

## **Per se performance of parents and their F<sub>1</sub> hybrids for yield and yield related traits in tomato (*Solanum lycopersicum* L.) under polyhouse condition**

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### **ABSTRACT**

The present investigation was carried out at Vegetable Research Center of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, with the objective to assess mean per se performance of parents and their F<sub>1</sub> hybrids for yield and yield related traits in tomato under polyhouse condition. The experimental material for the present study comprised of 36 treatments (28 F<sub>1</sub>s and 8 parents) which were evaluated in a Randomized Block Design (RBD). The genotypes were studied for fifteen yield related traits. For days to 50 per cent flowering and days to first fruit set parents, PCT-1 and PBT-2 and the crosses, PCT-1 x PBT-4 and PBT-9 x PBT-2 showed minimum value. Minimum days to first fruit ripening were recorded in parents PCT-1 and PBT-10 and hybrids, PCT-1 x PBT-5, PBT-9 x PBT-5 and PBT-9 x PBT-2. Maximum values for number of flowers per cluster, number of fruits per cluster and number of fruits per plant were observed in parents, PCT-1 and PBT-2 and in hybrids, PCT-1 x PBT-5, PBT-5 x PBT-4 and PCT-1 x PBT-2. Maximum average fruit weight recorded in parents, PBT-2 and PBT-9 and in hybrids PBT-13 x PBT-10, PBT-9 x PBT-5 and PBT-2 x PBT-9. Among the parents, maximum mean values for plant height were recorded in PBT-2 and PCT-1 whereas, among 28 F<sub>1</sub>s, PBT-13 x PBT-10, PCT-1 x PBT-4 and PCT-1 x PBT-9 has maximum values. Among the parents, maximum values for fruit yield were observed in PBT-2 and PCT-1 whereas, among hybrids, PCT-1 x PBT-5, PBT-2 x PBT-13 and PBT-9 x PBT-4 showed maximum values for fruit yield.

**Keywords:** Fruit yield, genotypes, hybrids, per se, polyhouse and tomato.

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### **INTRODUCTION**

Tomato (*Solanum lycopersicum* L.) is an important vegetable of Solanaceae family having chromosome number 2n=2x=24. It has originated from wild form in the Peru-Ecuador-Bolivia region of the Andes, South America [7] and is grown in almost every corner of the world [8]. The fruits are eaten as raw or cooked form. Large quantities of tomato are used to produce soup, juice, ketchup, puree, paste and powder. Green tomatoes are also used for pickles and preserves. Tomato universally treated as 'Protective Food' and is being extensively grown as annual plant all over the world. It is an excellent source of income to small and marginal farmers and contributes to the nutrition of the consumers. Tomato is one of the most highly praised vegetables consumed widely. It is a major source of vitamins, minerals and organic acids. Although, the vitamins only account for a small proportion of the total dry matter but they are highly significant from the nutritional point of view. There are various types of flavouring compounds found in the fruits, which enrich the taste. The

total sugar content is 2.5 per cent in ripe fruit and amount of ascorbic acid varies from 16-65mg/100g of fruit weight. Total amino acid is 100-350mg/100g. Tomato is also rich in medicinal values. The pulp and juice are digestible mid aperients, a promoter of gastric secretion and blood purifier. It is also considered to be intestinal antiseptic. It is said to be useful in cancer of the mouth, sore mouth, etc. Dried tomato juice retains vitamin C. It stimulates torpid liver and is good in chronic dyspepsia. It is one of the richest vegetables which keep our stomach and intestine in good condition. Tomato, a primary source of lycopene, showed significant association with low prostate cancer risk. Tomato juice has become an exceedingly popular appetizer and beverage. India have diverse agroclimatic conditions, the protected vegetable cultivation technology can be utilized for year round and off-season production of high value low volume vegetable crops, production of virus free high quality seedlings and quality hybrid seed production. Among vegetables, tomato is the first crop grown in polyhouse worldwide. Demand for tomatoes is usually strong due to the vine-ripe nature and general overall high level of eating quality.

## MATERIAL AND METHODS

The experiment was conducted at Vegetable Research Centre (V.R.C.), GovindBallabh Pant University of Agriculture & Technology, Pantnagar, Uttarakhand. This university is situated in the foot hills of Shivalik range of Himalayas in the narrow belt called 'Tarai'. Geographically, it is situated at an altitude of 243.84m above mean sea level, and between 29.50° North latitude and 79.30° East longitude. The climate of the region is broadly humid subtropical with cool winter and hot dry summer. During hot summer, maximum temperature exceeds 40°C while, in winters the minimum temperature occasionally touches 0°C. The monsoon generally starts from the third week of June and recedes by the end of September. Occasional light rains are expected during winter months also, frost is expected from late December to February. The mean relative humidity remains almost 80-90 per cent from mid-June to end of February and then it steadily decreases to 50 per cent by the first week of May and remains so till mid-June. The soil at Pantnagar comes under the category of mollisols. The soil of experimental field was sandy-loam with adequate drainage and optimum water holding capacity.

The experimental material for this study consists of 8 genotypes which were selected based on their diversity for various traits. From these 8 genotypes, 28 crosses were evolved in a half diallel mating design. The parents and their F<sub>1</sub>'s are presented in Table 1 and 2, respectively.

**Table 1 List of parents used for study**

S.No.	Parent line	Source
1	Pant Cherry Tomato-1 (PCT-1)	New Delhi
2	Pant Polyhouse Tomato -2 (PPT-2)	G. B. P. U. A. &T., Pantnagar
3	PBT-2	Rehovot Agriculture Campus, Israel
4	PBT-4	Rehovot Agriculture Campus, Israel
5	PBT-5	Rehovot Agriculture Campus, Israel
6	PBT-9	Rehovot Agriculture Campus, Israel
7	PBT-10	Rehovot Agriculture Campus, Israel
8	PBT-13	Rehovot Agriculture Campus, Israel

**Table 2: List of F<sub>1</sub> hybrids developed through diallel mating design**

S. No.	F <sub>1</sub> hybrids	S. No.	F <sub>1</sub> hybrids
1	PCT-1 x PPT-2	15	PBT-9 x PBT-2
2	PCT-1 x PBT-9	16	PBT-9 x PBT-13
3	PCT-1 x PBT-5	17	PBT-9 x PBT-10
4	PCT-1 x PBT-2	18	PBT-9 x PBT-4
5	PCT-1 x PBT-13	19	PBT-5 x PBT-2
6	PCT-1 x PBT-10	20	PBT-5 x PBT-13
7	PCT-1 x PBT-4	21	PBT-5 x PBT-10
8	PPT-2 x PBT-9	22	PBT-5 x PBT-4
9	PPT-2 x PBT-5	23	PBT-2 x PBT-13
10	PPT-2 x PBT-2	24	PBT-2 x PBT-10
11	PPT-2 x PBT-13	25	PBT-2 x PBT-4
12	PPT-2 x PBT-10	26	PBT-13 x PBT-10
13	PPT-2 x PBT-4	27	PBT-13 x PBT-4
14	PBT-9 x PBT-5	28	PBT-10 x PBT-4

The seeds were sown in plastic pro trays by using artificial soilless media inside the naturally ventilated polyhouse for raising healthy and vigorous seedlings of tomato. Combinations of three ingredients *viz.*, cocopeat, vermiculite and perlite are used as rooting medium for raising the nursery. These ingredients are mixed in 3:1:1 (V/V) ratio. The seedlings were ready for transplanting after one month of sowing and were subsequently transplanted inside the naturally ventilated polyhouse equipped with drip irrigation system for efficient use of water and fertilizers for long duration cultivation of tomato crop. Healthy seedlings are transplanted at a planting distance of 60 x 45cm. Before transplanting of seedlings, soil is thoroughly prepared and beds are made with the help of tractor rotavator. All 8 parents and 28 F<sub>1</sub> hybrids were evaluated different yield related traits during 2017-18 under polyhouse. The details of experimental plan are given below:

Experimental site	:	Vegetable Research Centre, Pantnagar
Design	:	Randomized Block Design (RBD)
Replication	:	3
Treatments	:	36
Spacing	:	60 cm x 45 cm

Five competitive plants from each entry in each replication were randomly selected before flowering and tagged for the purpose of recording observations on different quantitative traits and their average values were used in the statistical analysis. The genotypes were studied for fifteen yield related traits *viz.*, days to 50 per cent flowering, days to first fruit set, days to first fruit ripening, number of flowers per cluster, number of fruits per cluster, number of fruits per plant, internodal length (cm), average fruit weight (g), fruit length (cm), fruit width (cm), fruit shape index, plant height (cm), 100 seed weight (g), fruit yield per plant (kg) and fruit yield per hectare (t/ha).

## RESULTS AND DISCUSSIONS

The *per se* performance of parents and F<sub>1</sub> hybrids for yield related traits were computed and have been given in Table 3. Mean values for days to 50 per cent flowering ranged between 30.33 to 43.67 days with an average value 35.43 days. Among the parents, PCT-1 (31.67) and PBT-2 (32.67) were recorded the minimum days to 50 per cent flowering and among the crosses, minimum days to 50 per cent flowering was observed in PCT-1 x PBT-4 (30.33), PBT-9 x PBT-2 (30.33) and PBT-13 x PBT-10 (30.33). Similar results for the trait were observed by Anand and Sankari [1] and Kumar *et al.* [2]. Days to first fruit set ranged from 43.00 to 57.47 days with an average of 49.03 days. Among the parents, PCT-1 (43.50) and PBT-2 (44.20) recorded minimum mean values and among the crosses, minimum values for days to first fruit set. Mean values for days to first fruit ripening ranged from 68.20 to 95.13 days and the mean value for same trait was 84.01 days. Among the parents, minimum days to first fruit ripening were recorded in PCT-1 (68.20) and PBT-10 (74.40) whereas, among the hybrids generated, PCT-1 x PBT-5 (75.93), PBT-9 x PBT-5 (76.27) and PBT-9 x PBT-2 (77.53) recorded minimum days to first fruit ripening.

Number of flowers per cluster ranged from 7.67 to 26.40 with the mean value 12.56. Among the parents, maximum values for number of flowers per cluster was noticed in PCT-1 (22.00) and PPT-2 (13.73) and among the 28 F<sub>1</sub>s, PCT-1 x PBT-5 (26.40), PBT-5 x PBT-4 (17.93) and PCT-1 x PBT-13 (15.87) recorded maximum number of flowers per cluster. However, cross combination PBT-10 x PBT-4 (8.93), PPT-2 x PBT-9 (9.47), PPT-2 x PBT-5 (9.80) and PPT-2 x PBT-4 (9.80) recorded minimum number of flowers per cluster. Same result was observed by Anand and Sankari [1], Mamatha *et al.* [6] and Kumar *et al.* [2]. Number of fruits per cluster ranged from 5.47 to 14.80 with an average value 7.57. Among the parents, maximum values for this trait were recorded in PCT-1 (12.87) and PPT-2 (8.33) whereas, among the 28 F<sub>1</sub>s, maximum values for number of fruits per cluster were recorded in PCT-1 x PBT-5 (14.80), PCT-1 x PPT-2 (10.40) and PBT-5 x PBT-4 (9.93). Similar result was also found by Kumar *et al.* (2016). Number of fruits per plant ranged from 27.39 to 355.73 with an estimated mean value 55.12. Among the parents, maximum values for number of fruits per plant were noticed in PCT-1 (355.73) and PPT-2 (54.93) whereas, among the 28 F<sub>1</sub>s, PCT-1 x PBT-5 (94.78), PBT-5 x PBT-4 (84.81) and PCT-1 x PPT-2 (78.73) recorded maximum number of fruits per plant. Similar result was also found by Mamatha *et al.* [6].

Internodal length ranged from 7.80 to 13.40 cm with an average of 10.58 cm. Among the parents, PBT-5 (9.27) and PCT-1 (10.00) recorded minimum internodal length while, among

the 28 cross combinations, PBT-9 x PBT-4 (7.80), PBT-9 x PBT-5 (8.07) and PPT-2 x PBT-5 (8.53) recorded minimum internodal length. Average fruit weight exhibited variation among thirty six treatments which ranged from 9.90 to 159.93g with an average of 88.00g. Among the parents, PBT-2 (119.27) and PBT-9 (109.60) recorded maximum average fruit weight while, among the F<sub>1</sub> hybrids generated, maximum average fruit weight was recorded in PBT-13 x PBT-10 (159.93), PBT-9 x PBT-5 (141.53) and PPT-2 x PBT-9 (139.20). Similar findings for the trait were also reported by Marik [6], Anand and Sankari [1], Mamatha *et al.* [6] and Kumar *et al.* [2]. Mean values for fruit length ranged from 2.11 to 6.55 cm and the average value was 4.75 cm. Among the parents, PBT-4 (6.55) and PBT-9 (5.41) recorded maximum values for this trait, although among the 28 cross combinations, maximum values for fruit length were recorded in PPT-2 x PBT-9 (6.10), PBT-13 x PBT-10 (6.05) and PPT-2 x PBT-4 (5.82). Similar result was also reported by Kumar *et al.* [2]. Fruit width ranged from 1.83 cm to 6.35 cm with an average value 4.52 cm. Among the parents, maximum values for this trait were recorded in PBT-10 (5.62) and PBT-2 (5.40) whereas, among the 28 F<sub>1</sub>s, maximum values for fruit width were recorded in PBT-13 x PBT-10 (6.35), PBT-9 x PBT-5 (6.28) and PBT-13 x PBT-4 (5.47). Similar finding was also observed by Kumar *et al.* (2016). Mean values for fruit shape index ranged from 0.86 to 1.66 and the average value was 1.07. PBT-4 (1.59) and PBT-13 (1.18) recorded maximum values among the parents whereas, among the F<sub>1</sub>s, maximum values for fruit shape index were recorded in PBT-2 x PBT-4 (1.66), PPT-2 x PBT-4 (1.30) and PCT-1 x PBT-4 (1.25).

Plant height exhibited variation among 36 treatments which ranged from 236.13 to 448.67 cm with a mean value 384.05 cm. Among the parents, maximum mean values for plant height were recorded in PBT-2 (411.67) and PCT-1 (409.07) whereas, among 28 F<sub>1</sub>s, PBT-13 x PBT-10 (448.67), PCT-1 x PBT-4 (447.53) and PCT-1 x PBT-9 (438.33) have maximum values for plant height. Similar findings for plant height observed by Anand and Sankari [1], Mamatha *et al.* [6], Kumar *et al.* [2], Mahendrakar *et al.* [3, 4] and Sumathi *et al.* [9]. Mean values for 100 seed weight ranged from 0.13 to 0.42g and average value was 0.35g. Among the parents, maximum 100 seed weight was recorded in PBT-2 (0.40), PBT-9 (0.38) and PBT-10 (0.38) whereas, among the 28 cross combinations, PBT-9 x PBT-2 (0.42), PCT-1 x PBT-13 (0.40) and seven crosses with 0.39g of 100 seed weight had maximum mean values for the trait.

Mean values for fruit yield per plant was ranged between 1.34 to 6.83 kg and the average value was 3.67 kg. Among the parents, maximum values for the same trait were observed in PPT-2 (4.06) and PCT-1 (3.71) whereas, among the 28 cross combinations, PCT-1 x PBT-5 (6.83), PBT-2 x PBT-13 (6.19) and PBT-9 x PBT-4 (5.72) showed maximum values for fruit yield per plant. Same finding for fruit yield per plant was also reported by Anand and Sankari [1], Mamatha *et al.* [6] and Kumar *et al.* [2]. Fruit yield per hectare ranged from 47.27 to 240.37 t/ha with an average 129.00 t/ha. Among the parents, PPT-2 (142.97) and PCT-1 (130.44) recorded the highest fruit yield per hectare while, among the 28 F<sub>1</sub>s, PCT-1 x PBT-5 (240.37), PBT-2 x PBT-13 (217.82) and PBT-9 x PBT-4 (201.31) exhibited highest fruit yield per hectare.

**Table 3: Mean performance of tomato genotypes for different yield related traits**

S.N.	Genotypes	Days to 50% flowering	Days to first fruit set	Days to first fruit ripening	No. of flowers/ cluster	No. of fruits/ cluster	No. of fruits/ plant	Internodal length (cm)	Avg. fruit wt. (g)
1	PCT-1	31.67	43.50	68.20	22.00	12.87	355.73	10.00	9.90
2	PPT-2	37.67	50.33	82.40	13.73	8.33	54.93	10.27	77.00
3	PBT-9	36.00	49.20	83.13	9.13	5.67	30.37	11.00	109.60
4	PBT-5	36.67	48.73	81.93	10.00	7.13	40.67	9.27	89.07
5	PBT-2	32.67	44.20	81.40	7.67	5.87	27.39	13.07	119.27
6	PBT-13	43.00	56.27	95.13	9.20	5.47	31.89	13.07	69.80
7	PBT-10	35.00	47.07	74.40	10.67	7.93	47.19	10.27	76.27
8	PBT-4	38.67	51.60	88.80	8.47	5.67	30.25	12.80	91.53
9	PCT-1 x PPT-2	33.00	47.67	84.13	15.13	10.40	78.73	10.53	77.00
10	PCT-1 x PBT-9	36.33	49.27	82.93	13.33	9.20	70.99	10.93	31.73
11	PCT-1 x PBT-	31.00	43.33	75.93	26.40	14.80	94.78	11.20	71.73

	5								
12	PCT-1 x PBT-2	35.67	49.47	81.53	14.27	8.60	49.74	9.13	34.80
13	PCT-1 x PBT-13	38.00	52.07	86.20	15.87	8.13	56.60	9.67	43.40
14	PCT-1 x PBT-10	35.00	49.93	81.80	12.87	7.13	41.47	11.80	29.20
15	PCT-1 x PBT-4	30.33	43.00	79.93	15.47	9.33	75.11	11.00	69.07
16	PPT-2 x PBT-9	39.33	54.27	88.67	9.47	6.33	41.12	10.40	139.20
17	PPT-2 x PBT-5	39.67	54.40	90.67	9.80	6.40	38.38	8.53	107.60
18	PPT-2 x PBT-2	38.33	53.40	92.27	10.40	6.47	37.27	9.00	133.93
19	PPT-2 x PBT-13	43.67	57.47	92.93	10.13	5.87	33.50	11.20	121.27
20	PPT-2 x PBT-10	38.67	53.00	88.93	9.93	6.27	42.24	10.27	93.33
21	PPT-2 x PBT-4	39.00	52.53	86.60	9.80	6.47	34.03	9.40	125.93
22	PBT-9 x PBT-5	31.00	44.87	76.27	12.53	6.27	35.27	8.07	141.53
23	PBT-9 x PBT-2	30.33	43.53	77.53	11.33	6.53	33.27	8.87	68.47
24	PBT-9 x PBT-13	39.00	53.27	88.67	10.33	6.67	35.59	9.20	103.73
25	PBT-9 x PBT-10	39.67	54.00	90.20	11.27	5.87	32.09	11.27	109.07
26	PBT-9 x PBT-4	36.67	50.53	89.73	15.47	8.07	60.74	7.80	95.40
27	PBT-5 x PBT-2	32.67	46.00	81.73	11.20	6.73	41.49	9.07	64.00
28	PBT-5 x PBT-13	32.00	45.47	82.40	15.07	7.60	48.65	10.47	31.33
29	PBT-5 x PBT-10	31.67	44.40	81.73	9.87	5.80	35.75	8.80	106.27
30	PBT-5 x PBT-4	31.67	45.47	83.60	17.93	9.93	84.81	13.40	120.27
31	PBT-2 x PBT-13	33.67	46.67	79.47	13.00	9.60	51.33	12.40	123.80
32	PBT-2 x PBT-10	33.33	46.80	83.40	10.73	6.87	38.21	12.53	61.80
33	PBT-2 x PBT-4	32.33	48.00	82.33	11.07	6.60	48.96	12.93	91.87
34	PBT-13 x PBT-10	30.33	44.27	83.80	15.13	7.87	50.94	11.93	159.93
35	PBT-13 x PBT-4	38.00	52.27	90.40	14.67	7.93	39.65	11.60	106.40
36	PBT-10 x PBT-4	33.67	48.67	85.33	8.93	5.73	35.31	9.73	63.60
	<b>GM</b>	<b>35.43</b>	<b>49.03</b>	<b>84.01</b>	<b>12.56</b>	<b>7.57</b>	<b>55.12</b>	<b>10.58</b>	<b>88.00</b>
	Sem	1.34	1.27	0.98	0.508	0.299	5.17	0.52	3.76
	C.D. (1%)	5.03	4.70	3.67	1.90	1.12	19.33	1.96	14.06
	C.D. (5%)	3.79	3.54	2.77	1.44	0.85	14.56	1.48	10.59
	C.V.	6.57	4.44	2.02	7.01	6.84	16.22	8.57	7.39

S.N.	Genotypes	Fruit length (cm)	Fruit width (cm)	Fruit shape index	Plant height (cm)	100 seed wt. (g)	Fruit yield/plant (kg)	Fruit yield/ha (t/ha)
1	PCT-1	2.11	1.83	1.17	409.07	0.13	3.71	130.44
2	PPT-2	5.37	5.04	1.07	403.20	0.35	4.06	142.97
3	PBT-9	5.41	4.96	1.09	316.47	0.38	3.28	115.31
4	PBT-5	4.46	5.07	0.89	338.13	0.36	3.20	112.50
5	PBT-2	4.62	5.40	0.86	411.67	0.40	3.10	108.97
6	PBT-13	5.15	4.40	1.18	351.93	0.37	1.34	47.27
7	PBT-10	5.01	5.62	0.89	330.40	0.38	3.59	126.30
8	PBT-4	6.55	4.14	1.59	236.87	0.29	2.48	87.15
9	PCT-1 x PPT-2	4.07	3.62	1.13	401.40	0.39	3.06	107.75
10	PCT-1 x PBT-9	3.14	3.44	0.92	438.33	0.33	2.04	71.71
11	PCT-1 x PBT-5	3.76	3.81	0.99	431.67	0.30	6.83	240.37
12	PCT-1 x PBT-2	3.21	3.24	0.99	405.73	0.39	2.46	86.46
13	PCT-1 x PBT-13	3.99	3.82	1.05	423.33	0.40	2.19	76.89
14	PCT-1 x PBT-10	3.65	3.76	0.97	411.40	0.36	2.08	73.11
15	PCT-1 x PBT-4	5.11	4.09	1.25	447.53	0.31	3.41	119.98

16	PPT-2 x PBT-9	6.10	5.42	1.13	372.07	0.37	5.45	191.93
17	PPT-2 x PBT-5	5.21	4.99	1.05	332.40	0.36	4.13	145.32
18	PPT-2 x PBT-2	5.46	5.31	1.03	397.87	0.36	4.93	173.34
19	PPT-2 x PBT-13	5.36	4.72	1.14	420.00	0.38	4.02	141.33
20	PPT-2 x PBT-10	4.38	4.03	1.09	434.40	0.35	3.85	135.53
21	PPT-2 x PBT-4	5.82	4.47	1.30	430.00	0.36	4.04	142.06
22	PBT-9 x PBT-5	5.73	6.28	0.92	355.87	0.36	4.83	169.97
23	PBT-9 x PBT-2	3.89	4.39	0.89	236.13	0.42	2.41	84.70
24	PBT-9 x PBT-13	4.41	4.77	0.93	427.33	0.34	3.47	122.21
25	PBT-9 x PBT-10	4.93	4.71	1.05	330.53	0.38	2.90	102.15
26	PBT-9 x PBT-4	5.15	4.43	1.17	381.73	0.35	5.72	201.31
27	PBT-5 x PBT-2	4.19	4.38	0.96	346.67	0.39	2.49	87.61
28	PBT-5 x PBT-13	3.17	3.26	0.98	373.20	0.33	2.29	80.53
29	PBT-5 x PBT-10	5.26	4.85	1.09	427.60	0.33	3.89	136.77
30	PBT-5 x PBT-4	5.30	5.06	1.05	361.00	0.32	5.71	200.79
31	PBT-2 x PBT-13	5.05	5.43	0.93	368.40	0.39	6.19	217.82
32	PBT-2 x PBT-10	4.23	4.14	1.03	406.53	0.39	2.92	102.90
33	PBT-2 x PBT-4	5.68	3.46	1.66	411.27	0.28	3.06	107.57
34	PBT-13 x PBT-10	6.05	6.35	0.95	448.67	0.39	5.52	194.33
35	PBT-13 x PBT-4	5.18	5.47	0.95	420.87	0.36	4.26	149.89
36	PBT-10 x PBT-4	4.89	4.67	1.05	386.13	0.39	3.09	108.68
	<b>GM</b>	<b>4.75</b>	<b>4.52</b>	<b>1.07</b>	<b>384.05</b>	<b>0.35</b>	<b>3.67</b>	<b>129.00</b>
	Sem	0.15	0.21	0.06	23.43	0.01	0.25	8.64
	C.D. (1%)	0.57	0.78	0.23	87.73	0.04	0.92	32.67
	C.D. (5%)	0.43	0.59	0.18	66.08	0.03	0.69	24.38
	C.V.	5.52	7.99	10.18	10.56	5.78	11.60	11.61

## CONCLUSION

Thus, based on the findings of present investigation, on the basis of *per se* performance studies, it is concluded that the hybrids, PCT-1 x PBT-5, PBT-9 x PBT-5, PBT-9 x PBT-2 and PBT-2 x PBT-13 were found promising for earliness while, for fruit yield, PCT-1 x PBT-5, PBT-2 x PBT-13, PBT-9 x PBT-4 and PBT-5 x PBT-4 were found promising hybrids. For most of the quality related traits promising hybrids were PCT-1 x PPT-2, PBT-9 x PBT-2, PBT-2 x PBT-4 and PPT-2 x PBT-10, hence these crosses could be utilized as commercial hybrids for earliness, high yielding and industrial processing, respectively.

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