



Evaluation of Performance for the Quantitative Traits in Tomato (*Solanum lycopersicon* L.) Over Seasons

Shalu Yadav^{a#*} and G. C. Yadav^{a†}

^a Department of Vegetable Science, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture and Technology Kumarganj, Ayodhya, Uttar Pradesh (224229), India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i32771

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/97100>

Original Research Article

Received: 20/12/2022

Accepted: 25/02/2023

Published: 28/02/2023

ABSTRACT

Present investigations were carried out in tomato to assess the mean performance, general mean and range for nineteen quantitative characters. Forty-five tomato hybrids were generated by crossing ten parents in randomized complete block design with three replications at the Main Experiment Station, Department of Vegetable Science, ANDUA&T, Kumarganj, Ayodhya, during winter (*Rabi*) season 2020-2021 and 2021-2022. The pooled estimates of mean performance for total fruit yield per plant varied from 2.35 to 3.24 kg for parents and 1.87 to 3.43 kg fruit for hybrids. The mean values over the parents and F_1 hybrids were 2.51 and 2.68 kg, respectively. The highest mean performance for most desirable traits fruit yield per plant was exhibited by P_6 (3.24 kg) followed by P_9 (3.23 kg), P_{10} (3.09 kg), P_5 (2.99 kg) and P_4 (2.81 kg) for the parent. Among the hybrids, the highest fruit yield per plant was exhibited by $P_2 \times P_5$ (3.43 kg) followed by $P_4 \times P_9$ (3.41 kg), $P_4 \times P_7$ (3.30 kg), $P_1 \times P_5$ (3.22 kg) and $P_4 \times P_8$ (3.20 kg) in descending order.

Research Scholar;

† Professor;

*Corresponding author: E-mail: Yshalu697@gmail.com, yshalu697@outlook.com;

Keywords: Mean performance; mean value; tomato.

1. INTRODUCTION

A significant impact of globalization on horticulture has been an increasing demand for quality improvement and the wider adoption of quality standards for fruit, vegetable, and salad commodities. Tomato is used as a vegetable worldwide. It is a very popular and important vegetable in the world. Tomato (*Solanum lycopersicum* L.) is a member of the Solanaceae family. Its chromosome no is $2n=2x=24$. Tomato probably originated in Peru-Ecuador region [1]. All the species of tomato are native to Western Southern America [2]. It is grown worldwide under outdoor and indoor conditions. It has become an important commercial crop so far as the area, production, industrial values, and contribution to human nutrition are concerned. Tomato is known as protective food because of its special nutritive value and also for its high level of antioxidants. Tomatoes contain many health-promoting compounds and are easily integrated as a nutritious part of a balanced diet [3]. Tomato is one of the most popular and widely grown vegetable crops of the world next to potatoes. In the world, it ranks is the first among of all canned vegetables [4]. The genus *Solanum* consists of annual or short-lived perennial herbaceous, typical day-neutral plants and warm-season crops. Tomato fruit is eaten raw or cooked called "Protective Food" which is being extensively grown as an annual plant all over the world. Tomato in large quantities is used to produce several items like, juice, ketchup, paste, syrup, puree and drinks etc. It is rich in beta-carotene, folate, vitamin A, vitamin C, vitamin E, flavonoids, potassium and other minerals. Overall, tomatoes provide approximately 20 mg of vitamin 'C' per 100 grams of edible part. Vitamin C is considered an excellent antioxidant because it donates electrons to enzymes or other compounds that are oxidants. The red color of the tomato is due to the presence of lycopene. India ranks second in terms of the production of tomatoes after China. In India, the leading tomato-growing states are, Andhra Pradesh, Madhya Pradesh, Karnataka, West Bengal, Maharashtra, U.P., Haryana, Punjab, Gujarat and Bihar. The total area covered under tomato cultivation is 0.85 Mha with the production of 21.001 MT and its productivity is 25.34 tonnes per ha (NHB database, 2020). The mean performance of genotypes may be used as donor parents in the hybridization programme for developing high-yielding varieties of respective

groups. Some other genotypes exhibiting very high mean performance for characters other than fruit yield per plant may also be used for transferring these traits. These lines merits due consideration as promising parents for the hybridization programme for bringing overall improvement in plant genetic architecture in a component breeding approach ultimately leading to high yielding and high-quality bottle gourd genotypes even if they have moderate or low fruit yield. Keeping in view the above facts the present investigation was conducted to find out the stable genotype of bottle gourd for improvement in the future.

2. MATERIALS AND METHODS

The present research work was conducted during winter, (*Rabi*) seasons of 2020 (Y_1) and 2021 (Y_2) to study the mean performance, general mean and range for nineteen characters using diallel mating design at the Main Experiment Station (MES) of the Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Ayodhya (U.P.) India. The observations were recorded on nineteen characters. The experimental materials for the present investigation comprised nineteen promising and diverse inbred lines/varieties of tomato selected based on genetic variability from the germplasm stock maintained in the Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) India. The selected parental lines *i.e.*; 2013/TODVAR-2, NDT-2, NDT-Sel-1, NDT-5, NDT-7, NDT-4, NDT-P-1, NDT-6, NDT-6-2-1, NDT-Sel-2. to get 45 F_1 seed. Each hybrids and parents were grown in rows spaced 0.60 meters apart with a spacing of 0.50 meter. All the recommended agronomic package of practices and protection measures were followed to raise good crops. Observations were recorded on days to 50% flowering, days to first fruit harvest, plant height (cm), number of primary branches per plant, number of fruits per cluster, number of fruits per plant, average fruit weight (g), pericarp thickness (mm), number of locules per fruit, polar diameter (cm), equatorial diameter (cm), marketable fruit yield per plant (kg), total soluble solids (TSS), titrable acidity (%), ascorbic acid content (mg/100g) Reducing sugar (mg/100g). none - reducing sugar (mg/100g). total sugar (mg/100g) and total fruit yield per plant (kg). The mean data

of each character was subjected to statistical analysis for variance and tests the significance of each character as per the procedure of Panse and Sukhatme [5].

3. RESULTS AND DISCUSSION

Mean performance, general mean, range, coefficient of variation, critical difference, and standard error for nineteen characters 45 F₁'s and their 10 parents (Y₁=2020 and Y₂=2021) and pooled had been presented in Table 1. The highest mean performance for the most desirable traits total fruit yield per plant was exhibited by P₄(3.01 kg) followed by P₉(2.84 kg), P₇(2.83 kg), P₃(2.80) and P₁₀(2.62 kg) in Y₁, P₄(3.45 kg) exhibited highest fruit yield per plant followed by P₃(2.97 kg), P₉(2.89 kg), P₁(2.86) and P₇ 2.83 kg) in Y₂ and P₆(3.24 kg) exhibited highest fruit yield per plant followed by P₉(3.23 kg), P₁₀(3.09 kg), P₅(2.99 kg) and P₄(2.81 kg) in pooled.

The above- mentioned genotypes may be used as donor parents in the hybridization programme for developing high - yielding varieties of respective groups. Some other genotypes exhibiting very high mean performance for characters other than fruit yield per plant are also listed in Table 1. These lines merits due consideration as promising parents for the hybridization programme for bringing overall improvement in plant genetic architecture in a component breeding approach ultimately leading to high- yielding and high- quality tomato genotypes even if they have moderate or low fruit yield.

3.1 Days to Fifty Present Flowering

The most desirable parents were P₁₀(31.66 days) which showed earliness for days to fifty present flowering among the parents which was followed by P₁₀(34.66 days), P₁(35.00 days), P₅(38.66 days) and P₃(39.00 days) in Y₁, Parent P₆(31.33 days) followed by P₄(34.00 days), P₁₀(35.78 days) and P₁(36.12days) in Y₂ and Parent P₆(31.11 days) followed by P₅(31.77 days), P₄(32.00 days) and P₃(33.60 days) in pooled.

3.2 Days to First Harvest

Among the parents days to first fruit harvest were observed in P₆(83.00 days) followed by P₅(84.66 days), P₇(87.33 days) and P₄(89.66 days) in Y₁, P₆(80.00 days) followed by P₅(82.67), P₇(89.67

days) and P₉(90.62 days) in Y₂ and P₆(78.98 days) followed by and P₇(79.66 days), P₈(82.06 days) and P₂(83.32days) in pooled.

3.3 Plant Height (cm)

Highest plant height (cm) was recorded in parent P₁₀(119.58 cm) followed by P₃(114.84 cm), P₇(113.73cm) , P₃(114.84 cm) and P₇(113.73cm) in Y₁, P₇(120.65 cm) followed by P₃(115.67 cm), P₆(113.87cm), P₁₀(111.12cm)and P₉(110.00 cm) in Y₂ and P₇(120.09 cm) followed by P₆(116.80cm), P₃(114.35 cm), P₄(114.29 cm) and P₁₀(112.77 cm) in pooled.

3.4 Number of Primary Branches per Plant

Highest primary branches per plant among the parents was recorded in P₅(6.36 branches) followed by P₇(6.15 branches), P₂(5.36 branches), P₉(5.28 branches) And P₆(5.22 branches) in Y₁, P₅(6.98 branches) followed by P₇(6.89 branches), P₂(6.67 branches) P₉(6.33 branches) in Y₂ and P₅(6.67branches) followed by P₄(6.60 branches),P₃(6.58branches) and P₆(6.45 branches) in pooled; maximum number of fruit per cluster among the parents was observed in P₃(5.16) followed by P₆(4.45), P₁₀(4.19), P₄(3.97) and P₂(3.81) in Y₁, P₃(5.67) followed by P₅(5.00), P₁(4.69), P₁₀(4.32) and P₄(4.12) in Y₂ and P₅(4.90) followed by P₃(4.56), P₆(4.34) and P₉(4.20 m) in pooled.

3.5 Number of Fruit per Plant

Maximum number of fruit per plant was found in P₉(35.30), followed by P₄(33.62), P₆(31.26), P₁₀(30.33), and P₅(28.62) in Y₁, P₉(36.34) followed by P₄(35.89), P₃(33.87), P₇(32.78) and P₆(32.67) in Y₂ and P₆(36.52) was found for maximum number of fruit per plant among the parents which was followed by P₉(36.28), P₃(33.68), P₄(32.63) and P₁₀(30.03) in pooled.

3.6 Average Fruit Weight (g)

Maximum average fruit weight was observed in parent P₁(79.02g) followed by (76.13g), P₄(75.01 g), P₆(73.16g) and P₁₀(71.54 g) in Y₁, P₁(85.40g) followed by P₉(81.67g), P₃(78.86 g), P₄(75.45g) and P₆(74.76g) in Y₂ and P₆(78.41g) followed by P₃(77.89 g),P₁(76.09g), P₉(76.75g) and P₁₀(73.04g) in pooled.

Table 1. Mean performance, general mean, range, coefficient of variation, critical difference and standard error for nineteen characters of a diallel set of 45 F₁'s and their 10 parents (Y1=2020 -2021and Y2=2021-2022) and pooled

Genotypes	Days to 50% flowering			Days to first fruit harvest			Plant height (cm)			Primary branches per plant		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
P ₁	35.00	36.12	33.33	90.67	91.07	86.83	81.13	82.77	95.03	4.74	5.56	4.98
P ₂	41.33	42.00	37.50	93.00	94.23	83.32	94.78	95.78	105.27	5.36	6.67	6.12
P ₃	39.33	40.23	33.60	89.00	90.00	86.66	114.84	115.67	114.35	6.04	7.07	6.58
P ₄	33.00	34.00	32.00	89.66	89.13	83.83	108.03	110.03	114.29	5.23	5.44	6.49
P ₅	38.66	40.44	31.77	84.66	82.67	83.10	73.09	74.87	96.76	6.36	6.98	6.67
P ₆	31.66	31.36	31.11	83.66	80.54	78.98	108.93	113.87	116.80	5.22	6.79	6.45
P ₇	40.33	41.56	41.16	87.33	89.01	79.66	113.73	120.65	120.05	6.15	6.89	5.91
P ₈	38.00	39.00	40.39	87.33	89.00	82.06	91.56	90.77	93.50	4.97	5.89	4.94
P ₉	40.33	41.76	41.61	89.00	90.62	87.98	86.87	90.53	102.21	5.28	6.33	5.92
P ₁₀	34.66	35.78	38.77	90.33	92.67	102.21	119.5	111.67	112.77	4.78	5.69	5.48
P ₁ ×P ₂	32.00	34.00	34.06	84.00	85.90	87.53	86.01	87.67	84.39	5.10	6.90	5.33
P ₁ ×P ₃	31.00	32.56	32.50	72.00	70.67	78.95	95.97	96.79	91.81	5.60	6.75	6.24
P ₁ ×P ₄	29.33	31.78	30.94	81.00	78.78	75.83	104.37	110.78	100.58	4.38	5.98	5.56
P ₁ ×P ₅	35.33	36.56	33.55	84.67	85.89	81.72	100.34	103.85	105.55	6.45	7.65	6.21
P ₁ ×P ₆	33.33	35.00	34.94	75.33	76.56	80.61	114.74	117.89	109.29	5.12	5.56	6.38
P ₁ ×P ₇	30.00	28.56	32.50	87.33	88.45	81.94	107.75	108.89	112.82	4.27	5.87	4.91
P ₁ ×P ₈	33.33	34.67	30.94	75.33	78.45	81.89	84.90	82.90	96.89	5.58	6.70	5.72
P ₁ ×P ₉	28.00	26.21	31.33	87.00	87.85	82.72	91.64	90.67	87.26	6.48	7.45	6.59
P ₁ ×P ₁₀	31.33	33.67	28.77	71.67	73.65	79.75	114.42	115.76	102.54	5.28	6.89	6.36
P ₂ ×P ₃	30.33	31.97	36.16	88.00	98.45	91.11	115.06	116.76	105.42	6.07	6.66	6.37
P ₂ ×P ₄	30.00	31.89	30.98	83.33	76.98	90.89	104.35	108.56	110.55	7.12	8.56	6.89
P ₂ ×P ₅	30.00	32.87	30.94	74.00	75.67	75.49	93.33	93.98	100.94	5.00	6.07	6.78
P ₂ ×P ₆	26.33	24.87	29.60	72.00	68.11	73.83	109.77	110.67	101.87	5.13	5.87	5.60
P ₂ ×P ₇	25.00	25.78	24.93	74.33	75.78	71.22	111.04	112.56	110.85	6.22	6.54	6.04
P ₂ ×P ₈	34.67	35.00	30.22	86.00	80.67	80.89	86.35	85.98	99.45	5.96	6.32	6.25
P ₂ ×P ₉	30.67	31.78	32.83	90.00	93.89	85.33	91.27	92.76	88.62	7.30	7.86	6.81
P ₂ ×P ₁₀	26.00	27.87	28.89	82.67	84.34	88.27	112.08	113.86	102.42	6.40	7.12	7.13
P ₃ ×P ₄	24.00	22.89	32.11	81.67	83.89	85.83	117.30	120.67	116.48	5.63	6.32	6.35
P ₃ ×P ₅	28.00	27.13	25.44	85.33	79.67	84.61	118.52	125.78	119.59	6.27	7.59	6.29
P ₃ ×P ₆	31.67	32.97	29.39	85.33	81.87	82.50	117.78	121.65	121.77	5.41	5.98	6.50

Genotypes	Days to 50% flowering			Days to first fruit harvest			Plant height (cm)			Primary branches per plant			
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	
P ₃ ×P ₇	32.00	33.67	32.48	84.67	80.54	83.26	129.30	130.45	125.47	5.56	5.43	5.77	
P ₃ ×P ₈	31.33	32.00	32.50	87.33	84.56	83.93	123.20	128.67	126.82	7.12	8.56	6.27	
P ₃ ×P ₉	27.00	28.57	29.50	86.67	79.78	85.61	106.25	108.45	117.45	5.55	6.57	7.05	
P ₃ ×P ₁₀	30.00	31.00	29.28	75.00	78.01	77.39	124.71	120.56	116.57	6.63	7.76	6.60	
P ₄ ×P ₅	26.33	28.78	30.16	85.33	86.98	87.23	116.00	117.56	113.00	4.67	6.56	5.06	
P ₄ ×P ₆	25.33	26.89	27.05	72.33	72.89	79.65	118.08	119.56	117.82	4.61	4.99	5.58	
P ₄ ×P ₇	28.00	29.00	27.44	88.00	89.45	80.44	116.30	117.56	117.93	4.74	5.87	4.86	
P ₄ ×P ₈	41.00	42.76	35.00	84.67	84.78	87.05	105.78	108.53	111.66	5.15	7.56	5.51	
P ₄ ×P ₉	37.67	38.56	40.21	90.33	91.52	87.55	90.20	95.45	99.36	5.42	7.67	6.48	
P ₄ ×P ₁₀	27.33	24.89	32.94	86.00	81.54	88.76	118.86	120.45	107.15	4.48	6.98	6.07	
P ₅ ×P ₆	31.67	32.21	36.05	91.00	92.56	86.83	115.44	117.56	95.15	4.51	4.99	5.75	
P ₅ ×P ₇	28.00	29.56	30.10	88.00	89.56	90.28	105.39	105.96	111.47	4.34	4.98	4.66	
P ₅ ×P ₈	40.67	42.67	35.11	86.67	87.46	88.11	84.64	90.34	95.30	4.48	4.43	4.73	
P ₅ ×P ₉	29.00	32.56	35.83	87.00	88.76	87.22	89.08	90.67	89.70	7.26	7.67	5.84	
P ₅ ×P ₁₀	32.67	30.56	32.61	73.33	74.97	81.04	118.19	124.67	104.42	6.71	7.69	7.18	
P ₆ ×P ₇	33.00	33.67	32.16	73.00	68.78	76.77	117.45	118.34	115.66	5.60	6.98	6.19	
P ₆ ×P ₈	37.00	37.89	35.33	94.33	95.78	81.55	114.12	115.47	116.22	5.97	6.97	6.47	
P ₆ ×P ₉	36.67	37.35	37.27	81.00	82.67	88.39	83.75	84.45	99.61	6.54	7.98	6.75	
P ₆ ×P ₁₀	41.00	42.00	39.17	71.67	72.00	77.16	123.60	126.45	104.02	4.52	5.67	6.25	
P ₇ ×P ₈	40.33	25.90	34.44	88.67	89.47	88.84	109.41	117.56	115.03	5.56	6.98	6.22	
P ₇ ×P ₉	29.00	30.67	27.45	72.33	73.67	80.90	111.67	108.53	114.61	6.26	7.56	6.62	
P ₇ ×P ₁₀	41.00	42.78	35.83	75.33	76.79	74.50	116.82	95.45	112.67	5.62	4.89	6.59	
P ₈ ×P ₉	39.33	40.14	39.16	87.00	88.62	88.00	85.19	120.45	87.98	6.48	6.50	6.18	
P ₈ ×P ₁₀	41.33	42.89	40.73	91.66	86.98	90.14	114.77	117.56	117.61	5.96	6.56	6.23	
P ₉ ×P ₁₀	41.00	42.89	41.38	87.00	88.56	88.81	110.03	105.96	100.28	6.16	6.18	6.25	
Mean	32.86	33.82	33.30	83.51	83.66	83.49	105.77	107.85	106.78	5.61	6.58	6.09	
C.V.	7.73	6.49	12.65	6.59	5.47	8.41	6.55	5.12	10.50	11.54	8.76	14.43	
S.E. m ±	1.46	1.27	1.72	3.17	2.64	2.86	4.01	3.19	4.58	0.37	0.33	0.35	
C.D.@ 5%	4.10	3.55	4.79	8.91	7.41	7.98	11.23	8.93	12.753	1.05	0.93	0.99	
Range	Lowest	24.00	22.89	24.93	71.66	68.11	71.22	74.87	74.87	84.39	4.43	4.43	4.66
	highest	41.33	42.89	41.61	94.33	98.45	91.11	130.45	130.45	126.82	8.56	8.55	7.18

Genotypes	Fruit per cluster			No: of fruit per plant			Average fruit weight (g)			Pericarp thickness (mm)		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
P ₁	4.55	4.69	4.23	26.44	27.78	28.85	79.02	85.40	76.09	4.63	4.78	4.65
P ₂	3.81	3.87	3.91	24.81	26.56	27.39	68.25	70.67	71.01	3.78	3.86	3.82
P ₃	5.16	5.67	4.56	32.59	33.87	33.68	76.13	78.86	77.89	4.59	4.87	4.58
P ₄	3.97	4.12	3.48	33.62	35.89	32.63	75.01	75.45	71.28	5.09	5.67	5.49
P ₅	4.13	5.03	4.90	28.59	29.98	32.02	60.58	64.35	68.67	4.72	4.32	4.23
P ₆	3.91	4.12	4.34	31.26	32.77	36.52	73.16	74.67	78.41	4.67	4.77	4.72
P ₇	3.88	3.88	3.80	20.83	32.78	27.25	64.93	68.90	74.90	3.81	3.97	4.28
P ₈	3.91	3.91	3.75	27.37	28.98	29.02	78.54	79.33	76.75	4.81	4.83	4.31
P ₉	3.53	3.66	4.20	35.03	38.34	36.28	67.36	81.67	70.03	5.25	5.67	4.93
P ₁₀	4.19	4.32	3.93	30.33	22.86	30.00	71.54	74.87	73.04	4.58	4.45	4.96
P ₁ ×P ₂	4.52	4.78	4.61	34.04	37.45	30.91	64.84	69.97	75.12	4.44	4.78	4.60
P ₁ ×P ₃	3.39	3.67	4.08	27.23	31.78	32.34	66.27	71.97	68.11	4.64	4.83	4.71
P ₁ ×P ₄	3.71	4.72	3.68	26.78	34.23	29.28	72.85	77.34	72.41	4.53	4.59	4.68
P ₁ ×P ₅	4.29	4.29	4.50	25.29	29.00	29.75	82.74	85.76	80.03	4.80	4.98	4.69
P ₁ ×P ₆	4.27	4.76	4.27	25.60	27.89	27.30	81.33	84.87	83.54	5.27	5.55	5.12
P ₁ ×P ₇	4.67	4.65	4.71	35.79	32.89	31.83	75.01	76.54	79.93	4.85	4.87	5.20
P ₁ ×P ₈	3.69	3.98	4.17	30.47	35.89	31.68	78.33	82.76	77.43	3.63	4.12	4.24
P ₁ ×P ₉	4.54	4.87	4.26	31.78	33.87	33.83	82.46	85.76	82.61	4.58	4.56	4.35
P ₁ ×P ₁₀	3.89	3.99	4.38	26.93	29.98	30.40	72.83	73.78	79.29	3.68	3.87	4.12
P ₂ ×P ₃	4.59	4.76	4.23	25.49	28.12	26.02	82.49	80.56	76.58	4.75	4.97	4.30
P ₂ ×P ₄	3.57	4.56	4.16	29.49	33.45	28.80	75.90	80.56	78.23	4.67	4.77	4.82
P ₂ ×P ₅	3.60	3.60	4.08	26.91	28.65	30.18	77.47	79.54	79.01	4.67	4.65	4.72
P ₂ ×P ₆	3.74	3.86	3.67	26.59	29.56	27.61	76.24	76.32	77.89	3.83	4.56	4.23
P ₂ ×P ₇	3.62	3.56	3.73	32.93	27.45	31.24	69.87	70.54	73.09	4.53	4.68	4.54
P ₂ ×P ₈	3.37	3.65	3.46	28.89	30.34	28.17	83.60	87.56	77.06	4.66	4.88	4.67
P ₂ ×P ₉	4.63	4.76	4.13	29.52	31.56	29.93	71.49	76.43	79.52	4.83	4.97	4.85
P ₂ ×P ₁₀	3.96	3.97	4.36	33.52	34.78	32.54	76.85	79.65	76.64	4.48	4.58	4.72
P ₃ ×P ₄	4.49	4.50	5.08	32.37	33.78	33.12	66.17	69.54	72.51	4.65	4.65	4.76
P ₃ ×P ₅	3.45	4.87	3.97	33.42	39.67	33.60	65.56	71.87	67.55	3.83	3.95	4.24
P ₃ ×P ₆	3.70	4.12	4.28	31.23	34.67	35.45	63.52	66.56	67.69	4.67	4.78	4.31
P ₃ ×P ₇	3.67	3.65	3.89	27.93	29.56	31.29	67.52	70.67	67.03	4.83	4.83	4.80
P ₃ ×P ₈	3.86	4.65	3.75	31.03	34.67	30.29	83.33	85.45	77.00	5.46	5.76	5.14
P ₃ ×P ₉	4.52	4.57	4.58	32.90	35.54	33.78	82.83	83.43	84.14	5.60	5.87	5.68

Genotypes	Fruit per cluster			No: of fruit per plant			Average fruit weight (g)			Pericarp thickness (mm)			
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	
P ₃ ×P ₁₀	2.67	2.99	3.62	28.49	31.65	32.01	64.85	67.56	74.14	4.45	5.89	5.16	
P ₄ ×P ₅	3.56	3.87	3.84	27.51	29.67	31.70	79.36	83.32	77.40	4.40	4.56	5.03	
P ₄ ×P ₆	3.72	3.79	3.79	35.46	37.45	32.56	74.26	75.78	78.78	4.82	4.34	4.68	
P ₄ ×P ₇	3.60	3.87	3.69	28.15	30.56	32.80	75.02	77.56	75.40	3.68	3.35	4.01	
P ₄ ×P ₈	3.64	4.34	3.75	29.28	37.56	29.92	74.90	79.76	76.23	4.53	4.42	3.93	
P ₄ ×P ₉	3.63	4.53	3.98	26.18	31.87	31.87	76.04	78.56	77.90	4.50	4.32	4.46	
P ₄ ×P ₁₀	4.59	5.67	4.56	30.97	35.45	31.41	73.92	76.76	76.24	3.59	3.76	3.95	
P ₅ ×P ₆	4.14	4.87	4.57	25.23	29.56	27.60	71.98	73.89	68.16	4.90	4.83	4.61	
P ₅ ×P ₇	4.65	4.48	4.76	30.60	32.45	30.07	71.30	71.98	72.59	5.13	5.65	4.97	
P ₅ ×P ₈	5.29	5.23	4.88	26.74	30.56	29.59	75.00	76.67	73.49	3.85	3.92	4.75	
P ₅ ×P ₉	4.74	4.78	4.98	31.89	27.56	31.22	80.92	84.65	78.79	4.68	4.76	4.29	
P ₅ ×P ₁₀	4.71	4.78	4.74	34.45	41.78	31.00	78.04	83.67	81.34	4.66	4.78	4.71	
P ₆ ×P ₇	3.78	3.97	3.94	31.41	34.67	32.09	78.90	80.08	76.78	5.16	5.69	4.96	
P ₆ ×P ₈	4.25	4.35	4.11	33.49	35.67	34.07	82.81	84.78	81.44	4.77	4.81	5.23	
P ₆ ×P ₉	3.67	3.67	4.01	34.34	36.56	35.00	73.14	74.84	78.96	3.77	3.89	4.28	
P ₆ ×P ₁₀	3.65	3.73	3.66	31.60	33.67	34.07	80.73	84.87	77.78	4.59	4.75	4.24	
P ₇ ×P ₈	4.61	4.65	4.25	32.93	30.56	32.85	72.70	75.87	70.84	4.93	4.94	4.45	
P ₇ ×P ₉	3.44	4.21	4.04	33.20	33.67	31.88	70.96	73.98	73.41	4.76	4.87	4.85	
P ₇ ×P ₁₀	3.59	3.60	3.90	29.67	30.67	31.68	71.90	74.98	72.94	3.70	3.83	4.28	
P ₈ ×P ₉	4.37	4.67	4.14	30.48	30.56	29.73	73.65	77.85	76.49	4.67	4.78	4.75	
P ₈ ×P ₁₀	4.40	4.87	4.5367	32.86	37.56	31.71	68.35	72.65	73.10	4.63	4.62	4.70	
P ₉ ×P ₁₀	3.96	3.67	3.8133	27.36	29.67	32.85	75.90	74.56	78.63	5.15	5.35	5.41	
Mean	4.02	4.30	4.1613	29.98	32.44	31.28	74.15	77.21	75.66	4.56	4.72	4.64	
C.V.	8.51	7.48	11.75	7.11	6.20	10.32	6.42	5.64	7.89	7.33	8.39	10.74	
S.E. m ±	0.19	0.19	0.199	1.23	1.16	1.31	2.75	2.51	2.43	0.19	0.23	0.20	
C.D.@ 5%	0.55	0.52	0.55	3.45	3.25	3.67	7.71	7.04	6.78	0.54	0.64	0.56	
Range	Lowest	2.99	2.99	3.46	22.87	22.86	26.02	64.35	64.35	67.03	3.35	3.35	3.82
	highest	5.67	5.67	5.08	41.78	41.78	36.52	87.56	87.56	84.14	5.89	5.88	5.68

Genotypes	Number of Locules per fruit			Polar diameter of fruit(cm)			Equatorial diameter of fruit (cm)			Marketable fruit yields per plant (kg)		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
P ₁	4.63	4.64	4.57	4.83	4.96	5.14	7.57	7.76	7.83	2.53	2.73	2.34
P ₂	5.43	5.43	5.15	5.25	5.75	4.97	7.96	7.99	7.70	1.88	2.35	2.27
P ₃	3.74	3.77	5.19	6.31	5.48	6.0	6.44	6.67	6.94	2.53	2.87	2.61
P ₄	6.06	4.97	5.74	4.80	4.82	4.47	6.47	6.70	6.71	2.08	2.88	2.25
P ₅	4.54	4.67	4.60	5.55	6.38	4.71	9.48	8.09	9.17	1.65	2.34	2.47
P ₆	4.51	6.14	4.69	5.45	5.55	6.16	8.06	8.45	8.97	2.16	2.29	2.91
P ₇	6.19	6.34	5.42	4.40	4.48	5.08	8.35	9.76	8.66	2.41	2.78	2.30
P ₈	2.98	3.34	3.91	6.34	6.78	5.61	9.48	9.49	8.67	1.65	1.30	2.15
P ₉	4.60	4.67	4.19	5.51	5.87	6.49	7.7	7.78	8.28	2.43	2.67	2.97
P ₁₀	5.05	5.67	5.01	3.99	4.23	5.22	5.40	5.36	6.58	2.24	2.70	2.86
P ₁ ×P ₂	4.50	4.70	4.57	4.67	4.84	4.81	7.33	7.87	7.54	2.15	2.40	2.44
P ₁ ×P ₃	4.75	4.73	4.72	5.64	5.70	5.23	7.46	7.46	7.66	2.13	2.43	2.26
P ₁ ×P ₄	4.67	4.87	4.70	6.31	6.34	6.00	8.31	8.45	7.88	2.14	3.70	2.28
P ₁ ×P ₅	6.67	6.67	5.76	5.25	4.89	5.79	9.43	8.90	8.94	1.46	1.89	2.58
P ₁ ×P ₆	4.60	4.98	5.63	4.86	4.86	4.87	6.71	6.87	7.80	1.16	1.65	1.52
P ₁ ×P ₇	5.05	5.45	5.01	5.81	5.87	5.33	8.12	8.78	7.49	2.86	2.21	2.25
P ₁ ×P ₈	5.68	5.32	5.56	6.48	6.48	6.17	7.08	7.87	7.93	1.62	2.45	1.91
P ₁ ×P ₉	4.66	4.64	4.99	5.75	5.83	6.11	6.78	6.65	7.32	2.56	2.77	2.50
P ₁ ×P ₁₀	4.66	4.87	4.65	4.63	4.70	5.23	7.79	7.45	7.22	1.94	2.67	2.35
P ₂ ×P ₃	4.56	4.76	4.99	5.49	5.75	5.62	7.31	7.76	7.64	1.54	1.87	1.94
P ₂ ×P ₄	3.75	3.87	4.25	3.86	3.97	4.80	6.85	6.97	7.30	2.36	3.89	2.11
P ₂ ×P ₅	4.64	4.98	4.25	6.41	6.48	5.18	8.19	8.23	7.57	1.55	2.45	2.72
P ₂ ×P ₆	4.71	4.81	4.84	5.71	5.77	6.09	7.57	7.23	7.89	2.52	3.34	2.48
P ₂ ×P ₇	5.42	5.67	5.11	5.74	5.34	5.75	7.50	7.55	7.36	2.57	2.21	2.95
P ₂ ×P ₈	4.74	4.89	5.20	4.94	5.12	5.13	6.53	6.54	7.04	1.98	2.15	2.09
P ₂ ×P ₉	4.52	4.61	4.70	6.66	6.69	5.88	7.52	7.65	7.03	2.69	2.70	2.42
P ₂ ×P ₁₀	6.52	6.65	5.56	5.64	5.70	6.16	7.63	7.45	7.63	2.51	2.70	2.60
P ₃ ×P ₄	4.55	4.87	4.16	5.58	5.87	5.52	8.84	8.86	7.75	1.86	2.43	2.36
P ₃ ×P ₅	4.62	4.32	4.74	4.53	4.59	5.20	8.50	8.87	8.68	2.82	2.90	2.62
P ₃ ×P ₆	4.47	4.75	4.39	5.60	5.68	5.09	8.59	8.72	8.73	2.29	2.21	2.59
P ₃ ×P ₇	3.49	3.54	4.12	5.54	5.97	5.61	7.60	7.70	8.16	1.43	1.56	1.82
P ₃ ×P ₈	4.57	4.21	4.05	4.90	4.97	5.43	7.56	7.78	7.63	2.87	3.43	2.21
P ₃ ×P ₉	4.57	4.65	4.39	5.67	5.78	5.31	7.50	7.78	7.64	2.43	2.56	2.92

Genotypes	Number of Locules per fruit			Polar diameter of fruit(cm)			Equatorial diameter of fruit (cm)			Marketable fruit yields per plant (kg)			
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	
P ₃ ×P ₁₀	5.29	5.43	4.97	3.74	4.14	4.76	6.60	6.95	7.19	1.96	2.43	2.26	
P ₄ ×P ₅	3.51	3.64	4.24	5.58	5.72	5.20	9.43	9.49	8.06	2.67	2.50	2.77	
P ₄ ×P ₆	3.80	3.89	3.71	6.77	6.89	6.24	9.44	9.34	9.46	2.93	3.56	2.71	
P ₄ ×P ₇	4.67	4.84	4.28	5.79	5.46	6.33	9.38	9.45	9.35	2.76	2.76	3.16	
P ₄ ×P ₈	4.41	4.53	4.62	4.72	4.96	5.08	8.51	8.67	8.98	2.93	4.24	2.84	
P ₄ ×P ₉	5.34	5.75	4.93	5.44	5.44	5.19	9.01	9.34	8.83	2.84	3.12	3.53	
P ₄ ×P ₁₀	4.61	4.67	5.18	3.56	3.87	4.50	8.68	8.87	9.01	2.95	3.30	3.03	
P ₅ ×P ₆	3.58	3.76	4.12	4.56	4.64	5.47	8.38	8.56	8.23	1.48	2.31	1.91	
P ₅ ×P ₇	5.52	5.34	4.64	5.50	5.89	5.06	8.96	8.45	8.76	1.48	1.48	1.89	
P ₅ ×P ₈	3.72	3.56	4.52	4.53	4.58	5.21	6.38	6.79	7.41	2.21	2.41	1.84	
P ₅ ×P ₉	4.70	4.79	4.13	5.64	5.87	5.10	8.62	8.87	7.70	1.80	1.80	2.10	
P ₅ ×P ₁₀	4.74	4.87	4.76	6.26	6.87	6.06	9.66	9.87	9.26	2.96	3.65	2.38	
P ₆ ×P ₇	6.34	6.38	6.24	5.64	5.85	5.59	8.18	8.97	8.31	2.60	2.70	2.44	
P ₆ ×P ₈	4.44	4.65	5.41	4.51	4.98	5.18	7.54	7.87	8.25	1.78	2.30	2.23	
P ₆ ×P ₉	5.31	5.75	4.97	5.57	5.60	5.27	7.48	7.87	7.67	2.83	3.32	2.56	
P ₆ ×P ₁₀	4.52	4.65	5.13	5.48	5.78	5.54	8.57	8.97	8.22	1.66	2.21	2.48	
P ₇ ×P ₈	4.55	4.21	5.44	4.61	4.87	4.54	7.98	7.34	8.87	2.54	3.45	2.65	
P ₇ ×P ₉	6.61	6.76	5.41	4.63	4.87	4.75	6.86	7.23	7.10	2.44	2.22	2.94	
P ₇ ×P ₁₀	4.43	4.84	5.59	4.56	4.89	4.71	7.53	7.86	7.38	2.73	2.65	2.47	
P ₈ ×P ₉	4.46	4.32	3.90	5.83	5.97	6.30	7.44	7.97	8.47	2.43	2.80	1.86	
P ₈ ×P ₁₀	3.67	3.78	3.99	7.03	7.48	6.50	8.48	8.87	8.22	3.32	3.51	3.06	
P ₉ ×P ₁₀	4.67	4.98	4.67	5.90	6.45	5.88	7.39	7.76	7.58	2.95	3.48	2.81	
Mean	4.74	4.87	4.79	5.34	5.50	5.43	7.89	8.05	7.99	2.27	2.65	2.45	
C.V.	8.23	8.09	14.86	6.44	7.67	12.75	6.26	6.17	9.48	11.24	10.96	21.02	
S.E.m ±	0.22	0.23	0.29	0.19	0.24	0.28	0.28	0.29	0.30	0.14	0.17	0.21	
C.D. @ 5%	0.63	0.64	0.81	0.55	0.68	0.78	0.79	0.80	0.86	0.41	0.47	0.58	
Range	Lowest	3.98	3.34	3.71	3.56	3.87	4.47	5.40	5.33	6.58	1.15	1.30	1.52
	highest	6.66	6.76	6.24	7.03	7.48	6.50	9.65	9.86	9.46	3.32	4.24	3.53

...

Genotypes	TSS			Titrable acidity %			Ascorbic acid content (mg/100g)			Reducing sugar (mg/100g)		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
P ₁	5.69	5.70	5.31	0.46	0.42	0.43	20.50	20.53	21.29	1.11	1.43	1.18
P ₂	4.83	4.83	4.76	0.36	0.35	0.42	21.77	21.85	19.25	1.31	1.33	1.57
P ₃	4.78	4.79	5.10	0.34	0.37	0.31	24.56	24.59	24.06	0.97	1.54	1.15
P ₄	4.84	5.62	5.09	0.38	0.38	0.36	19.79	19.96	21.34	1.10	1.76	1.13
P ₅	5.25	4.96	5.11	0.37	0.35	0.40	20.54	20.87	20.15	1.54	1.11	1.47
P ₆	4.93	4.85	5.33	0.40	0.34	0.38	22.10	22.56	23.31	1.24	1.50	1.29
P ₇	5.01	5.05	5.49	0.45	0.42	0.42	23.54	23.95	23.49	1.66	1.65	1.44
P ₈	5.62	4.97	5.24	0.43	0.40	0.37	21.99	22.32	20.38	1.52	1.40	1.43
P ₉	5.47	5.47	5.12	0.35	0.30	0.34	19.49	19.64	21.73	1.39	1.76	1.27
P ₁₀	4.76	4.90	5.05	0.37	0.35	0.35	21.38	21.85	20.80	1.61	0.49	1.51
P ₁ ×P ₂	5.03	5.12	5.36	0.40	0.37	0.4083	22.15	22.78	21.3417	1.24	1.34	1.33
P ₁ ×P ₃	4.60	4.60	4.86	0.38	0.32	0.3750	23.59	23.65	23.1867	1.74	1.84	1.54
P ₁ ×P ₄	4.49	4.50	4.54	0.42	0.40	0.3700	19.57	19.87	21.6117	1.34	1.72	1.59
P ₁ ×P ₅	5.11	5.43	4.80	0.36	0.36	0.3783	20.59	20.78	20.2300	1.24	1.54	1.47
P ₁ ×P ₆	5.22	5.12	5.32	0.38	0.39	0.3683	22.33	21.66	21.5533	1.46	1.56	1.50
P ₁ ×P ₇	5.07	5.07	5.09	0.39	0.35	0.39	23.71	23.97	22.68	1.11	1.75	1.33
P ₁ ×P ₈	5.18	5.87	5.12	0.42	0.45	0.38	24.59	24.67	24.27	1.55	1.70	1.65
P ₁ ×P ₉	4.80	4.80	5.33	0.36	0.32	0.40	21.25	21.45	22.96	1.39	1.40	1.54
P ₁ ×P ₁₀	4.69	4.70	4.74	0.45	0.48	0.38	16.41	16.74	18.93	1.83	1.84	1.61
P ₂ ×P ₃	4.67	4.69	4.75	0.44	0.41	0.39	22.24	22.12	22.04	1.08	1.23	1.20
P ₂ ×P ₄	4.70	4.71	4.69	0.43	0.38	0.42	23.56	23.76	22.84	1.24	1.32	1.23
P ₂ ×P ₅	5.63	5.69	5.16	0.35	0.35	0.36	24.44	24.87	24.10	1.22	1.28	1.27
P ₂ ×P ₆	5.01	5.02	5.35	0.48	0.42	0.41	22.80	22.65	23.83	1.53	1.48	1.40
P ₂ ×P ₇	5.05	5.07	5.03	0.43	0.47	0.42	19.66	19.98	21.15	1.17	1.21	1.32
P ₂ ×P ₈	5.47	5.34	5.27	0.35	0.35	0.40	23.44	23.74	21.71	1.17	1.20	1.19
P ₂ ×P ₉	5.09	5.06	5.21	0.36	0.33	0.35	23.87	23.95	23.80	1.84	1.87	1.52
P ₂ ×P ₁₀	5.21	5.43	5.13	0.35	0.29	0.34	23.07	23.56	23.51	1.30	1.33	1.58
P ₃ ×P ₄	4.83	5.21	4.80	0.45	0.44	0.41	23.19	23.65	23.89	1.21	1.25	1.37
P ₃ ×P ₅	4.59	4.50	4.89	0.34	0.35	0.39	20.49	20.64	22.07	1.26	1.29	1.25
P ₃ ×P ₆	4.70	4.78	4.60	0.51	0.55	0.43	23.08	23.32	21.85	1.36	1.39	1.32
P ₃ ×P ₇	5.33	5.54	5.05	0.43	0.44	0.49	18.99	19.43	21.15	1.34	1.37	1.36
P ₃ ×P ₈	5.81	5.89	5.67	0.47	0.39	0.45	19.71	20.23	19.56	1.45	1.49	1.40

Genotypes	TSS			Titrable acidity %			Ascorbic acid content (mg/100g)			Reducing sugar (mg/100g)		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
P ₃ ×P ₉	4.58	4.79	5.23	0.39	0.33	0.39	20.64	21.23	20.43	1.32	1.37	1.40
P ₃ ×P ₁₀	4.83	5.34	4.80	0.38	0.34	0.35	22.50	22.90	21.86	1.13	1.17	1.25
P ₄ ×P ₅	4.66	4.97	5.14	0.33	0.28	0.35	19.68	19.87	19.82	1.21	1.20	1.48
P ₄ ×P ₆	5.71	5.78	5.33	0.43	0.41	0.35	24.88	24.98	22.37	1.39	1.14	1.29
P ₄ ×P ₇	5.11	5.23	5.44	0.35	0.35	0.37	23.18	23.78	24.08	1.45	1.47	1.29
P ₄ ×P ₈	5.09	5.67	5.15	0.43	0.46	0.39	21.71	21.75	22.74	1.20	1.22	1.33
P ₄ ×P ₉	4.53	4.53	5.10	0.51	0.54	0.48	22.99	23.45	22.37	1.50	1.47	1.36
P ₄ ×P ₁₀	5.06	4.98	4.79	0.41	0.44	0.47	19.63	19.76	21.54	1.39	1.41	1.42
P ₅ ×P ₆	4.98	5.54	4.97	0.39	0.35	0.36	24.76	25.21	22.81	1.16	1.12	1.13
P ₅ ×P ₇	5.18	5.86	5.36	0.41	0.38	0.38	23.84	23.98	24.52	1.39	1.42	1.25
P ₅ ×P ₈	4.61	4.79	5.23	0.36	0.34	0.37	18.88	19.45	21.43	1.41	1.44	1.41
P ₅ ×P ₉	4.58	4.65	4.68	0.48	0.45	0.41	20.53	21.43	19.99	1.72	1.75	1.58
P ₅ ×P ₁₀	5.21	5.73	4.92	0.41	0.36	0.42	23.83	24.53	22.63	1.33	1.34	1.54
P ₆ ×P ₇	4.40	4.65	4.62	0.53	0.50	0.43	25.03	25.87	23.79	1.88	1.89	1.69
P ₆ ×P ₈	4.69	4.73	4.66	0.37	0.37	0.43	24.77	24.83	25.31	1.12	1.15	1.50
P ₆ ×P ₉	4.46	4.75	4.59	0.42	0.41	0.39	21.10	21.45	22.96	1.28	1.30	1.21
P ₆ ×P ₁₀	5.32	5.97	5.03	0.42	0.39	0.41	23.10	23.45	22.27	1.18	1.22	1.24
P ₇ ×P ₈	5.26	5.76	5.15	0.38	0.35	0.40	25.21	25.76	24.57	1.11	1.15	1.38
P ₇ ×P ₉	4.58	5.76	5.17	0.36	0.37	0.35	21.21	21.45	23.48	1.12	1.15	1.13
P ₇ ×P ₁₀	4.74	4.87	5.25	0.38	0.32	0.37	18.56	18.78	20.00	1.32	1.35	1.23
P ₈ ×P ₉	5.13	5.65	5.05	0.40	0.37	0.40	20.61	21.21	21.46	1.02	1.05	1.21
P ₈ ×P ₁₀	4.68	4.78	5.17	0.38	0.34	0.37	23.81	23.97	22.51	1.11	1.16	1.08
P ₉ ×P ₁₀	5.13	5.35	5.30	0.37	0.35	0.33	19.58	20.23	19.61	1.31	1.42	1.53
Mean	4.98	5.15	5.06	0.40	0.38	0.39	21.97	22.27	22.12	1.33	1.40	1.37
C.V.	8.36	7.16	9.45	7.70	8.07	12.77	7.16	7.63	9.25	10.67	11.05	15.83
S.E. m ±	0.24	0.21	0.19	0.17	0.02	0.02	0.90	0.98	0.83	0.08	0.09	0.08
C.D. @ 5%	0.67	0.60	0.54	0.05	0.05	0.05	2.54	2.75	2.32	0.23	0.25	0.24
Range												
Lowest	4.40	4.50	4.54	0.33	0.28	0.31	16.41	16.74	18.93	0.97	0.50	1.08
highest	5.80	5.97	5.67	0.52	0.55	0.49	25.20	25.87	25.31	1.88	1.89	1.69

Genotypes	Non - reducing sugar (mg/100g)			Total sugar (mg/100g)			Total fruit yields per plant (kg)		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled
P ₁	2.68	2.76	2.57	3.51	4.08		2.67	2.86	2.46
P ₂	2.67	2.68	2.75	3.98	4.12	3.61	1.94	2.32	2.35
P ₃	2.49	2.17	2.36	3.45	3.2	4.33	2.80	2.97	2.78
P ₄	2.77	2.23	2.71	3.79	3.73	3.51	3.01	3.45	2.81
P ₅	2.54	2.64	2.37	4.07	4.39	3.80	2.22	2.54	2.99
P ₆	2.46	2.55	2.50	3.70	3.88	3.85	2.25	2.36	3.24
P ₇	2.43	2.54	2.34	4.08	4.08	3.80	2.83	2.83	2.64
P ₈	2.88	2.94	2.80	4.05	4.59	3.81	1.88	1.90	2.28
P ₉	2.78	2.16	2.56	4.16	3.56	4.06	2.84	2.89	3.25
P ₁₀	2.60	2.75	2.54	4.21	4.51	3.83	2.62	2.75	3.09
P ₁ ×P ₂	2.44	2.25	2.60	3.68	3.59	3.88	2.32	2.56	2.59
P ₁ ×P ₃	2.38	2.56	2.31	4.12	4.40	3.85	2.15	2.22	2.35
P ₁ ×P ₄	2.64	2.65	2.59	3.98	4.28	4.19	3.18	3.89	2.70
P ₁ ×P ₅	2.69	2.19	2.67	3.93	3.73	4.10	2.56	2.56	3.22
P ₁ ×P ₆	2.29	2.57	2.23	3.75	4.13	3.73	1.19	1.78	1.87
P ₁ ×P ₇	2.59	2.22	2.58	3.70	3.97	3.91	2.86	2.35	2.32
P ₁ ×P ₈	2.37	2.28	2.29	3.92	3.98	3.94	1.96	2.67	2.15
P ₁ ×P ₉	2.33	2.84	2.30	4.98	3.98	4.47	2.77	2.87	2.71
P ₁ ×P ₁₀	3.15	2.84	2.99	3.40	4.68	3.69	2.52	2.76	2.69
P ₂ ×P ₃	2.32	2.54	2.50	4.38	3.77	4.24	1.86	1.87	2.09
P ₂ ×P ₄	3.14	2.78	2.83	4.13	4.12	3.95	3.94	4.12	2.90
P ₂ ×P ₅	2.91	2.86	2.84	3.70	4.14	3.91	2.74	2.97	3.43
P ₂ ×P ₆	2.17	2.45	2.51	3.70	3.93	3.92	2.95	3.45	2.96
P ₂ ×P ₇	2.22	2.32	2.33	3.39	3.53	3.65	2.62	2.34	3.03
P ₂ ×P ₈	2.82	2.21	2.56	4.02	3.41	3.77	2.26	2.23	2.29
P ₂ ×P ₉	2.24	2.28	2.22	4.08	4.15	3.74	2.69	2.87	2.46
P ₂ ×P ₁₀	2.37	2.24	2.32	3.67	3.57	3.91	2.54	2.76	2.70
P ₃ ×P ₄	2.48	2.50	2.32	3.69	3.75	3.48	1.86	2.43	2.41
P ₃ ×P ₅	2.32	2.38	2.40	3.58	3.67	3.66	2.87	2.97	2.65
P ₃ ×P ₆	2.96	2.49	2.67	4.32	3.88	3.99	2.81	2.80	2.89
P ₃ ×P ₇	2.15	2.23	2.31	3.49	3.60	3.68	1.76	1.97	2.28

Genotypes	Non - reducing sugar (mg/100g)			Total sugar (mg/100g)			Total fruit yields per plant (kg)			
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	
P ₃ ×P ₈	2.74	2.36	2.48	4.19	3.85	3.89	2.93	3.54	2.44	
P ₃ ×P ₉	2.36	2.76	2.36	3.68	4.13	3.76	2.45	2.75	2.99	
P ₃ ×P ₁₀	3.14	2.65	2.95	4.27	3.82	4.20	2.18	2.61	2.46	
P ₄ ×P ₅	2.35	2.64	2.28	3.56	3.84	3.64	2.77	2.62	3.10	
P ₄ ×P ₆	2.85	2.93	2.74	4.24	4.07	4.04	3.42	3.82	3.02	
P ₄ ×P ₇	2.24	2.55	2.58	3.69	4.02	3.88	2.79	2.85	3.30	
P ₄ ×P ₈	2.37	2.37	2.46	3.57	3.59	3.79	3.56	3.93	3.20	
P ₄ ×P ₉	2.93	2.26	2.65	4.43	3.73	4.01	2.90	3.33	3.41	
P ₄ ×P ₁₀	2.26	2.21	2.26	3.65	3.62	3.69	3.02	3.76	3.17	
P ₅ ×P ₆	2.30	2.56	2.47	3.46	3.68	3.92	2.52	2.54	2.52	
P ₅ ×P ₇	2.96	2.62	2.75	4.35	4.04	4.01	1.67	1.63	2.10	
P ₅ ×P ₈	2.51	2.52	2.56	3.92	3.96	3.98	2.50	2.53	2.06	
P ₅ ×P ₉	2.45	2.36	2.48	4.17	4.11	4.06	1.88	1.93	2.20	
P ₅ ×P ₁₀	2.39	2.55	2.37	3.72	3.89	3.91	3.59	4.23	2.75	
P ₆ ×P ₇	2.61	2.92	2.58	4.74	4.81	4.31	2.66	2.72	2.51	
P ₆ ×P ₈	2.36	2.55	2.64	3.48	3.70	4.14	1.99	2.45	2.35	
P ₆ ×P ₉	2.28	2.25	2.41	3.56	3.55	3.63	3.67	3.53	3.06	
P ₆ ×P ₁₀	2.21	2.25	2.22	3.39	3.54	3.47	1.88	2.45	2.70	
P ₇ ×P ₈	2.38	2.40	2.46	3.56	3.55	3.82	2.88	3.56	2.85	
P ₇ ×P ₉	2.35	2.32	2.37	3.47	3.47	3.51	2.84	2.32	3.20	
P ₇ ×P ₁₀	2.40	2.73	2.36	3.73	4.08	3.60	2.83	2.67	2.57	
P ₈ ×P ₉	2.50	2.31	2.72	3.52	3.30	4.05	2.57	2.86	2.2	
P ₈ ×P ₁₀	2.48	2.35	2.39	3.59	3.51	3.44	3.41	3.63	3.13	
P ₉ ×P ₁₀	2.42	2.48	2.29	3.73	3.83	3.64	3.20	3.56	3.04	
Mean	2.52	2.49	2.50	3.86	3.89	3.87	2.61	2.82	2.71	
C.V.	10.67	9.70	11.2394	7.64	10.80	11.07	10.75	11.31	20.34	
S.E.m ±	0.15	0.14	0.1150	0.17	0.24	0.17	0.16	0.18	0.22	
C.D.@ 5%	0.97	0.39	0.3203	0.47	0.68	0.48	0.45	0.52	0.62	
Range										
	Lowest	2.14	2.16	2.22	3.39	3.28	3.44	1.18	1.63	1.87
	highest	3.14	2.94	2.99	4.98	4.81	4.47	4.23	3.43	

3.7 Pericarp Thickness (mm)

Parental line P₉ (5.25 mm) was found for maximum pericarp thickness followed by P₄ (5.09 mm), P₅ (4.72 mm), P₆ (4.67 mm) and P₁ (4.63 mm) in Y₁, P₄ (5.67 mm) followed by P₉ (5.66 mm), P₈ (4.83mm), P₁(4.78 mm) and P₆ (4.77 mm) in Y₂ and P₄ (5.49 mm) exhibited maximum pericarp thickness among the parents which was followed by P₉ (4.93 mm), P₁₀ (4.96 mm), P₉ (4.93mm) and P₆(4.72 mm) in pooled.

3.8 Number of Locules per Fruit

Maximum number of locules per fruit among the parents was observed in P₇(6.19) followed by P₄ (6.06), P₂ (5.43), P₁₀ (5.05) and P₆ (4.51) in Y₁, P₇ (6.34) followed by P₆(6.14), P₁₀(5.67), P₄(4.97) and P₉ (4.67) in Y₂ and P₄ (5.74) followed by P₇ (5.42), P₃ (5.19) and P₁₀ (5.01) in pooled.

3.9 Polar Diameter of Fruit (cm)

Maximum polar diameter of fruit (cm) was recorded in P₈ (6.34 cm) followed by P₃ (6.31 cm), P₅ (5.55 cm), P₆ (5.45 cm) and P₂(5.25 cm), Y₁, P₅ (6.39 cm) followed by P₈ (6.79 cm), P₉ (5.87 cm), P₂ (5.75 cm) and P₁ (4.96 cm) in Y₂ and P₉ (6.49 cm) followed by P₆ (6.16 cm), P₃ (6.00 cm), P₁ (5.14 cm) and P₇ (5.08 cm) in pooled.

3.10 Equatorial Diameter of Fruit (cm)

Maximum Equatorial diameter (cm) of fruit was recorded in P₅(9.48cm) followed by P₈(9.47 cm), P₇ (8.35 cm), P₂ (7.96 cm) and P₉ (7.70 cm), in Y₁, P₇ (9.76 cm) followed by P₈ (9.49 cm), P₅ (8.09 cm), P₆ (8.45 cm) and P₂ (7.99 cm) in Y₂ and P₅ (9.17 cm) followed by P₆ (8.97 cm), P₇ (8.66 cm) P₉ (8.28 cm) and P₁ (7.83 cm) in pooled.

3.11 Marketable Fruit Yields per Plant (kg)

Maximum marketable fruit yield per plant (kg) was recorded in P₃ (2.53 kg) followed by P₁ (2.51kg), P₉ (2.43kg) , P₃ (2.61kg) and P₁ (2.34kg)) in Y₁, P₄ (2.88 kg) followed by P₃ (2.877 kg), P₇ (2.78 kg), P₁ (2.73kg) and P₁₀ (2.70kg) in Y₂ and P₉ (2.97 kg) followed by P₆ (2.91kg), P₁₀ (2.86 kg), P₁ (2.34kg) and P₂ (2.27kg) in pooled.

3.12 Total Soluble Solids

Parents P₁(5.68) contain highest total soluble solids followed by P₈ (5.62 °B), P₅ (5.47 °B, P₇

(5.01 °B) and P₆ (4.93 °B)), in Y₁, P₁ (5.70 °B) followed by P₆ (5.33 °B), P₉ (5.47 °B), P₁ (5.31 °B) and P₈ (5.24 °B)) in Y₂ and P₇ (5.49 °B) followed by P₆ (5.33 °B), P₁ (5.31), P₁₀ (5.10 °B) and P₄ (5.09 °B) in pooled.

3.13 Titrable Acidity (%)

Maximum titrable acidity was recorded in P₁ (0.46%) followed by P₇ (0.45%), P₆ (0.40%), P₈ (0.43%) and P₁₀ (0.37%) in Y₁, P₁ (0.43%) followed by P₇ (0.42%), P₄ (0.38 %), P₃ (0.37 %) and P₂ (0.35%) in Y₂ and P₁ (0.43 %) followed by P₂ (0.41%), P₇ (0.40 %), P₄ (0.36%) and P₈ (0.37%) in pooled.

3.14 Ascorbic Acid Content (mg/100g)

Parents P₃ (24.57mg/100g) contain highest Ascorbic acid content followed by P₇ (23.54 mg/100g), P₆ (22.10 mg/100g), P₂ (21.77 mg/100g) and P₁₀ (21.38 mg/100g)), in Y₁ P₃ (24.59 mg/100g) followed by P₈(23.14 mg/100g), P₇(22.07 mg/100g), P₁ (21.53 mg/100g) and P₂ (21.85 mg/100g)) in Y₂ and P₃(24.06 mg/100g) followed by P₇ (22.07 mg/100g), P₉ (21.73 mg/100g), P₁ (21.53 mg/100g) and P₄ (21.34 mg/100g) in pooled.

3.15 Reducing Sugar (mg/100g)

Maximum reducing sugar was recorded in P₇ (1.66%) followed by P₉(1.39%), P₁₀ (1.61 %) , P₅ (1.54%) and in Y₁, P₉ (1.76%) followed by P₇ (1.65 %), P₆ (1.50%), P₃ (1.54 %) and P₁ (1.43%) in Y₂ and P₂ (0.57%) followed by P₁₀ (1.51%), P₅ (1.47%), P₇ (1.44%) and P₈ (1.43%) in pooled.

3.16 Non-Reducing Sugar (mg/100g)

Maximum non-reducing sugar(mg/100g) was recorded in P₉(2.78%) followed by P₄(2.77%), P₁ (2.68%)), P₂ (2.67%) and P₁₀ (2.60%) in Y₁, P₈ (2.94%) followed by P₁(2.76%), P₁₀ (2.75 %), P₂ (2.68 %) and P₅ (2.64%) in Y₂ and P₈ (2.80%) followed by P₂ (2.75 %), P₄ (2.71%), P₉ (2.56%) and P₁₀ (2.54%) in pooled.

3.17 Total Sugar (mg/100g)

Maximum total sugar(mg/100g) was recorded in P₁₀ (4.21%) followed by P₉ (4.16%), P₅ (4.07%), P₈ (4.05%) and P₂ (3.98%) in Y₁, P₈(4.59 %) followed by P₁₀(4.51%), P₅ (4.39%) , P₅ (4.07%) and P₆ (3.88 %) in Y₂ and P₂ (4.33%) followed by P₈ (4.06%), P₁₀ (4.02%), P₉ (3.83%) and P₆ (3.80%) in pooled.

Among the hybrids, the highest fruit yield per plant was exhibited by $P_2 \times P_4$ (3.94 kg) followed by $P_6 \times P_9$ (3.67 kg), $P_5 \times P_{10}$ (3.59 kg), $P_4 \times P_8$ (3.56 kg) and $P_9 \times P_{10}$ (5.13 kg) in Y_1 and $P_5 \times P_{10}$ (4.23 kg) followed by $P_2 \times P_4$ (4.12 kg), $P_1 \times P_4$ (3.89 kg), $P_4 \times P_8$ (3.93 kg) and $P_4 \times P_{10}$ (3.76 kg) in Y_2 , $P_2 \times P_5$ (3.43 kg) followed by $P_4 \times P_9$ (3.41 kg), $P_7 \times P_9$ (3.30 kg), $P_1 \times P_5$ (3.22 kg) and $P_4 \times P_8$ (3.20 kg) in pooled descending order.

Thus there were significant differences for all the traits over seasons and pooled among the parents and F_1 . This might be due to the influence of the environment. Similar observations in tomatoes were also reported by Joshi & Kohli [6], Jogi et al. [7], Mohammed et al. [8], Narolia et al. [9], kerketta et al. [10] Prakash et al. [11] and Anuradha et al. [12] in tomato.

4. CONCLUSION

On the basis of overall findings of the present research study it was concluded that there is wide range of variation in tomato strain for all the characters studied. The Parent P_4 (NDT-7) and P_9 (NDT-6-2-1) is highly significant for total fruit yields per plant, days to fifty percent flowering, number of fruit per cluster, number of fruit per plant, and for fruit weight. However, since this is based on experiment, further trials may be needed to substantiate the results in tomato.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Rick CM, Holle M. Andean *Lycopersicon esculentum* var. cerasiforme: genetic variation and its evolutionary significance. Econ. Bot. 1990;43(3):69-78.
2. Rick CM, Kesicki E, Fobes JF, Holle M. Genetic and bio-systematic studies on two new sibling species of *Lycopersicon* from Interandean Peru. Theoretical and Applied Genetics. 1976;47:55-68.
3. Martí R, Roselló S, Cebolla-Cornejo J. Tomato as a source of carotenoids and polyphenols targeted to cancer prevention. Cancer. 2016;8(6):58.
4. Rashid MA. Sabjibigan (Vegetable Science) in Bengali. Second Edn. Rashid Publishing House, 94 Old DOHS, Dhaka. 1999;1206.526.
5. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Worker's 2nd eds. Indian Council Agric. Res., New Delhi. 1967;152-157.
6. Joshi A, Kohli UK. Genetic divergence for qualitative and quantitative traits in tomato (*Lycopersicon esculentum* Mill.). Indian J. Agri. Sci. 2003;73(2):110-113.
7. Jogi P, Shukla N, Mehta N, Sahu M. Genetic divergence for fruit traits in tomato (*Lycopersicon esculentum* Mill.). Oris. J. Hort. 2008;36(2):149-151.
8. Mohamed SM, Ali EE, Mohamed TY. Study of heritability and genetic variability among different plant and fruit characters of tomato (*Solanum lycopersicum* L.). Int. J. Sci. Tech. Res. 2012;1(2):55-58.
9. Narolia RK, Reddy RVSK, Padma M. Correlation, path coefficient and genetic divergence analysis of growth, yield and quality of tomato (*Lycopersicon esculentum* Mill.). Indian J. Crop Bio. 2012; 20(1):65-69.
10. Kerketta A, Bahadur V, Rajesh J. Performance of different tomato genotypes (*Solanum lycopersicum* L.) for growth, yield and quality traits under Allahabad condition. J. Pharma. Phyto. 2018;7(6):1766-1769.
11. Prakash O, Choyal P, Godara A, Choudhary S. Mean performance of tomato (*Solanum lycopersicum* L.) genotypes for yield, yield parameters and quality traits. J. Pharma. Inno. 2019;8:763-765.
12. Anuradha B, Saidaiah P, Ravinder Reddy K, Harikishan Sudini GA. Mean performance of 40 genotypes in tomato (*Solanum lycopersicum* L.). Int. J. Chem. Stud. 2021;9(1):279-283.

© 2023 Yadav and Yadav; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/97100>