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Estimation of heterosis in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.)

Prateek Kumar and CN Ram

Abstract
The experiment entitled "Diallel cross analysis for growth (earliness), fruit yield and quality traits in bottle gourd [Lagenaria siceraria (Mol.) Standl.]" was carried out in Randomized Block Design (RBD) with three replications having each experimental unit of single row with spacing of 3 m x 0.5 m. The investigation were carried out at MES Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya during Zaid, 2017 and 2018 with the objectives for to estimate heterosis over better-parent and standard variety for the quantitative traits to planning of an appropriate strategy for development of high yielding bottle gourd hybrid as well as breeding procedure. The materials of experiment consisted of ten diverse parents Pusa Naveen (P_1), NDBG-601 (P_2), PBOG-3 (P_3), NDBG-517 (P_4), NDBG-603 (P_5), NDBG-624 (P_6), N. Pooja (P_7), NDBG-100 (P_8), Punjab Komal (P_9), and NDBG-11 (P_{10}) were crossed in diallel fashion excluding reciprocal to obtained 45 F_1.
Heterosis over better and standard parents for fruit yield per plant, varied from -36.91 (P1 x P4) to 12.15% (P4 x P9) and -24.61 (P1 x P9) to 29.24% (P1 x P2) in Zaid, 2017 (E1), -36.90 (P1 x P4) to 12.24% (P4 x P9) and -24.57 (P1 x P9) to 29.17% (P1 x P2) in Zaid, 2018 (E2) and -36.91 (P1 x P4) to 12.19% (P4 x P9) and -24.59 (P1 x P9) to 29.21% (P1 x P2) in pooled, respectively. Out of 45 F1s the best cross based on desirable and significant heterobeltiosis, per se performance and common crosses for eighteen characters reflect that common crosses based on per se performance and better parent heterosis for fruit yield per plant was P4 x P9 (12.15, 12.24, 12.19%) in both the seasons and pooled.

Keywords: Heterosis, diallel, pistillate, anthesis

Introduction
Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.], (2n =2x= 22) is an important cultivated annual cucurbitaceous crop grown throughout the country. Being warm season vegetable crop it thrives well in warm and humid climate but at present it's off season cultivation has progressively stretched throughout the year in northern Indian plains. In India, the total area covered under bottle gourd is 0.157 million ha with production of 2.683 million tonnes and its productivity is 17.09 tonnes per ha (Anonymous, 2018) [2].
According to De Candolle (1882), bottle gourd has been found in wild form in South Africa and India. However, Cutler and Whitaker (1961) [3] are of the view that probably it is indigenous to tropical Africa on the basis of variability in seeds and fruits. Out of all the cultivated cucurbits, bottle gourd with its high yield potential and adaptability to diverse climatic conditions holds a great promise to cope up with the per capita per day requirement of vegetables in the balanced diet (Singh, 1998) [10] of the fast growing population pressure and greater dietary awareness, particularly among the literate masses of a country like India. Bottle gourd was one of the first plant species to be domesticated for human use, providing food, medicine and a wide variety of utensils and musical instruments made from the large hard shelled mature fruits.
It is highly cross pollinated because of monoecious sex form and exhibits large amount of variation for its quantitative and qualitative traits. This crop is well suited for improvement through inbreeding followed by selection without significant loss in vigour. Therefore, high yielding inbreds can be developed easily with desired uniformity in agronomically important morphological traits.
The exploitation of heterosis is much easier in cross-pollinated vegetable crops. Bottle gourd being monoecious provides ample scope for the utilization of the hybrid vigour for yield improvement of this crop. The selection of suitable parents for hybridization on the basis of phenotypic performance alone is not a sound procedure as phenotypically superior lines may yield poor recombinants in the segregating generations.

It is, therefore, essential that parents should be selected on the basis of their genetic potential.

Material and Methods

The present investigation entitled "Diallel cross analysis for growth (earliness), fruit yield, its components and quality traits in bottle gourd" [Lagenaria siceraria (Mol.) Standl.] was conducted during Zaid 2017 (E1) and 2018 (E2) to study the heterosis over better parent and standard variety using diallel mating design at the Main Experiment Station (MES), Department of Vegetable Science, N.D. University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) India.

The experiments were conducted in a Randomized Complete Block Design (RBD) with three replications to assess the performance of 45 F1 hybrids and their 10 parental lines. The selected parental lines *i.e.* Pusa Naveen (P1), NDBG-601 (P2), PBOG-3 (P3), NDBG-517 (P4), NDBG-603 (P5), NDBG-624 (P6), N. Pooja (P7), NDBG-100 (P8), Punjab Komal (P9), and NDBG-11 (P10) were crossed in the all possible combinations, excluding reciprocals. For this experiment observations were recorded for 18 metric traits *viz*. days to first staminate and pistillate flower appearance, node number to first staminate and pistillate flower anthesis, days to first fruit harvest, primary branches per plant, vine length (m), fruit length (cm), fruit circumference (cm), T.S.S. (^{0} B), ascorbic acid (mg per 100 g fresh weight), reducing sugar, non-reducing sugar and total sugars (%),dry matter content, Fruit weight (kg), number of fruits per plant, fruit yield per plant (kg).

The magnitude of heterosis was studied using information on various quantitative and fruit quality traits. Heterosis expressed as per cent increase or decrease in the mean values of F1's (hybrid) over better-parent (heterobeltiosis) and standard variety (standard heterosis) was calculated according to method suggested by Hayes *et al*. (1955) [6].

Result and Discussion

The exploitation of heterosis refers as the superiority of F1 hybrid over its parent in terms of fruit yield and its attributing traits. The exploitation of heterosis requires an intensive evaluation of germplasm to find out diverse donors with high nicking of genes and further identification of heterotic crosses. In the present study, the estimates of heterosis over better parent (BP) and standard variety (SV) Pusa Naveen were calculated for forty five F_1's in 18 traits including biochemical / quality traits during two seasons (E1, E2) and over seasons (pooled).

Heterosis breeding offers the most efficient tool for development of hybrid varieties. With the use of inbreds in cross pollinated vegetable crops like bottle gourd hybrid with earliness, uniform fruits, fruit size, wide adaptability, resistance to insect and diseases with high yield potential can be developed to enhance productivity and production. Although, some of the private seed companies are marketing the seeds of hybrid bottle gourd developed by them but their popularity is limited only to the specific pockets. Maurya (1994) [8] suggested the great scope of heterosis breeding in bottle gourd and the possible use of hybrids in adverse environmental condition, in particular. Therefore, there is an urgent need to develop F_1 hybrid (s) with commercial heterosis, earliness, desirable fruit character as per market demand, wide adaptability and resistance.

Perusal of Table-1 revealed that nature and magnitude of heterosis differed for different characters and over seasons in various hybrid combinations. The heterobeltiosis and standard heterosis for fruit yield per plant varied from -36.91 (P_1 x P_4) to 12.15% (P_4 x P_9) and -24.61 (P_1 x P_9) to 29.24% (P_1 x P_2) in Zaid, 2017 (E_1), -36.90 (P_1 x P_4) to 12.24% (P_4 x P_9) and -24.57 (P_1 x P_9) to 29.17% (P_1 x P_2) in Zaid, 2018 (E_2) and -36.91 (P_1 x P_4) to 12.19% (P_4 x P_9) and -24.59 (P_1 x P_9) to 29.21% (P_1 x P_2) in pooled, respectively. A wide range of variations in positive and negative direction of heterosis were also recorded for remaining characters during both the seasons and over seasons (pooled). A perusal of Table-1 revealed that crosses exhibiting significant and positive estimates of heterosis for one or both types of heterosis for fruit yield also exhibited significant heterosis for some other important fruit yield and yield attributing traits. The above results are in conformity with the findings of Sirohi *et al*. (1985) [11], Kumar *et al*. (1998) [7] Dubey and Maurya (2003) [4] and Adarsh *et al*. (2017).

Negative heterosis is desirable for maturity characters. Since hybrids with heterosis for earliness produce first fruit earlier as compared to parents, thereby increasing their productivity per unit area and as a consequence fetch better prices in the market by early supply of produce. The best five crosses viz. P1 x P2 (29.24, 29.17, 29.21%), P4 x P5 (25.71, 25.75, 25.73%), P2 x P3 (21.05, 21.09, 21.07%), P3 x P10 (14.62, 14.71, 14.67%) and P3 x P5 (14.42, 14.53, 14.48%) showed positive desirable heterosis over standard variety in both the seasons and pooled for this trait. Further the earliness of parent as well as crosses were directly associated with the crosses having high magnitude of heterosis. It may therefore, safely be concluded that either of parents, P1, P3, P4, P9 and P10 or any two of them may be a better choice in any heterosis breeding programme intended to breed high yielding hybrids with considerable earliness. The present observations are in agreement with the findings of Maurya (2009) [9], Gayakawad *et al.* (2016) [5] and Adarsh *et al*. (2017) [1].

Since, earliness, desirable fruit shape, size, colour, number of fruits and fruit yield per plant are important consideration for choice of elite high yielding F1 hybrids. The decision for final selection of hybrids for commercial cultivation should also take into account the earlier mentioned features. Out of 20 top ranking hybrids based on fruit yield in over seasons (pooled) the five best common hybrids were P7 x P9, P3 x P7, P3 x P5, P3 x P5 and P4 x P8 which exhibited high standard heterosis of 28.30%, 21.98%, 21.75%, 21.75% and 19.23%, respectively (Table-1).

Table 1: Estimates of heterosis (%) over better parent (BP) and standard variety (SV) NDBGH-4 during two seasons (E_1, E_2) and pooled.

Crosses	No. of first staminate flower appearance						No. of first pistillate flower appearance					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	21.92 **	-15.24**	21.94 *	-15.22*	21.93 *	-15.23*	25.34 **	-11.73**	25.30 **	-11.74*	25.32 **	-11.73**
$P_1 \times P_3$	45.21 **	-6.19	45.21 **	-6.19	45.21 **	-6.19	38.57 **	1.52	38.59 **	1.52	38.58 **	1.52
$P_1 \times P_4$	54.79 **	20.21**	54.74 **	20.17**	54.77 **	20.19**	22.85 **	-0.25	22.86 **	-0.27	22.86 **	-0.26
$P_1 \times P_5$	95.89 **	5.93	95.88 **	5.92	95.88 **	5.92	38.06 **	-12.17**	38.05 **	-12.18**	38.05 **	-12.17**
$P_1 \times P_6$	89.04 **	2.22	89.01 **	2.21	89.02 **	2.21	31.33 **	-3.79	26.20 **	-7.57	28.73 **	-5.71

$P_1 \times P_7$	68.49 **	7.89	68.44 **	7.86	68.47 **	7.88	38.57 **	-6.29	38.59 **	-6.27	38.58 **	-6.28
$P_1 \times P_8$	53.97 **	19.57**	53.95 **	19.55**	53.96 **	19.56**	27.20 **	1.32	27.18 **	1.33	27.19 **	1.33
$P_1 \times P_9$	48.63 **	11.74 *	48.63 **	11.77	48.63 **	11.75	3.93	-11.84*	3.92	-11.84*	3.92	-11.84*
$P_1 \times P_{10}$	42.51 **	-11.08*	55.72 **	-2.82	49.21 **	-6.89	32.37 **	-0.78	32.36 **	-0.8	32.37 **	-0.79
$P_2 \times P_3$	61.64 **	4.42	12.45	4.5	12.42 *	4.46	4.62	0.58	5.86	1.79	5.25	1.2
$P_2 \times P_4$	48.90 **	3.52	15.63 *	3.51	15.63 *	3.52	12.59 *	-2.33	12.58 *	-2.31	12.59 *	-2.32
$P_2 \times P_5$	75.34 **	-5.19	21.88 **	-5.2	21.89 **	-5.19	-0.22	-9.87*	-0.21	-9.88*	-0.22	-9.87*
$P_2 \times P_6$	89.04 **	2.22	31.40 **	2.21	31.42 **	2.21	-0.98	-4.81	-1	-4.79	-1	-4.8
$P_2 \times P_7$	59.18 **	1.93	10.66	1.93	10.66	1.93	0.58	-3.43	0.59	-3.42	0.59	-3.42
$P_2 \times P_8$	51.10 **	5.05	17.31 *	5.02	17.33 **	5.04	8.73	-3.86	8.8	-3.82	8.77	-3.84
$P_2 \times P_9$	52.05 **	5.71	14.33 *	5.7	14.32 *	5.71	11.49 *	-7.43	11.53 *	-7.4	11.51 *	-7.42
$P_2 \times P_{10}$	56.16 **	-2.56	8.57	-2.54	8.57	-2.55	-4.57	-10.34*	-4.59	-10.33*	-4.58	-10.33*
$P_3 \times P_4$	37.81 **	-10.97*	6.99	-11	37.79 **	-2.82	6.72	-3.71	6.68	-3.73	6.7	-3.72
$P_3 \times P_5$	76.71 **	-4.44	15.64 **	-3.21	77.87 **	4.71	8.33	-5.92	8.34	-5.92	8.33	-5.92
$P_3 \times P_6$	89.04 **	2.22	22.11 **	2.21	89.02 **	11.28**	-10.58 *	-10.58*	-10.59 *	-10.61*	-10.59 *	-10.60*
$P_3 \times P_7$	58.90 **	1.75	2.66	1.76	58.91 **	2.21	-7.58	-14.69**	-7.58	-14.67**	-7.58	-14.68**
$P_3 \times P_8$	48.90 **	-3.81	15.63 *	-3.81	48.90 **	5.02	-10.30 *	-17.50 **	-10.24	-17.48 **	-10.27 *	-17.49 **
$P_3 \times P_9$	40.41 **	-9.29	5.57	-9.31	40.40 **	-2.43	4.39	-9.85 *	4.43	-9.83 *	4.41	-9.84 *
$P_3 \times P_{10}$	67.12 **	4.27	7.96	4.29	67.12 **	6.09	-13.18 **	-15.15 **	-13.19 **	-15.15 **	-13.19 **	-15.15 **
$P_4 \times P_5$	73.97 **	-5.93	35.11 **	-5.92	73.98 **	10.92*	12.26 *	-12.04 **	12.22 *	-12.05 **	12.24 *	-12.04 **
$P_4 \times P_6$	80.82 **	-2.22	40.41 **	-2.23	80.81 **	15.28 **	-8.82	-17.73 **	-8.83	-17.75 **	-8.82	-17.74 **
$P_4 \times P_7$	39.32 **	-10.79*	8.23	-10.76	39.34 **	-2.19	3.36	-13.92 **	3.31	-13.92 **	3.34	-13.92 **
$P_4 \times P_8$	44.66 **	12.34*	12.36	12.36	44.67 **	12.35*	-9.82	-11.53 *	-9.83	-11.49 *	-9.83	-11.51 *
$P_4 \times P_9$	34.38 **	1.03	4.3	1.00	34.35 **	2.65	3.42	-1.01	3.44	-1.03	3.43	-1.02
$P_4 \times P_{10}$	53.42 **	-4.27	19.17 **	-4.23	53.44 **	6.18	-20.91 **	-26.98 **	-20.92 **	-26.99 **	-20.91 **	-26.98 **
$P_5 \times P_6$	75.34 **	-5.19	-5.2	-5.2	75.33 **	-5.19	-6.82	-19.08 **	-6.86	-19.10 **	-6.84	-19.09 **
$P_5 \times P_7$	50.68 **	-18.52**	-3.49	-18.50**	50.70 **	-11.64**	-11.19 **	-16.45 **	-11.16 *	-16.44 **	-11.17 **	-16.44 **
$P_5 \times P_8$	58.08 **	-14.52**	22.79 **	-14.50**	58.10 **	0.8	-9.31	-27.57 **	-9.25	-27.55 **	-9.28	-27.56 **
$P_5 \times P_9$	47.95 **	-20.00**	11.23	-20.01**	47.93 **	-6.94	10	-17.50 **	10.02	-17.50 **	10.01	-17.50 **
$P_5 \times P_{10}$	68.49 **	-8.89*	5.15	-8.89	68.49 **	-2.38	-5.5	-19.80 **	-5.52	-19.80 **	-5.51	-19.80 **
$P_6 \times P_7$	73.97 **	-5.93	11.38	-5.94	73.95 **	2.00	-6.82	-13.99 **	-6.86	-13.99 **	-6.84	-13.99 **
$P_6 \times P_8$	56.16 **	-15.56**	21.27 **	-15.56**	56.16 **	-0.44	-5.52	-13.11 **	-5.49	-13.14 **	-5.51	-13.12 **
$P_6 \times P_9$	46.58 **	-20.74**	10.23	-20.73**	46.58 **	-7.79	3.51	-10.61 *	3.52	-10.64 *	3.51	-10.62 *
$P_6 \times P_{10}$	49.32 **	-19.26**	-6.8	-19.25**	49.33 **	-13.48**	-15.12 **	-17.05 **	-15.15 **	-17.08 **	-15.13 **	-17.06 **
$P_7 \times P_8$	48.49 **	-4.91	15.35 *	-4.88	48.52 **	4.25	-2.64	-17.34 **	-2.61	-17.34 **	-2.62	-17.34 **
$P_7 \times P_9$	35.21 **	-13.42**	1.7	-13.40*	35.22 **	-6.47	-7.89	-26.57 **	-7.86	-26.55 **	-7.88	-26.56 **
$P_7 \times P_{10}$	39.59 **	-12.91**	-10.59	-12.86*	39.61 **	-11.76*	-10.85 *	-19.58 **	-10.86 *	-19.56 **	-10.86 *	-19.57 **
$P_8 \times P9$	23.70 **	-7.00	-3.96	-7.00	23.68 **	-5.50	12.28 *	5.44	12.29 *	5.47	12.29 *	5.45
$P_8 \times P_{10}$	41.10 **	-11.97*	9.57	-11.95*	41.09 **	-2.37	-10.21 *	-15.50 **	-10.19	-15.53 **	-10.20 *	-15.51 **
$P_9 \times P_{10}$	37.95 **	-13.93**	3.7	-13.94*	37.92 **	-5.94	9.15	-3.54	11.50 *	-1.50	10.34	-2.51
No. of crosses with significant (+) heterosis	45	4	23	1	0	6	12	0	13	0	12	0
No. of crosses with significant (-) 'heterosis	0	15	0	11	43	4	8	28	6	28	8	28
Range of heterosis	21.92-95.89	-20.74-20.21	-10.59-95.88	-20.73-20.17	8.57-95.88	-15.23-20.19	-20.91-38.57	-27.57-5.44	-20.92-38.59	-27.55-5.47	-20.91-38.58	-27.56-5.45

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

Table 1: Contd….

Crosses	Day to first staminate flower anthesis						Day to first pistillate flower anthesis					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	5.16	-3.62	5.2	-3.58	5.18	-3.60	7.2	-7.49	7.14	-7.55	7.17	-7.52
$P_1 \times P_3$	9.36	-4.78	9.37	-4.78	9.36	-4.78	10.17	-5.79	10.19	-5.79	10.18	-5.79
$P_1 \times P_4$	10.91	-3.44	10.91 *	-3.43	10.91 *	-3.43	17.25 **	3.39	17.25 **	3.39	17.25 **	3.39
$P_1 \times P_5$	11.35 *	-0.14	11.36 *	-0.13	11.35 *	-0.14	12.16	-4.1	12.17 *	-4.09	12.16 *	-4.09
$P_1 \times P_6$	-7.56	-19.87**	-7.56	-19.88**	-7.56	-19.88**	5.71	-9.75	2.37	-12.60**	4.01	-11.20*
$P_1 \times P_7$	6.27	2.06	6.27	2.13	6.27	2.09	7.27	-7.43	7.28	-7.43	7.27	-7.43
$P_1 \times P_8$	1.62	-4.67	1.63	-4.66	1.63	-4.67	15.14 *	2.43	15.14 **	2.51	15.14 **	2.47
$P_1 \times P_9$	-1.21	-5.83	-1.22	-5.84	-1.21	-5.83	9.8	2.91	9.81	2.91	9.8	2.91
$P_1 \times P_{10}$	2.4	-3.94	2.41	-3.94	2.4	-3.94	3.47	-4.72	3.48	-4.74	3.48	-4.73
$P_2 \times P_3$	6.69	1.35	6.7	1.36	6.69	1.35	0.43	-0.49	0.43	-0.48	0.43	-0.49
$P_2 \times P_4$	-4.68	-9.45	-4.69	-9.46*	-4.69	-9.46*	3.28	1.07	3.28	1.07	3.28	1.07
$P_2 \times P_5$	-1.4	-3.52	-1.4	-3.52	-1.4	-3.52	-2.03	-2.93	-2.04	-2.93	-2.04	-2.93
$P_2 \times P_6$	7.49	1.65	7.49	1.66	7.49	1.65	-0.86	-1.91	-0.86	-1.91	-0.86	-1.91
$P_2 \times P_7$	15.18 **	9.93	15.26 **	9.93*	15.22 **	9.93*	3.64	3.64	3.64	3.64	3.64	3.64
$P_2 \times P_8$	4.04	1.65	4.05	1.65	4.04	1.65	13.25 *	9.85	13.33 **	9.84*	13.29 **	9.85*
$P_2 \times P_9$	2.53	-1.42	2.52	-1.42	2.53	-1.42	5.35	-3.00	5.34	-3.01	5.35	-3.00
$P_2 \times P_{10}$	-6.85	-8.98	-6.85	-8.99	-6.85	-8.98	1.06	-5.29	1.03	-5.29	1.05	-5.29
$P_3 \times P_4$	-11.97 *	-11.97*	-11.96 **	-11.96**	-11.97 *	-11.97*	3.57	0.42	3.56	0.42	3.56	0.42
$P_3 \times P_5$	-3.77	-6.58	-3.77	-6.58	-3.77	-6.58	3.54	3.54	3.54	3.54	3.54	3.54
$P_3 \times P_6$	3.53	3.06	3.53	3.06	3.53	3.06	4.39	4.24	4.39	4.24	4.39	4.24
$P_3 \times P_7$	1.88	-7.64	1.96	-7.62	1.92	-7.63	4.28	3.33	4.28	3.33	4.28	3.33

$P_3 \times P_8$	4.52	-2.99	4.54	-2.98	4.53	-2.98	4.3	0.25	4.38	0.25	4.34	0.25
$P_3 \times P_9$	2.53	-6.36	2.53	-6.35	2.53	-6.35	8.72	-0.81	5.81	-3.46	7.24	-2.16
$P_3 \times P_{10}$	6.22	-1.41	6.22	-1.41	6.22	-1.41	12.48 *	4.46	12.45 *	4.45	12.47 *	4.45
$P_4 \times P_5$	-2.15	-5.01	-2.16	-5.01	-2.15	-5.01	5.69	2.48	5.69	2.48	5.69	2.48
$P_4 \times P_6$	-2.99	-3.42	-2.99	-3.43	-2.99	-3.42	1.31	-1.91	1.31	-1.90	1.31	-1.90
$P_4 \times P_7$	1.14	-8.31	1.2	-8.31	1.17	-8.31	1.07	-1.09	1.07	-1.09	1.07	-1.09
$P_4 \times P_8$	-1.52	-8.60	-1.51	-8.59	-1.52	-8.60	9.05	8.10	9.14	8.10	9.1	8.10
$P_4 \times P_9$	1.3	-7.48	1.3	-7.47	1.3	-7.47	11.16	4.60	11.16 *	4.59	11.16 *	4.59
$P_4 \times P_{10}$	-1.52	-8.6	-1.52	-8.59	-1.52	-8.6	3.5	-0.88	3.48	-0.88	3.49	-0.88
$P_5 \times P_6$	4.33	0.83	4.32	0.82	4.32	0.83	3.12	2.97	3.11	2.96	3.11	2.96
$P_5 \times P_7$	5.69	-1.30	5.76	-1.30	5.73	-1.30	4.1	3.15	4.08	3.13	4.09	3.14
$P_5 \times P_8$	2.83	-1.69	2.84	-1.69	2.83	-1.69	1.77	-2.19	1.83	-2.2	1.8	-2.19
$P_5 \times P_9$	-3.61	-9.32	-3.62	-9.32*	-3.62	-9.32	13.26 *	3.33	13.26 **	3.33	13.26 *	3.33
$P_5 \times P_{10}$	-6.12	-10.25*	-6.13	-10.25*	-6.12	-10.25*	7.69	0.01	6.82	-0.78	7.25	-0.39
$P_6 \times P_7$	4.78	-5.43	4.85	-5.44	4.81	-5.44	0.21	-0.85	0.21	-0.85	0.21	-0.85
$P_6 \times P_8$	0.9	-6.77	0.91	-6.77	0.9	-6.77	0.82	-3.24	0.9	-3.23	0.86	-3.24
$P_6 \times P_9$	5.73	-3.87	5.72	-3.87	5.72	-3.87	12.33 *	2.33	12.32 *	2.33	12.32 *	2.33
$P_6 \times P_{10}$	3.8	-4.09	3.8	-4.09	3.8	-4.09	1.9	-5.51	1.87	-5.51	1.89	-5.51
$P_7 \times P_8$	4.78	2.35	4.85	2.36	4.82	2.35	7.06	3.85	7.14	3.85	7.1	3.85
$P_7 \times P_9$	-2.65	-3.37	-2.59	-3.38	-2.62	-3.37	14.42 *	5.35	14.42 **	5.35	14.42 **	5.35
$P_7 \times P_{10}$	3.54	1.14	3.61	1.13	3.58	1.13	11.2	4.21	11.16 *	4.21	11.18 *	4.21
$P_8 \times P9$	4.01	2.35	4	2.36	4.01	2.35	8.76	3.24	8.76	3.31	8.76	3.28
$P_8 \times P_{10}$	-0.48	-0.48	-0.47	-0.48	-0.48	-0.48	10.36	6.62	10.33 *	6.71	10.34 *	6.66
$P_9 \times P_{10}$	2.29	0.65	2.27	0.64	2.28	0.65	1.4	-0.38	1.39	-0.41	1.39	-0.40
No. of crosses with significant (+) heterosis	2	0	3	1	3	1	7	0	11	1	11	1
No. of crosses with significant (-) 'heterosis	1	3	1	5	1	4	0	0	0	1	0	1
Range of heterosis	-11.97-15.18	-19.87-9.93	-11.96-15.26	-19.88-9.93	-11.97-15.22	-19.88-9.93	-2.03-17.25	-7.49-9.85	-2.04-17.25	-12.60-9.84	-2.04-17.25	-11.20-9.85

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

Table 1: Contd….

Crosses	Days to first fruit harvest						No. of primery branches per plant					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	7.5	-6.32	7.51	-6.32	7.5	-6.32	-28.64**	25.88**	-28.65**	25.84*	-28.64**	25.86**
$P_1 \times P_3$	5.57	-4.90	5.57	-4.9	5.57	-4.90	-30.94**	18.66*	-30.93**	19.08	-30.94**	18.87*
$P_1 \times P_4$	14.12 **	2.63	14.11 **	2.62	14.12 **	2.63	-32.82**	2.5	-32.80**	2.49	-32.81**	2.49
$P_1 \times P_5$	8.57	-2.36	8.57	-2.36	8.57	-2.36	-1.42	13.58*	-1.40	13.61	-1.41	13.59*
$P_1 \times P_6$	3.88	-4.81	3.88	-4.82	3.88	-4.81	-2.42	7.84	-2.87	7.34	-2.65	7.58
$P_1 \times P_7$	8.38	0.70	8.39	0.70	8.38	0.70	-27.02**	3.29	-26.48**	4.06	-26.75**	3.68
$P_1 \times P_8$	3.76	-5.90	3.76	-5.90	3.76	-5.90	-9.64*	-9.64*	-9.62	-9.62	-9.63	-9.63
$P_1 \times P_9$	9.32	4.11	9.32	4.10	9.32	4.11	0.27	17.11**	0.3	17.17*	0.29	17.14**
$P_1 \times P_{10}$	2.88	-10.01*	2.76	-10.12*	2.82	-10.07*	3.40	5.41	3.59	5.58	3.50	5.50
$P_2 \times P_3$	1.98	-1.36	1.97	-1.35	1.97	-1.36	-7.80	58.40**	-7.76	59.04**	-7.78	58.73**
$P_2 \times P_4$	3.43	0.22	3.43	0.22	3.43	0.22	-8.29	39.93**	-8.57	39.43**	-8.43	39.67**
$P_2 \times P_5$	0.51	-2.61	0.51	-2.61	0.51	-2.61	4.43	20.32**	4.47	20.37**	4.45	20.34**
$P_2 \times P_6$	5.5	0.33	5.5	0.33	5.5	0.33	26.44**	39.73**	26.65**	39.95**	26.54**	39.84**
$P_2 \times P_7$	8.59	1.85	8.59	1.86	8.59	1.85	-9.76*	27.73**	-9.74	27.76**	-9.75	27.74**
$P_2 \times P_8$	7.65	3.43	7.66	3.44	7.65	3.44	-2.86	-2.86	-2.87	-2.87	-2.86	-2.86
$P_2 \times P_9$	6.01	-3.00	6.01	-2.99	6.01	-2.99	4.92	22.54**	4.96	22.61**	4.94	22.58**
$P_2 \times P_{10}$	2.02	1.63	2.02	1.64	2.02	1.64	20.47**	22.81**	20.50**	22.82**	20.48**	22.81**
$P_3 \times P_4$	0.68	0.51	0.68	0.51	0.68	0.51	-2.91	48.13**	-2.87	48.14**	-2.89	48.13**
$P_3 \times P_5$	3.6	3.43	3.6	3.43	3.6	3.43	-0.15	15.05**	-0.12	15.08*	-0.13	15.07*
$P_3 \times P_6$	3.26	1.52	3.27	1.52	3.27	1.52	27.66**	41.08**	27.70**	41.11**	27.68**	41.09**
$P_3 \times P_7$	1.05	-2.03	1.04	-2.03	1.04	-2.03	-24.43**	6.96	-24.39**	7.02	-24.41**	6.99
$P_3 \times P_8$	-0.4	-1.07	-0.4	-1.07	-0.4	-1.07	-4.92	-4.92	-4.91	-4.91	-4.92	-4.92
$P_3 \times P_9$	2.8	-2.76	2.79	-2.76	2.8	-2.76	-2.40	14.00*	-2.38	14.04*	-2.39	14.02*
$P_3 \times P_{10}$	5.74	2.68	5.74	2.67	5.74	2.67	4.70	6.73	4.71	6.72	4.70	6.73
$P_4 \times P_5$	6.58	6.58	6.58	6.58	6.58	6.58	3.45	19.19**	3.47	19.22**	3.46	19.20**
$P_4 \times P_6$	1.37	-0.51	1.37	-0.50	1.37	-0.50	-4.38	5.68	-4.33	5.71	-4.35	5.70
$P_4 \times P_7$	7.14	3.71	7.31	3.88	7.23	3.79	-17.09**	17.34*	-17.05**	17.41*	-17.07**	17.38*
$P_4 \times P_8$	5.95	5.06	5.95	5.06	5.95	5.06	14.45**	14.45**	14.49*	14.49*	14.47**	14.47**
$P_4 \times P_9$	5.48	-0.39	5.48	-0.39	5.48	-0.39	25.53**	46.62**	25.55**	46.67**	25.54**	46.64**
$P_4 \times P_{10}$	3.54	0.71	3.54	0.7	3.54	0.71	3.82	5.83	3.82	5.82	3.82	5.83--
$P_5 \times P_6$	2.41	0.51	2.41	0.51	2.41	0.51	1.98	12.70*	2.00	12.72	1.99	12.71*

$P_5 \times P_7$	8.59	5.11	8.59	5.11	8.59	5.11	-10.05*	3.63	-10.04	3.65	-10.05	3.64
$P_5 \times P_8$	0.91	0.06	0.9	0.05	0.9	0.05	10.79*	10.79*	10.83	10.83	10.81*	10.81*
$P_5 \times P_9$	-0.18	-5.73	-0.18	-5.73	-0.18	-5.73	-15.95**	-3.16	-15.93**	-3.14	-15.94**	-3.15
$P_5 \times P_{10}$	-2.59	-5.25	-2.58	-5.25	-2.58	-5.25	-11.23*	-9.5	-11.2	-9.5	-11.21*	-9.5
$P_6 \times P_7$	-3.48	-4.81	-3.49	-4.82	-3.49	-4.81	-14.89**	-5.95	-14.88*	-5.95	-14.89**	-5.95
$P_6 \times P_8$	-3.26	-4.25	-3.27	-4.25	-3.27	-4.25	6.38	6.38	6.41	6.41	6.39	6.39
$P_6 \times P_9$	3.63	-0.29	3.63	-0.28	3.63	-0.28	-16.51**	-7.73	-16.52**	-7.75	-16.51**	-7.74
$P_6 \times P_{10}$	1.89	-2.73	1.89	-2.74	1.89	-2.74	-12.62**	-10.92*	-12.60*	-10.92	-12.61*	-10.92*
$P_7 \times P_8$	2.5	0.06	2.49	0.05	2.5	0.06	5.72	5.72	5.75	5.75	5.74	5.74
$P_7 \times P_9$	12.98 **	10.22*	12.85 *	10.10*	12.91 **	10.16*	-24.41**	-11.71*	-24.32**	-11.59	-24.36**	-11.65
$P_7 \times P_{10}$	6.97	0.71	6.97	0.71	6.97	0.71	-8.36	-6.58	-8.36	-6.6	-8.36	-6.59
$P_8 \times P_9$	5.36	0.34	5.36	0.34	5.36	0.34	17.83**	17.83**	17.84**	17.84**	17.84**	17.84**
$P_8 \times P_{10}$	3.17	-0.49	3.17	-0.49	3.17	-0.49	-18.34**	-18.34**	-18.33**	-18.33**	-18.34**	-18.34**
$P_9 \times P_{10}$	6.96	-1.75	6.97	-1.75	6.97	-1.75	-2.93	-1.05	-2.94	-1.07	-2.93	-1.06
No. of crosses with significant (+) heterosis	2	1	2	1	2	1	6	22	5	16	7	22
No. of crosses with significant (-) ‘heterosis	0	1	0	1	0	1	16	4	11	1	12	2
Range of heterosis	-3.48-14.12	-10.01-10.22	-3.49-14.11	-10.12-10.10	-3.49-14.12	-10.07-10.16	-32.82-27.66	-18.34-58.40	-32.80-27.70	-18.33-59.04	-32.81-27.68	-18.34-58.73

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

Table 1: Contd….

Crosses	Vine length (M)						Fruit length (cm)					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	0.66	17.15**	0.72	17.23**	0.69	17.19**	-0.47	3.42	-0.48	3.41	-0.47	3.42
$P_1 \times P_3$	-26.79**	-22.39**	-26.76**	-22.38**	-26.78**	-22.38**	-12.24**	-2.1	-12.24**	-2.09	-12.24**	-2.1
$P_1 \times P_4$	-21.16**	-9.73*	-21.16**	-9.76	-21.16**	-9.74	-12.00**	-12.00**	-11.99**	-11.99**	-12.00**	-12.00**
$P_1 \times P_5$	9.81*	32.20**	9.84	32.14**	9.82*	32.17**	-21.65**	2.45	-21.65**	2.45	-21.65**	2.45
$P_1 \times P_6$	-11.31**	-11.31**	-11.28*	-11.28*	-11.30*	-11.30*	-13.87**	-7.33	-13.88**	-7.34	-13.88**	-7.34
$P_1 \times P_7$	-2.77	31.56**	-2.75	31.56**	-2.76	31.56**	-21.72**	1.53	-21.72**	1.53	-21.72**	1.53
$P_1 \times P_8$	-14.59**	6.5	-14.58**	6.47	-14.58**	6.48	-12.00**	-8.78*	-11.99**	-8.77*	-12.00**	-8.78*
$P_1 \times P_9$	-13.66**	2.22	-13.63*	2.24	-13.64**	2.23	-35.76**	-16.01**	-35.77**	-16.01**	-35.77**	-16.01**
$P_1 \times P_{10}$	-1.45	6.06	-1.44	6.07	-1.45	6.07	-19.53**	-6.56	-19.52**	-6.54	-19.53**	-6.55
$P_2 \times P_3$	-11.31**	-5.97	-11.33*	-6.03	-11.32*	-6	-19.84**	-16.71**	-19.83**	-16.71**	-19.84**	-16.71**
$P_2 \times P_4$	-14.12**	-1.67	-14.12**	-1.7	-14.12**	-1.69	-5.88	-5.88	-5.88	-5.88	-5.88	-5.88
$P_2 \times P_5$	9.81*	27.80**	9.84	27.84**	9.82*	27.82**	-11.06**	-7.58	-11.06**	-7.59	-11.06**	-7.59
$P_2 \times P_6$	2.82	2.82	2.84	2.84	2.83	2.83	-9.88*	-6.36	-9.89**	-6.37	-9.88*	-6.36
$P_2 \times P_7$	-8.49*	6.5	-8.48	6.51	-8.49	6.51	-8.47*	-4.89	-8.46*	-4.89	-8.47*	-4.89
$P_2 \times P_8$	-25.39**	-13.16**	-25.41**	-13.18*	-25.40**	-13.17*	-6.94	-3.54	-6.95	-3.54	-6.94	-3.54
$P_2 \times P_9$	-19.76**	-6.61	-19.72**	-6.57	-19.74**	-6.59	-14.35**	-11.00*	-14.34**	-11.00**	-14.35**	-11.00**
$P_2 \times P_{10}$	-12.72**	-6.06	-12.68*	-6.02	-12.70**	-6.04	-28.53**	-25.74**	-28.91**	-26.13**	-28.72**	-25.94**
$P_3 \times P_4$	-21.12**	-16.37**	-21.16**	-16.45**	-21.14**	-16.41**	-7.76	-7.76	-7.76*	-7.76*	-7.76	-7.76
$P_3 \times P_5$	9.81*	16.42**	9.84	16.40**	9.82*	16.41**	-14.82**	-4.99	-14.82**	-4.97	-14.82**	-4.98
$P_3 \times P_6$	-9.90*	-9.90*	-9.88	-9.88	-9.89*	-9.89*	-14.35**	-7.85	-14.34**	-7.84	-14.35**	-7.84
$P_3 \times P_7$	-14.12**	-8.96*	-14.17**	-9.04	-14.15**	-11.55	-13.18**	-3.15	-13.17**	-3.13	-13.17**	-3.14
$P_3 \times P_8$	-18.35**	-13.43**	-18.37**	-13.49*	-18.36**	-13.46**	-5.69	-2.24	-5.69	-2.24	-5.69	-2.24
$P_3 \times P_9$	-14.12**	-8.96*	-14.12**	-8.99	-14.12**	-8.97	-23.55**	-14.72**	-23.57**	-14.73**	-23.56**	-14.73 **
$P_3 \times P_{10}$	-5.68	11.66	-5.64	11.69	-5.66	11.67	-17.18**	-7.61	-17.17**	-7.6	-17.17**	-7.60
$P_4 \times P_5$	11.22**	27.35**	11.24*	27.32**	11.23*	27.34**	-12.94**	-12.94**	-12.94**	-12.94**	-12.94**	-12.94 **
$P_4 \times P_6$	-5.63	-5.63	-5.6	-5.6	-5.61	-5.61	-13.12**	-13.12**	-13.11**	-13.11**	-13.12**	-13.12 **
$P_4 \times P_7$	-2.82	11.28*	-2.75	11.31	-2.78	11.30*	-13.96**	-13.96**	-13.95**	-13.95**	-13.96**	-13.96 **
$P_4 \times P_8$	-18.35**	-6.5	-18.37**	-6.56	-18.36**	-6.53	-7.76	-7.76	-7.76*	-7.76*	-7.76	-7.76
$P_4 \times P_9$	-14.12**	-1.67	-14.12**	-1.7	-14.12**	-1.69	-24.54**	-24.54**	-24.55**	-24.55**	-24.54**	-24.54**
$P_4 \times P_{10}$	-25.62**	-19.95**	-25.59**	-19.91**	-25.60**	-19.93**	-9.41*	-9.41*	-9.41*	-9.41*	-9.41*	-9.41*
$P_5 \times P_6$	14.50**	14.50**	14.53**	14.53**	14.52**	14.52**	-12.00**	-5.32	-11.21**	-4.46	-11.60**	-4.88
$P_5 \times P_7$	2.77	23.73**	2.8	23.67**	2.78	23.70**	-18.12**	6.19	-18.12**	6.19	-18.12**	6.19
$P_5 \times P_8$	1.36	22.03**	1.35	21.93**	1.36	21.98**	-12.71**	-9.51*	-12.71**	-9.52*	-12.71**	-9.52*
$P_5 \times P_9$	-31.02**	-18.33**	-31.00**	-18.32**	-31.01**	-18.33**	-31.53**	-10.46	-31.54**	-10.47*	-31.53**	-10.47*
$P_5 \times P_{10}$	2.53	10.35*	2.57	10.39	2.55	10.37*	-18.59**	-5.46	-18.60**	-5.47	-18.59**	-5.46
$P_6 \times P_7$	-18.35**	-18.35**	-18.37**	-18.37**	-18.36**	-18.36**	-15.84**	-9.45*	-15.84**	-9.45*	-15.84**	-9.45*
$P_6 \times P_8$	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-12.71**	-9.51*	-12.71**	-9.52*	-12.71**	-9.52*
$P_6 \times P_9$	-19.76**	-19.76**	-19.72**	-19.72**	-19.74**	-19.74**	-19.37**	-13.25**	-19.37**	-13.25**	-19.37**	-13.25**
$P_6 \times P_{10}$	-14.83**	-14.83**	-14.85**	-14.85**	-14.84**	-14.84**	-23.80**	-18.01**	-23.86**	-18.08**	-23.83**	-18.04**
$P_7 \times P_8$	-18.35**	1.81	-18.37**	1.74	-18.36**	1.78	-10.12*	-6.83	-10.11**	-6.82	-10.12*	-6.83
$P_7 \times P_9$	-25.39**	-11.67*	-25.41**	-11.7	-25.40**	-11.68*	-18.57**	5.6	-18.57**	5.6	-18.57**	5.6

$P_7 \times P_{10}$	-26.79**	-21.21**	-26.76**	-21.18**	-26.78**	-21.19**	-12.94**	1.09	-12.94**	1.1	-12.94**	1.1
$P_8 \times P9$	-14.12**	1.67	-14.12**	1.66	-14.12**	1.66	-23.14**	-20.33**	-23.13**	-20.32**	-23.13**	-20.32**
$P_8 \times P_{10}$	-18.30**	-12.07**	-18.32**	-12.09*	-18.31**	-12.08*	-9.57*	-6.26	-9.56*	-6.25	-9.57*	-6.26
$P_9 \times P_{10}$	-19.76**	-13.64**	-19.72**	-13.60*	-19.74**	-13.62**	-22.80**	-10.36*	-22.75**	-10.28*	-22.77**	-10.32*
No. of crosses with significant (+) heterosis	4	11	2	7	4	11	3	0	3	0	3	5
No. of crosses with significant(-) 'heterosis	28	15	27	13	28	14	36	19	37	21	36	19
Range of heterosis	-26.79-14.50	-22.39-32.20	-31.00-14.53	-22.38-32.14	-31.01-11.23	-22.38-32.17	-35.76- -0.47	-25.74-6.19	-35.77- -0.48	-.24.55-6.19	-35.77- -0.47	-25.94-6.19

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

Table 1: Cont…..

Crosses	Fruit circumference (cm)						Total soluble solid					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	-28.89**	3.57	-28.88**	3.6	-28.89**	3.59	-52.02**	-16.00**	-52.03**	-15.96**	-52.03**	-15.98**
$P_1 \times P_3$	-26.17**	1.35	-26.18**	1.37	-26.18**	1.36	-37.88**	-12.77**	-37.87**	-12.73**	-37.88**	-12.75**
$P_1 \times P_4$	-34.99**	-11.98*	-34.98**	-11.96**	-34.99**	-11.97**	-37.88**	-22.15**	-37.87**	-22.15**	-37.88**	-22.15**
$P_1 \times P_5$	-28.95**	3.48	-28.95**	3.5	-28.95**	3.49	-46.97**	-18.60**	-47.48**	-19.38**	-47.23**	-18.99**
$P_1 \times P_6$	-28.60**	-12.37**	-28.63**	-12.42**	-28.61**	-12.40**	-43.94**	-17.78**	-44.46**	-18.52**	-44.20**	-18.15**
$P_1 \times P_7$	-34.28**	-7.98	-34.28**	-7.96	-34.28**	-7.97	-53.54**	9.28	-53.56**	9.47	-53.55**	9.37
$P_1 \times P_8$	-16.68**	17.22**	-16.67**	17.18**	-16.68**	17.20**	-33.33**	-33.33**	-33.37**	-33.37**	-33.35**	-33.35**
$P_1 \times P_9$	-32.15**	-32.15**	-32.14**	-32.14**	-32.15**	-32.15**	-48.99**	-3.81	-49.01**	-2.92	-49.00**	-3.36
$P_1 \times P_{10}$	-34.89**	-5.17	-34.89**	-5.15	-34.89**	-5.16	-53.54**	-6.22	-53.56**	-6.29	-53.55**	-6.26
$P_2 \times P_3$	-34.99**	-10.75*	-34.98**	-10.72*	-34.99**	-10.74*	-43.94**	-21.28**	-43.96**	-21.28**	-43.95**	-21.28**
$P_2 \times P_4$	-33.47**	-9.92*	-33.47**	-9.92*	-33.47**	-9.92*	-34.85**	-18.35**	-34.36**	-17.74**	-34.60**	-18.05**
$P_2 \times P_5$	-37.33**	1.15	-37.33**	1.14	-37.33**	1.15	-41.41**	-10.08*	-41.44**	-10.11**	-41.43**	-10.09*
$P_2 \times P_6$	-30.81**	-15.09**	-30.83**	-15.12**	-30.82**	-15.11**	-41.41**	-14.07**	-41.44**	-14.09**	-41.43**	-14.08**
$P_2 \times P_7$	-34.59**	-8.4	-34.59**	-8.4	-34.59**	-8.4	-50.51**	-13.35**	-50.50**	-13.27**	-50.50**	-13.31**
$P_2 \times P_8$	-34.69**	-8.12	-34.69**	-8.16	-34.69**	-8.14	-37.88**	-37.88**	-37.87**	-37.87**	-37.88**	-37.88**
$P_2 \times P_9$	-21.97**	-21.97**	-21.97**	-21.97**	-21.97**	-21.97**	-44.44**	-2.74	-44.46**	-2.69	-44.45**	-2.71
$P_2 \times P_{10}$	-31.00**	6.27	-30.94**	6.34	-30.97**	6.3	-48.99**	-10.70*	-49.01**	-10.67**	-49.00**	-10.68*
$P_3 \times P_4$	-30.11**	-5.37	-30.10**	-5.35	-30.11**	-5.36	-27.27**	-8.86*	-27.77**	-9.49**	-27.53**	-9.18**
$P_3 \times P_5$	-31.94**	-6.56	-31.93**	-6.53	-31.94**	-6.55	-34.85**	-8.51*	-34.85**	-8.48*	-34.85**	-8.50*
$P_3 \times P_6$	-24.62**	-7.49	-24.61**	-7.49*	-24.61**	-7.49	-32.88**	-5.74	-32.87**	-5.7	-32.88**	-5.72
$P_3 \times P_7$	-34.99**	-10.75*	-34.98**	-10.72*	-34.99**	-10.74*	-42.93**	-19.86**	-42.92**	-19.82**	-42.93**	-19.84**
$P_3 \times P_8$	-34.18**	-9.64*	-34.18**	-9.62*	-34.18**	-9.63*	-28.79**	-28.79**	-28.81**	-28.81**	-28.80**	-28.80**
$P_3 \times P_9$	-22.79**	-22.79**	-22.99**	-22.99**	-22.89**	-22.89**	-44.44**	-21.99**	-44.46**	-21.97**	-44.45**	-21.98**
$P_3 \times P_{10}$	-34.69**	-10.34*	-34.69**	-10.32*	-34.69**	-10.33*	-45.96**	-24.11**	-45.99**	-24.13**	-45.98**	-24.12**
$P_4 \times P_5$	-32.15**	-8.13	-32.14**	-8.12	-32.15**	-8.12	-36.36**	-20.25**	-36.39**	-20.29**	-36.38**	-20.27**
$P_4 \times P_6$	-30.52**	-14.73**	-30.52**	-14.74**	-30.52**	-14.74**	-31.82**	-14.56**	-31.83**	-14.58**	-31.83**	-14.57**
$P_4 \times P_7$	-31.84**	-7.71	-31.83**	-7.7	-31.84**	-7.71	-45.45**	-31.65**	-45.50**	-31.70**	-45.48**	-31.67**
$P_4 \times P_8$	-32.15**	-8.13	-32.14**	-8.12	-32.15**	-8.12	-27.27**	-27.27**	-27.28**	-27.28**	-27.28**	-27.28**
$P_4 \times P_9$	-24.01**	-24.01**	-24.01**	-24.01**	-24.01**	-24.01**	-36.36**	-20.25**	-36.39**	-20.29**	-36.38**	-20.27**
$P_4 \times P_{10}$	-31.74**	-7.58	-31.73**	-7.56	-31.73**	-7.57	-37.88**	-22.15**	-37.87**	-22.15**	-37.88**	-22.15**
$P_5 \times P_6$	-31.27**	-15.66**	-32.26**	-16.88**	-31.78**	-16.28**	-33.33**	-2.22	-33.37**	-2.25	-33.35**	-2.24
$P_5 \times P_7$	-25.23**	4.70	-25.22**	4.72	-25.22**	4.71	-48.94**	-21.63**	-48.96**	-21.66**	-48.95**	-21.64**
$P_5 \times P_8$	-33.88**	-6.97	-33.87**	-7	-33.87**	-6.99	-33.33**	-33.33**	-33.37**	-33.37**	-33.35**	-33.35**
$P_5 \times P_9$	-25.94**	-25.94**	-25.93**	-25.93**	-25.94**	-25.94**	-53.54**	-28.68**	-53.56**	-28.72**	-53.55**	-28.70**
$P_5 \times P_{10}$	-33.98**	1.68	-33.98**	1.67	-33.98**	1.67	-34.85**	53.57	-34.85**	53.68	-34.85**	53.62
$P_6 \times P_7$	-32.25**	-16.85**	-32.25**	-16.87**	-32.25**	-16.86**	-45.96**	-20.74**	-45.99**	-20.77**	-45.98**	-20.76**
$P_6 \times P_8$	-35.81**	-21.22**	-35.81**	-21.23**	-35.81**	-21.23**	-28.79**	-28.79**	-28.81**	-28.81**	-28.80**	-28.80**
$P_6 \times P_9$	-21.76**	-21.76**	-21.77**	-21.77**	-21.76**	-21.76**	-43.94**	-17.78**	-44.46**	-18.52**	-44.20**	-18.15**
$P_6 \times P_{10}$	-34.69**	-19.85**	-34.48**	-19.60**	-34.58**	-19.72**	-44.44**	-18.52**	-44.46**	-18.52**	-44.45**	-18.52**
$P_7 \times P_8$	-26.42**	3.03	-26.41**	3.05	-26.41**	3.04	-36.36**	-36.36**	-36.39**	-36.39**	-36.38**	-36.38**
$P_7 \times P_9$	-27.77**	-27.77**	-27.77**	-27.77**	-27.77**	-27.77**	-50.51**	-6.67	-50.50**	-5.75	-50.50**	-6.21
$P_7 \times P_{10}$	-16.79**	16.52**	-16.78**	16.54**	-16.78**	16.53**	-51.01**	-1.12	-51.04**	-1.20	-51.03**	-1.16
$P_8 \times P9$	-31.74**	-31.74**	-31.74**	-31.74**	-31.74**	-31.74**	-41.41**	-41.41**	-41.44**	-41.44**	-41.43**	-41.43**
$P_8 \times P_{10}$	-27.77**	1.62	-27.79**	1.55	-27.78**	1.58	-28.79**	-28.79**	-28.81**	-28.81**	-28.80**	-28.80**
$P_9 \times P_{10}$	-23.09**	-23.09**	-22.99**	-22.99**	-23.04**	-23.04**	-34.85**	22.86**	-28.81**	35.53**	-31.80**	29.23**
No. of crosses with significant (+) heterosis	1	1	0	1	0	1	0	0	1	0	0	0
No. of crosses with significant (-)	44	22	45	24	45	22	45	44	25	36	45	44

'heterosis													
Range of heterosis	-37.33- -16.68	-32.15-17.22	-37.33- -16.67	-32.14-17.18	-37.33 – -16.68	-32.15-17.20	-53.54 - -27.27	-41.41-53.57	-53.56- -27.77	-41.44-53.68	-53.55-27.28	-41.43-53.62

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

Table 1: Cont….

Crosses	Ascorbic acid (mg/100g) fresh fruit						Reducing sugar (%)					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	-27.48**	-15.11**	-27.50**	-15.11**	-27.49**	-15.11**	-61.05**	-35.29**	-61.03**	-35.32**	-61.04**	-35.30**
$P_1 \times P_3$	-40.78**	-16.09**	-40.79**	-16.09**	-40.78**	-16.09**	-34.23**	-13.33**	-34.18**	-13.29**	-34.21**	-13.31**
$P_1 \times P_4$	-27.48**	-27.48**	-27.50**	-27.50**	-27.49**	-27.49**	-61.21**	-29.66**	-61.19**	-29.67**	-61.20**	-29.67**
$P_1 \times P_5$	-30.39**	2.87	-30.42**	2.86	-30.40**	2.86	-56.16**	13.04*	-56.17**	12.93**	-56.16**	12.98*
$P_1 \times P_6$	-35.92**	-11.65*	-35.93**	-11.64*	-35.93**	-11.64*	-40.98**	-0.85	-40.96**	-0.83	-40.97**	-0.84
$P_1 \times P_7$	-32.04**	0.43	-32.06**	0.42	-32.05**	0.43	-62.90**	-31.54**	-61.19**	-28.46**	-62.04**	-29.98**
$P_1 \times P_8$	-32.04**	0.43	-32.06**	0.42	-32.05**	0.43	-61.21**	-11.54*	-61.19**	-11.45**	-61.20**	-11.49*
$P_1 \times P_9$	-39.81**	-36.80**	-43.64**	-40.83**	-41.74**	-38.83**	-56.16**	-56.16**	-56.17**	-56.17**	-56.16**	-56.16**
$P_1 \times P_{10}$	-29.13**	4.73	-29.12**	4.78	-29.12**	4.76	-33.73**	70.13**	-33.68**	70.16**	-33.70**	70.14**
$P_2 \times P_3$	-29.13**	-17.05**	-29.15**	-17.04**	-29.14**	-17.04**	-61.21**	-48.89**	-61.19**	-48.87**	-61.20**	-48.88**
$P_2 \times P_4$	-27.28**	-27.28**	-31.40**	-31.40**	-29.36**	-29.36**	-56.16**	-27.17**	-56.17**	-27.26**	-56.16**	-27.22**
$P_2 \times P_5$	-28.71**	-16.55**	-28.86**	-16.71**	-28.78**	-16.63**	15.78	66.11**	15.81	65.97**	15.79	66.04**
$P_2 \times P_6$	-32.33**	-20.80**	-32.35**	-20.79**	-32.34**	-20.80**	-58.97**	-31.84**	-61.19**	-35.59**	-60.09**	-33.73**
$P_2 \times P_7$	-40.78**	-30.68**	-40.79**	-30.67**	-40.78**	-30.68**	-57.84**	-29.97**	-57.83**	-30.01**	-57.83**	-29.99**
$P_2 \times P_8$	-27.48**	-15.11**	-30.92**	-19.12**	-29.22**	-17.14**	-48.23**	-14.01**	-48.24**	-14.09**	-48.23**	-14.05**
$P_2 \times P_9$	-51.75**	-49.34**	-51.76**	-49.35**	-51.75**	-49.34**	-62.34**	-62.34**	-61.19**	-61.19**	-61.76**	-61.76**
$P_2 \times P_{10}$	-41.75**	-31.82**	-41.77**	-31.82**	-41.76**	-31.82**	-60.65**	-34.64**	-61.19**	-35.59**	-60.92**	-35.12**
$P_3 \times P_4$	-39.81**	-39.81**	-39.87**	-39.87**	-39.84**	-39.84**	-43.17**	-25.11**	-43.16**	-25.13**	-43.17**	-25.12**
$P_3 \times P_5$	-33.98**	-6.46	-34.00**	-6.47	-33.99**	-6.47	-57.84**	-44.44**	-57.83**	-44.44**	-57.83**	-44.44**
$P_3 \times P_6$	-23.01**	6.16	-23.03**	6.17	-23.02**	6.16	-40.47**	-21.56**	-40.46**	-21.57**	-40.47**	-21.56**
$P_3 \times P_7$	-39.81**	-14.72*	-39.87**	-14.79**	-39.84**	-14.75**	-57.84**	-44.44**	-57.83**	-44.44**	-57.83**	-44.44**
$P_3 \times P_8$	-41.75**	-17.47**	-41.77**	-17.48**	-41.76**	-17.48**	-56.16**	-42.22**	-56.17**	-42.27**	-56.16**	-42.24**
$P_3 \times P_9$	-30.00**	-26.50**	-31.78**	-28.37**	-30.90**	-27.45**	-33.73**	-33.73**	-33.68**	-33.68**	-33.70**	-33.70**
$P_3 \times P_{10}$	-34.95**	-7.84	-34.98**	-7.87	-34.97**	-7.85	-59.30**	-46.37**	-61.19**	-48.87**	-60.26**	-47.63**
$P_4 \times P_5$	-40.78**	-40.78**	-40.79**	-40.79**	-40.78**	-40.78**	-59.53**	-26.61**	-59.48**	-26.57**	-59.50**	-26.59**
$P_4 \times P_6$	-38.83**	-38.83**	-38.85**	-38.85**	-38.84**	-38.84**	-33.73**	11.33**	-33.68**	11.39**	-33.70**	11.36**
$P_4 \times P_7$	-30.00**	-30.00**	-31.78**	-31.78**	-30.90**	-30.90**	-57.84**	-23.55**	-57.83**	-23.58**	-57.83**	-23.56**
$P_4 \times P_8$	-38.83**	-38.83**	-38.85**	-38.85**	-38.84**	-38.84**	-55.59**	-19.47**	-56.17**	-20.58**	-55.89**	-20.03**
$P_4 \times P_9$	-29.81**	-29.81**	-29.84**	-29.84**	-29.83**	-29.83**	-33.73**	-33.73**	-33.68**	-33.68**	-33.70**	-33.70**
$P_4 \times P_{10}$	-39.81**	-39.81**	-39.84**	-39.84**	-39.82**	-39.82**	-56.16**	-20.49**	-56.17**	-20.58**	-56.16**	-20.53**
$P_5 \times P_6$	-29.81**	-3.21	-29.84**	-3.24	-29.83**	-3.23	-54.47**	-23.51**	-54.47**	-23.52**	-54.47**	-23.52**
$P_5 \times P_7$	-28.83**	5.16	-28.86**	5.16	-28.85**	5.16	-40.47**	9.85 *	-40.46**	9.76**	-40.47**	9.80**
$P_5 \times P_8$	-33.01**	-1.00	-33.02**	-0.98	-33.01**	-0.99	-63.13**	-15.90**	-61.19**	-11.45**	-62.15**	-13.65**
$P_5 \times P_9$	-31.36**	-27.93**	-31.40**	-27.97**	-31.38**	-27.95**	-56.16**	-56.16**	-56.17**	-56.17**	-56.16**	-56.16**
$P_5 \times P_{10}$	-36.89**	-6.74	-36.92**	-6.75	-36.91**	-6.75	-33.73**	70.13**	-33.68**	70.16**	-33.70**	70.14**
$P_6 \times P_7$	-26.50**	1.34	-26.55**	1.31	-26.53**	1.33	-56.16**	-26.35**	-56.17**	-26.39**	-56.16**	-26.37**
$P_6 \times P_8$	-40.78**	-18.34**	-40.79**	-18.33**	-40.78**	-18.33**	-51.10**	-17.85**	-51.05**	-17.78**	-51.07**	-17.81**
$P_6 \times P_9$	-27.48**	-23.85**	-27.50**	-23.88**	-27.49**	-23.86**	-34.74**	-34.74**	-34.73**	-34.73**	-34.73**	-34.73**
$P_6 \times P_{10}$	-33.01**	-7.63	-33.05**	-7.66	-33.03**	-7.64	-59.53**	-32.01**	-61.19**	-34.81**	-60.37**	-33.43**
$P_7 \times P_8$	-30.10**	4.2	-30.13**	4.21	-30.11**	4.2	-54.47**	-15.98**	-54.47**	-16.06**	-54.47**	-16.02**
$P_7 \times P_9$	-29.81**	-26.30**	-30.99**	-27.54**	-30.40**	-26.93**	-33.73**	-33.73**	-33.68**	-33.68**	-33.70**	-33.70**
$P_7 \times P_{10}$	-37.86**	-4.48	-37.90**	-4.49	-37.88**	-4.48	-56.16**	-19.09**	-56.17**	-19.21**	-56.16**	-19.15**
$P_8 \times P_9$	-28.45**	-24.87**	-28.48**	-24.91**	-28.46**	-24.89**	-64.59**	-64.59**	-64.61**	-64.61**	-64.60**	-64.60**
$P_8 \times P_{10}$	-25.92**	10.42	-25.94**	10.45	-25.93**	10.44	-40.47**	35.77**	-40.46**	35.85**	-40.47**	35.81**
$P_9 \times P_{10}$	-33.98**	-30.68**	-33.97**	-30.67**	-33.97**	-30.68**	-56.16**	-56.16**	-56.17**	-56.17**	-56.16**	-56.16**
No. of crosses with significant (+) heterosis	0	0	0	0	0	0	0	0	0	4	1	6
No. of crosses with significant (-) 'heterosis	45	29	45	29	45	28	43	43	44	41	44	39
Range of heterosis	-51.75 - -23.01	-49.34-10.42	-51.76- -23.03	-49.35-10.45	-51.75- -23.02	-49.34-10.44	-64.59-15.78	-64.59-70.13	-64.61-15.81	-64.61-70.16	-64.60-15.79	-64.60-70.14

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

Table 1: Contd….

Crosses	Non-reducing sugar (%)						Total sugar (%)					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	14.08*	50.00**	14.29*	50.30**	14.19*	50.15**	-50.48**	-24.09**	-50.47**	-23.84**	-50.47**	-23.96**
$P_1 \times P_3$	-21.13**	-12.5	-21.20**	-12.31	-21.16**	-12.4	-29.21**	-12.95**	-29.20**	-12.89**	-29.20**	-12.92**
$P_1 \times P_4$	-7.04	8.20	-7.37	8.06	-7.21	8.13	-53.02**	-23.71**	-53.01**	-23.67**	-53.01**	-23.69**
$P_1 \times P_5$	1.41	3.35	1.38	3.77	1.40	3.56	-47.30**	18.71**	-47.25**	18.81**	-47.28**	18.76**
$P_1 \times P_6$	-25.35**	-19.70**	-25.35**	-19.40**	-25.35**	-19.55**	-36.03**	-3.82	-36.05**	-3.82	-36.04**	-3.82
$P_1 \times P_7$	2.82	37.74**	2.76	37.65**	2.79	37.69**	-53.49**	-21.73**	-51.92**	-19.39**	-52.70**	-20.55**
$P_1 \times P_8$	-26.76**	-26.76**	-26.73**	-26.73**	-26.74**	-26.74**	-55.24**	-14.80**	-55.19**	-14.71**	-55.21**	-14.76**
$P_1 \times P_9$	-8.45	41.30**	-8.76	40.43**	-8.6	40.86**	-48.20**	-48.20**	-48.39**	-48.39**	-48.30**	-48.30**
$P_1 \times P_{10}$	15.49*	41.38**	15.67*	41.81**	15.58*	41.60**	-24.60**	64.36**	-24.64**	64.18**	-24.62**	64.27**
$P_2 \times P_3$	1.41	12.5	1.38	12.82	1.4	12.66	-52.59**	-41.70**	-52.07**	-41.03**	-52.33**	-41.37**
$P_2 \times P_4$	2.82	19.67**	2.76	19.89**	2.79	19.78**	-47.14**	-18.98**	-47.15**	-18.74**	-47.15**	-18.86**
$P_2 \times P_5$	-1.41	0.48	-1.38	0.94	-1.40	0.71	5.24*	61.31**	5.24*	61.80**	5.24*	61.56**
$P_2 \times P_6$	-5.63	1.52	-5.99	1.49	-5.81	1.5	-50.74**	-25.93**	-52.85**	-29.10**	-51.81**	-27.53**
$P_2 \times P_7$	1.41	33.33**	1.38	33.33**	1.4	33.33**	-48.89**	-21.65**	-48.91**	-21.45**	-48.90**	-21.55**
$P_2 \times P_8$	-11.27	-11.27	-11.52	-11.52	-11.4	-11.4	-41.27**	-9.98**	-41.80**	-10.53**	-41.54**	-10.25**
$P_2 \times P_9$	47.89**	94.44**	47.93**	94.55**	47.91**	94.50**	-47.88**	-47.88**	-46.78**	-46.78**	-47.33**	-47.33**
$P_2 \times P_{10}$	-9.86	10.34	-10.14	10.17	-10	10.26	-52.80**	-27.66**	-53.84**	-29.03**	-53.33**	-28.35**
$P_3 \times P_4$	2.82	14.06*	2.76	14.36*	2.79	14.21*	-34.92**	-19.97**	-34.91**	-19.91**	-34.91**	-19.94**
$P_3 \times P_5$	-18.31**	-16.75**	-18.43**	-16.51*	-18.37**	-16.63**	-51.11**	-39.88**	-51.14**	-39.89**	-51.13**	-39.88**
$P_3 \times P_6$	-11.27	-4.55	-11.52	-4.48	-11.4	-4.51	-33.65**	-18.41**	-33.97**	-18.76**	-33.81**	-18.59**
$P_3 \times P_7$	-26.76**	-18.75**	-26.73**	-18.46**	-26.74**	-18.60**	-52.06**	-41.05**	-52.07**	-41.03**	-52.07**	-41.04**
$P_3 \times P_8$	1.41	1.41	1.38	1.38	1.4	1.4	-47.30**	-35.20**	-47.30**	-35.16**	-47.30**	-35.18**
$P_3 \times P_9$	-18.31**	-9.38	-18.43**	-9.23	-18.37**	-9.3	-28.41**	-28.41**	-28.42**	-28.42**	-28.42**	-28.42**
$P_3 \times P_{10}$	-30.99**	-23.44**	-30.88**	-23.08**	-30.93**	-23.26**	-53.39**	-42.68**	-55.71**	-45.50**	-54.56**	-44.10**
$P_4 \times P_5$	18.31**	20.57**	18.89**	21.70**	18.60**	21.14**	-48.57**	-16.49**	-48.60**	-16.51**	-48.59**	-16.50**
$P_4 \times P_6$	-5.63	1.52	-5.99	1.49	-5.81	1.5	-26.98**	9.79 **	-26.97**	9.83**	-26.98**	9.81**
$P_4 \times P_7$	45.07**	68.85**	45.16**	69.35**	45.12**	69.11**	-43.97**	-9.02*	-43.98**	-9.01**	-43.98**	-9.02*
$P_4 \times P_8$	16.90**	16.90**	17.51**	17.51**	17.21**	17.21**	-45.03**	-10.74**	-45.54**	-11.54**	-45.29**	-11.14**
$P_4 \times P_9$	4.23	21.31**	4.15	21.51**	4.19	21.41**	-25.66**	-25.66**	-26.40**	-26.40**	-26.03**	-26.03**
$P_4 \times P_{10}$	-45.07**	-36.07**	-44.70**	-35.48**	-44.88**	-35.77**	-52.54**	-22.94**	-52.54**	-22.91**	-52.54**	-22.93**
$P_5 \times P_6$	-30.99**	-29.67**	-30.88**	-29.25**	-30.93**	-29.45**	-49.37**	-23.87**	-49.38**	-23.87**	-49.37**	-23.87**
$P_5 \times P_7$	18.31**	20.57**	18.89**	21.70**	18.60**	21.14**	-30.63**	16.74**	-30.60**	16.35**	-30.62**	16.54**
$P_5 \times P_8$	-15.49*	-15.49*	-15.67*	-15.67*	-15.58*	-15.58*	-54.81**	-14.00**	-54.46**	-13.33**	-54.64**	-13.66**
$P_5 \times P_9$	2.82	4.78	2.76	5.19	2.79	4.99	-48.20**	-48.20**	-47.10**	-47.10**	-47.64**	-47.64**
$P_5 \times P_{10}$	30.99**	33.49**	31.34**	34.43**	31.16**	33.97**	-22.86**	68.17**	-22.87**	68.02**	-22.87**	68.09**
$P_6 \times P_7$	-25.35**	-19.70**	-25.35**	-19.40**	-25.35**	-19.55**	-49.79**	-24.50**	-50.36**	-25.35**	-50.08**	-24.93**
$P_6 \times P_8$	-15.49*	-15.49*	-15.67*	-15.67*	-15.58*	-15.58*	-44.44**	-16.47**	-44.45**	-16.46**	-44.45**	-16.46**
$P_6 \times P_9$	18.31**	27.27**	18.89**	28.36**	18.60**	27.82**	-25.24**	-25.24**	-25.26**	-25.26**	-25.25**	-25.25**
$P_6 \times P_{10}$	16.90**	25.76**	17.51**	26.87**	17.21**	26.32**	-48.73**	-22.91**	-50.31**	-25.27**	-49.53**	-24.10**
$P_7 \times P_8$	-45.07**	-45.07**	-44.70**	-44.70**	-44.88**	-44.88**	-50.95**	-17.45**	-50.99**	-17.83**	-50.97**	-17.64**
$P_7 \times P_9$	-21.13**	5.66	-21.20**	5.56	-21.16**	5.61	-28.73**	-28.73**	-29.25**	-29.25**	-28.99**	-28.99**
$P_7 \times P_{10}$	-46.48**	-34.48**	-46.08**	-33.90**	-46.28**	-34.19**	-52.70**	-20.39**	-52.70**	-20.70**	-52.70**	-20.55**
$P_8 \times P_9$	-18.31**	-18.31**	-18.43**	-18.43**	-18.37**	-18.37**	-57.46**	-57.46**	-57.52**	-57.52**	-57.49**	-57.49**
$P_8 \times P_{10}$	43.66**	43.66**	43.78**	43.78**	43.72**	43.72**	-27.78**	37.46**	-27.75**	37.51**	-27.76**	37.49**
$P_9 \times P_{10}$	-26.76**	-10.34	-26.73**	-10.17	-26.74**	-10.26	-51.53**	-51.53**	-50.52**	-50.52**	-51.02**	-51.02**
No. of crosses with significant (+) heterosis	9	16	6	16	11	7	1	7	1	5	1	5
No. of crosses with significant (-) 'heterosis	36	29	39	34	34	38	44	35	44	40	44	40
Range of heterosis	-46.48-47.89	-45.07-94.44	-46.08-47.93	-44.70-94.55	-46.28-47.91	-44.88-94.50	-57.46-5.24	-57.46-68.17	-57.52-5.24	-57.52-68.02	-57.49-5.24	-57.49-68.09

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

Table 1: Contd….

Crosses	Dry matter content						Fruit weight (kg)					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	-49.15**	-45.74**	-49.21**	-45.78**	-49.18**	-45.76**	-22.22**	12.21*	-22.03**	12.90*	-22.12**	12.57*
$P_1 \times P_3$	-10.17**	-4.13	-10.21**	-4.14	-10.19**	-4.14	-21.43**	-19.51**	-21.78**	-20.00**	-21.61**	-19.76**
$P_1 \times P_4$	-46.73**	-43.15**	-46.76**	-43.16**	-46.74**	-43.16**	-20.63**	3.09	-20.54**	3.22	-20.59**	3.16
$P_1 \times P_5$	-18.40**	-12.92**	-18.35**	-12.84**	-18.38**	-12.88**	-27.25**	-19.59**	-27.23**	-19.23**	-27.24**	-19.41**
$P_1 \times P_6$	-11.14**	-11.14**	-11.16**	-11.16**	-11.15**	-11.15**	-28.04**	-10.23*	-27.97**	-10.19	-28.01**	-10.21*
$P_1 \times P_7$	-29.78**	-25.06**	-29.75**	-25.00**	-29.76**	-25.03**	-31.75**	-25.86**	-32.18**	-26.34**	-31.97**	-26.11**

$P_1 \times P_8$	-41.89**	-37.98**	-41.85**	-37.92**	-41.87**	-37.95**	-25.66**	-25.66**	-25.74**	-25.74**	-25.70**	-25.70**
$P_1 \times P_9$	-19.37**	-13.95**	-15.74**	-10.05**	-17.54**	-11.98**	-16.67**	-10.76**	-16.58**	-10.85*	-16.62**	-10.81*
$P_1 \times P_{10}$	-15.98**	-10.34**	-15.98**	-10.30**	-15.98**	-10.32**	-37.30**	-9.54	-37.13**	-8.96	-37.21**	-9.24
$P_2 \times P_3$	-49.15**	-32.91**	-49.21**	-32.92**	-49.18**	-32.91**	-44.97**	-43.63**	-45.05**	-43.80**	-45.01**	-43.72**
$P_2 \times P_4$	-14.77**	-0.56	-11.16**	3.69	-12.94**	1.59	-31.75**	-11.34*	-31.68**	-11.25*	-31.71**	-11.30*
$P_2 \times P_5$	-49.15**	-32.91**	-49.21**	-32.92**	-49.18**	-32.91**	-26.46**	-18.71**	-26.49**	-18.41**	-26.47**	-18.56**
$P_2 \times P_6$	-11.86**	-11.86**	-11.95**	-11.95**	-11.91**	-11.91**	-41.53**	-27.06**	-41.58**	-27.16**	-41.56**	-27.11**
$P_2 \times P_7$	-34.62**	-13.74**	-34.65**	-13.69**	-34.64**	-13.71**	-34.92**	-29.31**	-35.40**	-29.84**	-35.17**	-29.58**
$P_2 \times P_8$	-70.94**	-61.66**	-71.04**	-61.76**	-70.99**	-61.71**	-20.63**	-20.63**	-20.54**	-20.54**	-20.59**	-20.59**
$P_2 \times P_9$	-39.47**	-20.13**	-39.48**	-20.06**	-39.47**	-20.09**	-29.63**	-24.65**	-29.46**	-24.60**	-29.54**	-24.62**
$P_2 \times P_{10}$	-32.20**	-15.92**	-32.20**	-15.98**	-32.20**	-15.95**	-42.59**	-12.85*	-42.82**	-13.48*	-42.71**	-13.18*
$P_3 \times P_4$	-8.47**	6.78*	-8.47*	6.83	-8.47**	6.81	-19.84**	-17.89**	-20.05**	-18.23**	-19.95**	-18.06**
$P_3 \times P_5$	-44.31**	-4.17	-44.30**	-4.22	-44.31**	-4.19	-19.84**	-17.89**	-19.80**	-17.97**	-19.82**	-17.93**
$P_3 \times P_6$	-37.05**	-37.05**	-37.10**	-37.10**	-37.08**	-37.08**	-7.14	-4.88	-6.93	-4.81	-7.03	-4.84
$P_3 \times P_7$	-23.97**	30.83**	-23.97**	30.75**	-23.97**	30.79**	-24.60**	-22.76**	-24.50**	-22.78**	-24.55**	-22.77**
$P_3 \times P_8$	-41.89**	-37.98	-41.85**	-37.81	-41.87**	-37.89	-11.90 **	-11.90**	-11.88**	-11.88**	-11.89**	-11.89**
$P_3 \times P_9$	-14.53**	47.08**	-14.56**	46.94**	-14.54**	47.01**	-22.22**	-20.33**	-22.03**	-20.25**	-22.12**	-20.29**
$P_3 \times P_{10}$	-51.57**	-39.94**	-51.58**	-40.00**	-51.58**	-39.97**	-30.69**	-29.00**	-30.94**	-29.37**	-30.82**	-29.19**
$P_4 \times P_5$	-7.99**	7.34*	-7.91*	7.48	-7.95*	7.41*	-19.05**	-10.53*	-19.06**	-10.16*	-19.05**	-10.34*
$P_4 \times P_6$	-49.15**	-49.15**	-49.21**	-49.21**	-49.18**	-49.18**	-35.71**	-19.80**	-36.14**	-20.37**	-35.93**	-20.10**
$P_4 \times P_7$	-21.79**	-8.76**	-21.84**	-8.77*	-21.81**	-8.76*	-24.87**	-18.39**	-27.23**	-20.97**	-26.09**	-19.72**
$P_4 \times P_8$	-20.10**	-6.78*	-20.09**	-6.74	-20.10**	-6.76	-14.29**	-14.29**	-14.36**	-14.36**	-14.32**	-14.32**
$P_4 \times P_9$	-49.15**	-40.68**	-49.21**	-40.72**	-49.18**	-40.70**	-33.33**	-28.61**	-33.66**	-29.10**	-33.50**	-28.86**
$P_4 \times P_{10}$	-32.20**	-20.90**	-32.12**	-20.78**	-32.16**	-20.84**	-37.30**	-18.56**	-37.13**	-18.33**	-37.21**	-18.44**
$P_5 \times P_6$	-51.57**	-51.57**	-51.58**	-51.58**	-51.58**	-51.58**	3.97	14.91**	4.21	15.66**	4.09	15.30**
$P_5 \times P_7$	-55.69**	-8.50	-55.62**	-8.33	-55.65**	-8.42	-15.08**	-7.76	-14.85**	-7.53	-14.96**	-7.64
$P_5 \times P_8$	-26.63**	44.29**	-26.66**	44.39**	-26.65**	44.34**	-14.29**	-14.29**	-14.11**	-14.11**	-14.19**	-14.19**
$P_5 \times P_9$	-49.15**	5.00	-49.21**	4.90	-49.18**	4.95	-29.89**	-24.93**	-30.20**	-25.40**	-30.05**	-25.17**
$P_5 \times P_{10}$	-15.98**	4.20	-15.98**	4.12	-15.98**	4.16	-34.13**	-27.19**	-34.41**	-27.20**	-34.27**	-27.20**
$P_6 \times P_7$	-49.15**	-49.15**	-49.21**	-49.21**	-49.18**	-49.18**	-37.30**	-31.90**	-37.13**	-31.72**	-37.21**	-31.81**
$P_6 \times P_8$	-46.73**	-46.73**	-46.76**	-46.76**	-46.74**	-46.74**	-2.65	-2.65	-2.48	-2.48	-2.56	-2.56
$P_6 \times P_9$	-37.05**	-37.05**	-37.10**	-37.10**	-37.08**	-37.08**	-23.81**	-18.41**	-23.76**	-18.52**	-23.79**	-18.47**
$P_6 \times P_{10}$	-21.79**	-21.79**	-21.84**	-21.84**	-21.81**	-21.81**	-23.02**	-3.96	-23.02**	-4.01	-23.02**	-3.99
$P_7 \times P_8$	-34.62**	28.57**	-34.65**	28.66**	-34.64**	28.62**	-19.84**	-19.84**	-20.05**	-20.05**	-19.95**	-19.95**
$P_7 \times P_9$	-41.89**	20.00**	-41.85**	20.10**	-41.87**	20.05**	-22.22**	-16.71**	-22.03**	-16.67**	-22.12**	-16.69**
$P_7 \times P_{10}$	-46.73**	-33.93**	-46.76**	-34.02**	-46.74**	-33.98**	-19.84**	-12.93**	-20.05**	-13.17**	-19.95**	-13.06**
$P_8 \times P_9$	-28.09**	41.43**	-28.09**	41.59**	-28.09**	41.51**	-23.02**	-23.02**	-23.27**	-23.27**	-23.15**	-23.15**
$P_8 \times P_{10}$	-37.05**	-21.92**	-37.10**	-22.06**	-37.08**	-21.99**	-39.15**	-39.15**	-39.36**	-39.36**	-39.26**	-39.26**
$P_9 \times P_{10}$	-18.16**	1.50	-21.91**	-3.24	-20.06**	-0.89	-30.69**	-25.78**	-30.94**	-26.19**	-30.82**	-25.99**
No. of crosses with significant (+) heterosis0	0	8	0	7	0	7	0	1	0	1	0	0
No. of crosses with significant (-) 'heterosis	45	35	45	30	45	30	42	40	42	35	42	39
Range of heterosis	-70.94- -7.99	-51.57 - 47.08	-71.04- -7.91	-61.76- 46.94	-70.99- -7.95	-61.71- 47.01	-44.97- 3.97	-43.63- 14.91	-45.05- 4.21	-43.80- 15.66	-45.01- 4.09	-43.72- 15.30

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

Table 1: Contd….

Crosses	Number of fruit per plant						Fruit yield per plant (kg)					
	E_1		E_2		Pooled		E_1		E_2		Pooled	
	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
$P_1 \times P_2$	-12.85 **	-12.85 **	-12.85 **	-12.85 **	-12.85 **	-12.85 **	-0.32	29.24 **	-0.34	29.17 **	-0.33	29.21 **
$P_1 \times P_3$	-38.19 **	-14.12 **	-38.18 **	-14.10 **	-38.18 **	-14.11 **	-27.92 **	-10.92	-27.86 **	-10.76 *	-27.89 **	-10.84 *
$P_1 \times P_4$	-50.31 **	-30.95 **	-50.31 **	-30.95 **	-50.31 **	-30.95 **	-36.91 **	-18.20 **	-36.90 **	-18.22 **	-36.91 **	-18.21 **
$P_1 \times P_5$	-29.50 **	-2.04	-29.48 **	-2.01	-29.49 **	-2.03	-35.65 **	-16.56 **	-35.63 **	-16.56 **	-35.64 **	-16.56 **
$P_1 \times P_6$	-34.52 **	-11.57 *	-34.52 **	-11.59 **	-34.52 **	-11.58 *	-27.92 **	-23.96 **	-27.91 **	-23.91 **	-27.91 **	-23.93 **
$P_1 \times P_7$	-36.96 **	-12.41 *	-36.92 **	-12.35 **	-36.94 **	-12.38 **	-27.29 **	-11.69	-27.32 **	-11.70 *	-27.31 **	-11.69 *
$P_1 \times P_8$	-35.99 **	-11.05 *	-35.96 **	-11.02 *	-35.97 **	-11.04 *	-15.30 **	-12.40 *	-15.28 **	-12.40 **	-15.29 **	-12.40 **
$P_1 \times P_9$	-46.88 **	-26.19 **	-46.87 **	-26.18 **	-46.88 **	-26.18 **	-24.61 **	-24.61 **	-24.57 **	-24.57 **	-24.59 **	-24.59 **
$P_1 \times P_{10}$	-29.25 **	-6.32	-29.18 **	-6.21	-29.21 **	-6.26	-13.72 **	11.86	-13.71 **	11.85 *	-13.72 **	11.85 *
$P_2 \times P_3$	-35.01 **	-35.01 **	-35.01 **	-35.01 **	-35.01 **	-35.01 **	-2.05	21.05 **	-2.11	21.09 **	-2.08	21.07 **
$P_2 \times P_4$	-34.15 **	-34.15 **	-34.13 **	-34.13 **	-34.14 **	-34.14 **	-22.87 **	4.49	-22.85 **	4.46	-22.86 **	4.47
$P_2 \times P_5$	-41.13 **	-41.13 **	-41.11 **	-41.11 **	-41.12 **	-41.12 **	-17.67 **	11.54	-17.74 **	11.38 *	-17.70 **	11.46
$P_2 \times P_6$	-33.05 **	-33.05 **	-33.03 **	-33.03 **	-33.04 **	-33.04 **	-22.87 **	-18.64 **	-22.95 **	-18.67 **	-22.91 **	-18.65 **
$P_2 \times P_7$	-25.09 **	-25.09 **	-25.06 **	-25.06 **	-25.07 **	-25.07 **	-15.14 **	3.07	-15.14 **	3.1	-15.14 **	3.09
$P_2 \times P_8$	-24.24 **	-24.24 **	-24.26 **	-24.26 **	-24.25 **	-24.25 **	2.05	5.55	2.01	5.49	2.03	5.52
$P_2 \times P_9$	-10.24 **	-10.24 **	-10.76 **	-10.76 **	-10.51 **	-10.51 **	7.10	7.10	7.17	7.17	7.14	7.14

$P_2 \times P_{10}$	-10.77 **	-10.77 **	-10.76 **	-10.76 **	-10.76 **	-10.76 **	-14.51 **	11.07	-14.50 **	11.11 *	-14.50 **	11.09
$P_3 \times P_4$	-35.99 **	-0.57	-35.96 **	-0.53	-35.97 **	-0.55	-10.57 *	10.53	-10.52 **	10.70 *	-10.54 *	10.62 *
$P_3 \times P_5$	-34.03 **	21.67 **	-34.02 **	21.83 **	-34.02 **	21.75 **	-7.41	14.42 *	-7.42	14.53 **	-7.42	14.48 **
$P_3 \times P_6$	-30.97 **	-6.78	-30.97 **	-6.8	-30.97 **	-6.79	7.89	13.81 **	7.76	13.74 **	7.82	13.78 **
$P_3 \times P_7$	-30.11 **	22.01 **	-30.09 **	21.96 **	-30.10 **	21.98 **	-8.68	10.92	-8.75 *	10.87 *	-8.71 *	10.89 *
$P_3 \times P_8$	-26.32 **	15.99 **	-26.32 **	16.04 **	-26.32 **	16.01 **	3.15	6.69	3.19	6.71	3.18	6.7
P3 × P9	-22.40 **	15.69 **	-22.43 **	15.63 **	-22.41 **	15.66 **	5.21	5.21	5.21	5.21	5.21	5.21
P3 × P10	-25.95 **	-1.94	-25.97 **	-1.97	-25.96 **	-1.96	-7.26	14.62 *	-7.27	14.71 **	-7.26	14.67 **
P4 × P5	-35.01 **	0.95	-35.01 **	0.95	-35.01 **	0.95	-9.78 *	25.71 **	-9.78 *	25.75 **	-9.78 *	25.73 **
P4 × P6	-24.48 **	1.98	-24.49 **	1.96	-24.48 **	1.97	-8.52	-3.49	-8.45 *	-3.37	-8.48	-3.43
P4 × P7	-24.24 **	17.68 **	-24.26 **	17.65 **	-24.25 **	17.67 **	-8.68	10.92	-8.70 *	10.93 *	-8.69 *	10.92 *
P4 × P8	-23.26 **	19.20 **	-23.23 **	19.25 **	-23.24 **	19.23 **	2.37	5.87	2.31	5.79	2.34	5.83
P4 × P9	-26.19 **	10.04	-26.20 **	10.01 *	-26.20 **	10.02	12.15 *	12.15 *	12.24 **	12.24 **	12.19 **	12.19 **
P4 × P10	-27.66 **	-4.21	-27.65 **	-4.19	-27.66 **	-4.2	-15.93 **	9.22	-15.97 **	9.2	-15.95 **	9.21
P5 × P6	-37.94 **	-16.20 **	-37.95 **	-16.22 **	-37.95 **	-16.21 **	1.42	6.99	1.43	7.05	1.42	7.02
P5 × P7	-35.99 **	11.75	-35.96 **	11.71 *	-35.97 **	11.73	-10.73 *	8.43	-10.81 **	8.36	-10.77 *	8.39
P5 × P8	-37.90 **	-2.25	-38.25 **	-2.76	-38.08 **	-2.51	-8.83	-5.71	-8.80 *	-5.69	-8.81 *	-5.7
P5 × P9	-36.23 **	-4.93	-36.23 **	-4.95	-36.23 **	-4.94	-7.41	-7.41	-7.42	-7.42	-7.42	-7.42
P5 × P10	-34.27 **	-12.97 **	-34.25 **	-12.93 **	-34.26 **	-12.95 **	-18.45 **	5.94	-18.43 **	6	-18.44 **	5.97
P6 × P7	-20.56 **	7.27	-20.56 **	7.26	-20.56 **	7.27	-22.87 **	-18.64 **	-22.85 **	-18.57 **	-22.86 **	-18.60 **
P6 × P8	-29.99 **	-5.45	-29.98 **	-5.46	-29.98 **	-5.46	-0.16	3.26	-0.2	3.2	-0.18	3.23
P6 × P9	-23.99 **	2.64	-23.99 **	2.63	-23.99 **	2.64	3.63	3.63	3.64	3.64	3.63	3.63
P6 × P10	-22.03 **	3.24	-22.01 **	3.28	-22.02 **	3.26	-5.52	-0.33	-5.55	-0.31	-5.54	-0.32
P7 × P8	-33.78 **	4.24	-33.79 **	4.26	-33.79 **	4.25	-12.15 *	-9.14	-12.14 **	-9.15 *	-12.14 **	-9.14 *
P7 × P9	-13.95 **	28.28 **	-13.92 **	28.31 **	-13.94 **	28.30 **	3.63	3.63	3.64	3.64	3.63	3.63
P7 × P10	-21.54 **	3.89	-21.51 **	3.94	-21.53 **	3.92	-2.52	18.39 **	-2.56	18.39 **	-2.54	18.39 **
P8 × P9	-24.24 **	12.96 *	-24.26 **	12.91 **	-24.25 **	12.93 *	1.42	1.42	1.43	1.43	1.42	1.42
P8 × P10	-22.89 **	2.11	-22.88 **	2.12	-22.89 **	2.11	-8.99	-5.87	-8.94 *	-5.84	-8.97 *	-5.86
P9 × P10	-22.77 **	2.27	-22.77 **	2.27	-22.77 **	2.27	-3.15	-3.15	-3.14	-3.14	-3.15	-3.15
No. of crosses with significant (+) heterosis	0	8	0	11	0	8	1	7	1	13	1	11
No. of crosses with significant (-) 'heterosis	45	16	45	17	45	17	21	8	25	10	26	10
Range of heterosis	-50.31- -10.24	-41.13-28.28	-50.31- -10.76	-41.11-28.31	-41.12- -10.51	-41.12-28.30	-36.91-12.15	-24.61-29.24	-36.90-12.24	-24.57-29.17	-36.91-12.19	-24.59-29.21

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

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