **	32.77 **	4.71 **	-30.56 **	58.75 **	-4.60 **	-32.19 **	-53.94 **	-2.79 **	7.32 **	-11.29 **	-17.05 **
23	EC- 520074 x EC – 914097	37.36 **	-29.78 **	10.00 **	-27.05 **	19.54 **	-28.17 **	97.85 **	34.40 **	0.00	10.40 **	28.29 **	19.95 **
24	EC- 520074 x VRT - - 02	107.33 **	5.99 **	1.76 **	-32.51 **	38.57 **	-16.73 **	-9.87 **	-38.78 **	-0.35 **	10.02 **	-3.10 **	-9.40 **
25	EC- 914115 x EC – 165690	33.33 **	-31.84 **	88.63 **	25.10 **	69.35 **	1.77 **	-3.00 **	-34.11 **	0.00	10.40 **	-0.87 **	-7.31 **
26	EC- 914115 x EC – 914092	119.41 **	12.17 **	30.98 **	-13.13 **	61.81 **	-2.76 **	35.62 **	-7.87 **	0.00	10.40 **	10.30 **	3.13 **
27	EC- 914115 x EC – 520078	-3.30 **	-50.56 **	110.20 **	39.40 **	70.63 **	2.53 **	101.29 **	36.73 **	0.00	10.40 **	29.28 **	20.88 **
28	EC- 914115 x WIR – 3957	15.38 **	-41.01 **	80.98 **	20.03 **	58.11 **	-4.99 **	19.74 **	-18.66 **	-2.79 **	7.32 **	3.72 **	-3.02 **
29	EC- 914115 x EC – 914097	119.05 **	11.99 **	109.02 **	38.62 **	112.52 **	27.71 **	0.43 **	-31.78 **	-0.35 **	10.02 **	-0.12 **	-6.61 **
30	EC- 914115 x VRT - 02	27.47 **	-34.83 **	21.96 **	-19.12 **	23.88 **	-25.56 **	130.04 **	56.27 **	0.00	10.40 **	37.59 **	28.65 **
31	EC-165690 x EC- 914092	32.23 **	-32.40 **	3.92 **	-31.08 **	13.79 **	-31.62 **	-28.33 **	-51.31 **	-5.58 **	4.24 **	-12.16 **	-17.87 **
32	EC-165690 x EC- 520078	43.96 **	-26.40 **	58.24 **	4.94 **	53.26 **	-7.90 **	-31.76 **	-53.64 **	0.00	10.40 **	-9.18 **	-15.08 **
33	EC-165690 x WIR – 3957	127.84 **	16.48 **	-9.80 **	-40.18 **	38.19 **	-16.96 **	-28.76 **	-51.60 **	-3.49 **	6.55 **	-10.79 **	-16.59 **
34	EC-165690 x EC-914097	54.95 **	-20.79 **	-43.33 **	-62.42 **	-9.07 **	-45.36 **	-30.90 **	-53.06 **	-5.93 **	3.85 **	-13.15 **	-18.79 **
35	EC-165690 x VRT - 02	-7.33 **	-52.62 **	-30.00 **	-53.58 **	-22.09 **	-53.18 **	-41.63 **	-60.35 **	0.17 **	10.60 **	-11.91 **	-17.63 **
36	EC-914092 x EC-520078	32.97 **	-32.02 **	0.78	-33.16 **	12.01 **	-32.69 **	-57.94 **	-71.43 **	-3.32 **	6.74 **	-19.11 **	-24.36 **
37	EC- 914092 x WIR – 3957	-1.47 **	-49.63 **	-3.73 **	-36.15 **	-2.94 **	-41.67 **	90.56 **	29.45 **	0.17 **	10.60 **	26.30 **	18.10 **
38	EC-914092 x EC-914097	213.92 **	60.49 **	-15.69 **	-44.08 **	64.37 **	-1.23 **	127.47 **	54.52 **	0.17 **	10.60 **	36.97 **	28.07 **
39	EC-914092 x VRT - 02	33.70 **	-31.65 **	-41.57 **	-61.25 **	-15.33 **	-49.12 **	-19.74 **	-45.48 **	-4.54 **	5.39 **	-8.93 **	-14.85 **
40	EC-520078 x WIR-3957	-56.04 **	-77.53 **	-9.41 **	-39.92 **	-25.67 **	-55.33 **	-8.58 **	-37.90 **	-23.73 **	-15.80 **	-19.35 **	-24.59 **
41	EC-520078 x EC - 914097	61.90 **	-17.23**	18.24 **	-21.59**	33.46**	-19.80**	81.97**	23.62**	-78.53**	-76.30**	-32.13**	-36.54**
42	EC-520078 x VRT - 02	150.18**	27.90**	-20.20**	-47.07**	39.21**	-16.35**	76.39**	19.83**	0.00	10.40**	22.08**	14.15**
43	WIR – 3957 x EC - 914097	135.16**	20.22**	74.51**	15.73**	95.66**	17.57**	-44.21**	-62.10**	0.00	10.40**	-12.78**	-18.45**
44	WIR – 3957 x VRT - 02	80.59**	-7.68**	88.04**	24.71**	85.44**	11.44**	-53.65**	-68.51**	-5.58**	4.24**	-19.48**	-24.71**
45	EC - 914097 x VRT - 02	18.68**	-39.33**	64.90**	9.36**	48.79**	-10.59**	49.79**	1.75**	0.00	10.40**	14.39**	6.96**
Range	Min	-56.04**	-77.53**	-43.92**	-62.81**	-25.67**	-55.33**	-57.94**	-71.43**	-81.68**	-79.77**	-35.61**	-39.79**
	Max	213.92**	60.49**	110.20**	39.40**	112.52**	27.71**	151.93**	71.14**	0.17**	10.60**	43.92**	34.5**

*, ** Significant at 5 and 1 per cent levels, respectively.

Table 4: Estimation of heterosis (%) over checks for quality traits in Cherry tomato

S. No	Crosses	Reducing sugar (%)						Non-reducing sugar (%)					
		E1		E2		Pooled		E1		E2		Pooled	
		C1	C2	C1	C2	C1	C2	C1	C2	C1	C2	C1	C2
1	Sun Cherry x WIR - 5032	109.09 **	48.67 **	-35.10 **	-26.56 **	5.76 **	2.50 **	-4.35 **	-44.30 **	-0.50 **	-0.60 **	-1.71 **	-19.84 **
2	Sun Cherry x EC – 520074	45.45 **	3.42 **	0.00	13.16 **	12.88 **	9.40 **	8.70 **	-36.71 **	-0.10	-0.10 **	2.67 **	-16.28 **
3	Sun Cherry x EC – 914115	85.56 **	31.94 **	0.42 **	13.64 **	24.55 **	20.70 **	82.61 **	6.33 **	-2.89 **	-2.99 **	23.99 **	1.11 **
4	Sun Cherry x EC – 165690	156.15 **	82.13 **	-29.81 **	-20.57 **	22.88 **	19.09 **	102.17 **	17.72 **	-26.62 **	-26.69 **	13.88 **	-7.13 **
5	Sun Cherry x EC – 914092	97.86 **	40.68 **	-8.46 **	3.59 **	21.67 **	17.91 **	119.57 **	27.85 **	0.00	-0.10	37.59 **	12.21 **

6	Sun Cherry x EC – 520078	112.83 **	51.33 **	-9.51 **	2.39 **	25.15 **	21.29 **	56.52 **	-8.86 **	-3.09 **	-3.19 **	15.65 **	-5.69 **
7	Sun Cherry x WIR – 3957	116.04 **	53.61 **	0.63 **	13.88 **	33.33 **	29.22 **	30.43 **	-24.05 **	-2.89 **	-2.99 **	7.59 **	-12.26 **
8	Sun Cherry x EC – 914097	160.96 **	85.55 **	0.21 **	13.40 **	45.76 **	41.26 **	115.22 **	25.32 **	-1.20 **	-1.29 **	35.41 **	10.42 **
9	Sun Cherry x VRT - 02	124.06 **	59.32 **	6.34 **	20.33 **	39.70 **	35.39 **	36.96 **	-20.25 **	-32.70 **	-32.77 **	-10.80 **	-27.26 **
10	WIR – 5032 x EC – 520074	117.11 **	54.37 **	1.27 **	14.59 **	34.09 **	29.96 **	115.22 **	25.32 **	-6.08 **	-6.18 **	32.06 **	7.69 **
11	WIR – 5032 x EC – 914115	127.81 **	61.98 **	-81.18 **	-78.71 **	-21.97 **	-24.38 **	34.78 **	-21.52 **	-83.85 **	-83.86 **	-46.55 **	-56.41 **
12	WIR – 5032 x EC – 165690	96.79 **	39.92 **	-32.77 **	-23.92 **	3.94 **	0.73 **	-2.17 **	-43.04 **	-35.79 **	-35.86 **	-25.22 **	-39.02 **
13	WIR – 5032 x EC – 914092	113.90 **	52.09 **	-84.14 **	-82.06 **	-28.03 **	-30.25 **	-23.91 **	-55.70 **	-55.73 **	-55.78 **	-45.73 **	-55.74 **
14	WIR – 5032 x EC – 520078	85.56 **	31.94 **	1.69 **	15.07 **	25.45 **	21.59 **	115.22 **	25.32 **	-7.88 **	-7.97 **	30.83 **	6.69 **
15	WIR – 5032 x WIR – 3957	159.89 **	84.79 **	-1.90 **	11.00 **	43.94 **	39.50 **	80.43 **	5.06 **	0.00	-0.10	25.29 **	2.17 **
16	WIR – 5032 x EC – 914097	-40.11 **	-57.41 **	-46.93 **	-39.95 **	-45.00 **	-46.70 **	43.48 **	-16.46 **	-9.57 **	-9.66 **	7.11 **	-12.65 **
17	WIR – 5032 x VRT - 02	145.99 **	74.90 **	0.00	13.16 **	41.36 **	37.00 **	56.52 **	-8.86 **	0.00	-0.10	17.77 **	-3.96 **
18	EC- 520074 x EC – 914115	-51.34 **	-65.40 **	1.48 **	14.83 **	-13.48 **	-16.15 **	-71.74 **	-83.54 **	-7.88 **	-7.97 **	-27.96 **	-41.25 **
19	EC- 520074 x EC – 165690	-50.27 **	-64.64 **	-0.42 **	12.68 **	-14.55 **	-17.18 **	-54.35 **	-73.42 **	0.00	-0.10	-17.09 **	-32.39 **
20	EC- 520074 x EC – 914092	20.86 **	-14.07 **	0.00	13.16 **	5.91 **	2.64 **	78.26 **	3.80 **	-1.30 **	-1.39 **	23.72 **	0.89 **
21	EC- 520074 x EC – 520078	159.36 **	84.41 **	-42.49 **	-34.93 **	14.70 **	11.16 **	15.22 **	-32.91 **	-56.23 **	-56.27 **	-33.77 **	-45.99 **
22	EC- 520074 x WIR - 3957	-31.55 **	-51.33 **	-2.11 **	10.77 **	-10.45 **	-13.22 **	-34.78 **	-62.03 **	-6.18 **	-6.27 **	-15.17 **	-30.82 **
23	EC- 520074 x EC – 914097	97.33 **	40.30 **	0.00	13.16 **	27.58 **	23.64 **	102.17 **	17.72 **	-0.20 **	-0.30 **	31.99 **	7.64 **
24	EC- 520074 x VRT - 02	-1.60 **	-30.04 **	0.21 **	13.40 **	-0.30 **	-3.38 **	-41.30 **	-65.82 **	-3.69 **	-3.78 **	-15.52 **	-31.10 **
25	EC- 520078 x EC – 165690	2.14 **	-27.38 **	0.00	13.16 **	0.61 **	-2.50 **	-23.91 **	-55.70 **	-0.20 **	-0.30 **	-7.66 **	-24.69 **
26	EC- 914115 x EC – 914092	39.04 **	-1.14 **	0.00	13.16 **	11.06 **	7.64 **	21.74 **	-29.11 **	-0.30 **	-0.40 **	6.63 **	-13.04 **
27	EC- 914115 x EC – 520078	114.97 **	52.85 **	0.00	13.16 **	32.58 **	28.49 **	47.83 **	-13.92 **	-0.10	-0.20 **	14.97 **	-6.24 **
28	EC- 914115 x WIR – 3957	19.25 **	-15.21 **	-2.11 **	10.77 **	3.94 **	0.73 **	21.74 **	-29.11 **	-6.28 **	-6.37 **	2.53 **	-16.39 **
29	EC- 914115 x EC – 914097	-1.60 **	-30.04 **	1.27 **	14.59 **	0.45 **	-2.64 **	11.74 **	-36.71 **	-8.97 **	-9.06 **	-3.42 **	-21.24 **
30	EC- 914115 x VRT - 02	140.11 **	70.72 **	0.00	13.16 **	39.70 **	35.39 **	89.13 **	10.13 **	-0.50 **	-0.60 **	27.68 **	4.12 **
31	EC-165690 x EC-914092	-63.64 **	-74.14 **	-5.92 **	6.46 **	-22.27 **	-24.67 **	115.22 **	25.32 **	-3.79 **	-3.88 **	33.63 **	8.97 **
32	EC-165690 x EC-520078	-28.34 **	-49.05 **	0.00	13.16 **	-8.03 **	-10.87 **	-45.65 **	-68.35 **	0.00	-0.10	-14.35 **	-30.16 **
33	EC-165690 x WIR – 3957	-48.13 **	-63.12 **	-4.02 **	8.61 **	-16.52 **	-19.09 **	50.00 **	-12.66 **	-1.40 **	-1.49 **	14.76 **	-6.41 **
34	EC-165690 x EC-914097	-48.66 **	-63.50 **	-7.40 **	4.78 **	-19.09 **	-21.59 **	41.30 **	-17.72 **	0.00	-0.10	12.99 **	-7.86 **
35	EC-165690 x WIR - 02	-39.57 **	-57.03 **	0.00	13.16 **	-11.21 **	-13.95 **	-50.00 **	-70.89 **	0.00	-0.10	-15.72 **	-31.27 **
36	EC-914092 x EC-520078	-59.89 **	-71.48 **	-3.59 **	9.09 **	-19.55 **	-22.03 **	-50.00 **	-70.89 **	-2.89 **	-2.99 **	-17.70 **	-32.89 **
37	EC- 914092 x WIR – 3957	120.86 **	57.03 **	0.21 **	13.40 **	34.39 **	30.25 **	-32.61 **	-60.76 **	-0.50 **	-0.60 **	-10.59 **	-27.09 **
38	EC-914092 x EC-914097	139.57 **	70.34 **	0.21 **	13.40 **	39.70 **	35.39 **	78.26 **	3.80 **	-0.80 **	-0.90 **	24.06 **	1.17 **
39	EC-914092 x VRT - 02	-14.97 **	-39.54 **	-0.21 **	12.92 **	-4.39 **	-7.34 **	-39.13 **	-64.56 **	-24.93 **	-25.00 **	-29.39 **	-42.42 **
40	EC-520078 x WIR-3957	-9.09 **	-35.36 **	-26.22 **	-16.51 **	-21.36 **	-23.79 **	-6.52 **	-45.57 **	-11.86 **	-11.95 **	-10.18 **	-26.76 **
41	EC-520078 x EC - 914097	109.63 **	49.05 **	-80.97 **	-78.47 **	-26.97 **	-29.22 **	-30.43 **	-59.49 **	-66.80 **	-66.83 **	-55.37 **	-63.60 **
42	EC-520078 x VRT - 02	75.40 **	24.71 **	0.00	13.16 **	21.36 **	17.62 **	80.43 **	5.06 **	-0.20 **	-0.30 **	25.15 **	2.06 **
43	WIR – 3957 x EC - 914097	-42.78 **	-59.32 **	0.6 **	13.88 **	-11.67 **	-14.39 **	-50.00 **	-70.89 **	-3.49 **	-3.59 **	-18.11 **	-33.22 **
44	WIR – 3957 x VRT - 02	-55.08 **	-68.06 **	-6.34 **	5.98 **	-20.15 **	-22.61 **	-50.00 **	-70.89 **	-2.79 **	-2.89 **	-17.64 **	-32.8 **
45	EC - 914097 x VRT - 02	39.57 **	-0.76 **	0.00	13.16 **	11.21 **	7.78 **	91.30 **	11.39 **	-0.70 **	-0.80 **	28.23 **	4.57 **
Range	Min	-63.64 **	-74.14 **	-84.14 **	-82.06 **	-45.00 **	-46.70 **	-71.74 **	-83.54 **	-83.85 **	-83.86 **	-55.37 **	-63.60 **
	Max	160.96 **	85.55 **	6.34 **	20.33 **	45.76 **	41.26 **	119.57 **	27.85 **	0.00	-0.10 **	37.59 **	2.21 **

*, ** Significant at 5 and 1 per cent levels, respectively

Table 5: Estimation of heterosis (%) over checks for quality traits in Cherry tomato

S. No	Crosses	Juice to pulp ratio					
		E ₁		E ₂		Pooled	
		C ₁	C ₂	C ₁	C ₂	C ₁	C ₂
1	Sun Cherry x WIR - 5032	-21.86 **	-28.52 **	-4.57 **	-6.70 **	-14.69 **	-19.82 **
2	Sun Cherry x EC – 520074	-28.74 **	-34.81 **	24.57 **	21.79 **	-6.64 **	-12.25 **
3	Sun Cherry x EC – 914115	-38.87 **	-44.07 **	8.57 **	6.15 **	-19.19 **	-24.05 **
4	Sun Cherry x EC – 165690	-50.61 **	-54.81 **	8.00 **	5.59 **	-26.30 **	-30.73 **
5	Sun Cherry x EC – 914092	-19.03 **	-25.93 **	-1.71 **	-3.91 **	-11.85 **	-17.15 **
6	Sun Cherry x EC – 520078	-14.17 **	-21.48 **	13.71 **	11.17 **	-2.61 **	-8.46 **
7	Sun Cherry x WIR – 3957	20.24 **	10.00 **	-9.71 **	-11.73 **	7.82 **	1.34 **
8	Sun Cherry x EC – 914097	54.25 **	41.11 **	-10.29 **	-12.29 **	27.49 **	19.82 **
9	Sun Cherry x VRT - 02	-21.46 **	-28.15 **	17.14 **	14.53 **	-5.45 **	-11.14 **
10	WIR – 5032 x EC – 520074	71.66 **	-44.07 **	-1.14 **	-3.35 **	41.47 **	32.96 **
11	WIR – 5032 x EC – 914115	4.86 **	-4.07 **	41.71 **	38.55 **	20.14 **	12.92 **
12	WIR – 5032 x EC – 165690	-21.46 **	-28.15 **	32.00 **	29.05 **	0.71 **	-5.35 **
13	WIR – 5032 x EC – 914092	49.80 **	37.04 **	34.86 **	31.84 **	43.60 **	34.97 **
14	WIR – 5032 x EC – 520078	-17.00 **	-24.07 **	-5.71 **	-7.82 **	-12.32 **	-17.59 **
15	WIR – 5032 x WIR – 3957	40.89 **	28.89 **	-0.57 **	-2.79 **	23.70 **	16.26 **
16	WIR – 5032 x EC – 914097	-17.00 **	-24.07 **	6.86 **	4.47 **	-7.11 **	-12.69 **
17	WIR – 5032 x VRT - 02	-15.79 **	-22.96 **	40.00 **	36.87 **	7.35 **	0.89 **
18	EC- 520074 x EC – 914115	26.72 **	-28.52 **	24.00 **	21.23 **	25.59 **	18.04 **
19	EC- 520074 x EC – 165690	-40.89 **	-34.81 **	-9.71 **	-11.73 **	-27.96 **	-32.2 **
20	EC- 520074 x EC – 914092	87.04 **	57.04 **	25.14 **	22.35 **	61.37 **	51.67 **
21	EC- 520074 x EC – 520078	-21.86 **	-28.52 **	-10.86 **	-12.85 **	-17.30 **	-22.27 **
22	EC- 520074 x WIR - 3957	26.72 **	15.93 **	-7.43 **	-9.50 **	12.56 **	5.79 **
23	EC- 520074 x EC – 914097	3.64 **	-5.19 **	-5.14 **	-7.26 **	0.00	-6.01 **
24	EC- 520074 x VRT - 02	8.10 **	-1.11 **	3.43 **	1.12 **	6.16 **	-0.22 **
25	EC- 914115 x EC – 165690	-16.60 **	-23.70 **	0.57 **	-1.68 **	-9.48 **	-14.92 **
26	EC- 914115 x EC – 914092	6.48 **	-2.59 **	-4.00 **	-6.15 **	2.13 **	-4.01 **
27	EC- 914115 x EC – 520078	-15.38 **	-22.59 **	-0.57 **	-2.79 **	-9.24 **	-14.70 **
28	EC- 914115 x WIR – 3957	2.02 **	-6.67 **	-6.29 **	-8.38 **	-1.42 **	-7.35 **

29	EC-914115 x EC-914097	61.94 **	48.15 **	0.57 **	-1.68 **	36.49 **	28.29 **
30	EC-914115 x VRT-02	-13.36 **	-20.74 **	-9.71 **	-11.73 **	-11.85 **	-17.15 **
31	EC-165690 x EC-914092	-7.29 **	-15.19 **	9.14 **	6.70 **	-0.47 **	-6.46 **
32	EC-165690 x EC-520078	-22.67 **	-29.26 **	-7.43 **	-9.50 **	-16.35 **	-21.38 **
33	EC-165690 x WIR-3957	-13.77 **	-21.11 **	-12.00 **	-13.97 **	-13.03 **	-18.26 **
34	EC-165690 x EC-914097	0.40 **	-8.15 **	-3.43 **	-5.59 **	-1.18 **	-7.13 **
35	EC-165690 x VRT-02	12.55 **	2.96 **	21.14 **	18.44 **	16.11 **	9.13 **
36	EC-914092 x EC-520078	29.15 **	18.15 **	-13.14 **	-15.08 **	11.61 **	4.90 **
37	EC-914092 x WIR-3957	9.31 **	-0.00	-2.86 **	-5.03 **	4.27 **	-2.00 **
38	EC-914092 x EC-914097	57.89 **	44.44 **	-7.43 **	-9.50 **	30.81 **	22.94 **
39	EC-914092 x VRT-02	-36.44 **	-41.85 **	-8.57 **	-10.61 **	-24.88 **	-29.40 **
40	EC-520078 x WIR-3957	-6.07 **	-14.07 **	13.71 **	11.17 **	2.13 **	-4.01 **
41	EC-520078 x EC-914097	-15.38 **	-22.59 **	38.29 **	35.20 **	6.87 **	0.45 **
42	EC-520078 x VRT-02	42.51 **	30.37 **	8.00 **	5.59 **	28.20 **	20.49 **
43	WIR-3957 x EC-914097	-30.36 **	-36.30 **	3.43 **	1.12 **	-16.35 **	-21.38 **
44	WIR-3957 x VRT-02	-18.22 **	-25.19 **	-4.00 **	-6.15 **	-12.32 **	-17.59 **
45	EC-914097 x VRT-02	-16.19 **	-23.33 **	-10.29 **	-12.29 **	-13.74 **	-18.93 **
Range	Min	-50.61 **	-54.81 **	-13.14 **	-15.08 **	-27.96 **	-32.29 **
	Max	87.04 **	57.04 **	41.71 **	38.55 **	61.37 **	51.67 **

*, ** Significant at 5 and 1 per cent levels, respectively

Conclusion

From this study, it is concluded that cross EC-914092 x EC-914097 and Sun Cherry x EC-914097 in E₁; cross WIR-5032 x VRT-02 and EC-914092 x EC-914097 in E₂ and cross Sun Cherry x EC-914097 and EC-914092 x EC-914097 in pooled data analysis exhibited significant and desirable heterosis for most of the traits. Hence, these could be used to develop a hybrid which can have maximum number of desirable traits, keeping the quality as primary concern.

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