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To study the nature and magnitude of heterosis for fruit yield and yield attributes in okra [*Abelmoschus esculentus* (L.) Moench]

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Abstract
Line x tester analysis was carried out with the objective of to find out the superior combinations of parents giving high degree of useful heterosis for fruit yield and its contributing characters and for future use in the breeding programme. Significant and desired directional heterosis was observed for majority of the yield attributing trits for fruit yield per plant in okra. Experimental material comprising twelve parents and their thirty two hybrids along with one standard check (GJOH-3) were evaluated in randomized block design with three replications during kharif 2016 at the college farm, Navsari Agricultural University, Navsari. The highest heterobeltiosis was observed in crosses KS-404 x GAO-5 followed by JOL-11-12 x GAO-5 and AOL-03-1 x GAO-5 and the highest standard heterosis for cross JOL-11-12 x GAO-5. High heterosis for fruit yield per plant in these hybrids was due to, positive heterotic response in other yield related characters viz., plant height, fruit yield per plant and fruit dry weight.

Keywords: okra [*Abelmoschus esculentus* (L.) Moench], line x tester, heterobeltiosis and standard heterosis

Introduction
Okra [*Abelmoschus esculentus* (L.) Moench] is known by many names in different parts of the world. It is called lady's finger in England, gumbo in United States of America, guino- gombo in Spain, guiberio in Portugal and bhindi in India, being native of tropical and sub-tropical Africa. It belongs to Malvaceae family. It is one of the priced vegetables grown throughout the country as *summer* and *kharif* crop in all type of soil particularly in the state of Uttar Pradesh, Madhya Pradesh, Karnataka, Maharashtra and Gujarat. It is important vegetable crop of Gujarat state.

The term heterosis was coined by Shull (1914) [14] which refers to a superiority or inferiority of F_1 hybrids in one or more characters over its parents. The occurrence of heterosis is common in plant species, but its level of expression is highly variable. Hybrid vigour in okra was first reported by Vijayaraghvan and Warier (1946) [16]. The ease in emasculation and very high percentage of fruit/seed setting indicate the possibilities of exploitation of hybrid vigour.

Okra is essentially a native of Africa but wild types have also been found in India. Okra is an allopolyploid, with 2n = 73 to 130 chromosome numbers and genome size ranged from 3897 Mbp to 17321 Mbp. It is an often cross pollinated crop and occurrence of out crossing is an extent of 4 to 19 % with the maximum of 42.2 % with the insect assisted pollination (Kumar, 2006) [5]. Choice of the parents for a breeding programme is important to improve quantitative characters like fruit yield and its components. Exploitation of hybrid vigour is an important tool for making general improvement of yield and its attributing characters in okra.

Materials and Methods
The experimental materials comprised of eight parental lines viz., Arka- Anamika, KS-404, AOL-03-1, JF-108-02, JF-55, JOL-13-07, JOL-11-12, JOL-09-07 and four testers viz., GO-2, GJO-3, GAO-5 and VRO-6 as well as their 32 F_1's obtain through line x tester mating design. Thus, 12 parental lines and 32 hybrids along with one standard check (GJOH-3) were evaluated in randomized block design with three replication during *kharif* 2016 at college farm, Navsari Agricultural University, Navsari. In experiment, Each plot consisted of twelve plants in a row at 60 cm x 30 cm inter and intra row spacing all the recommended package of practices were adopted for raising a successful and healthy crop. Observations were recorded on five plants for the characters *viz*., days to 50% flowering, plant height (cm), number of internodes per plant, fruit length (cm), Fruit girth (cm), fruit weight (g), number of fruits per plant, fruit yield per plant (g), fruit dry weight (mg/100g), total sugar (%), total phenol (%).

The analysis of data was done as described by Snedecore and Cochran (1967) [13] and heterosis expressed as percentage whether increase or decrease in the mean values of crosses over the parents, mid parent and standard check cultivar was calculated as reported by Hayman (1957) [3]. Heterobeltiosis was computed as deviation of mean performance of F_1 from that of better parent (BP). The estimation of economic heterosis were computed as deviation of mean performance of F_1 hybrid from that of the check parent (GJOH-3). The magnitude of heterosis was calculated and expressed as percent.

Results and Discussion

Heterosis was computed as percentage increases or decreases F_1 values over better parent (heterosis) and over the best commercial variety (standard heterosis). In present investigation the nature and magnitude of heterosis for fruit yield and yield attributes over the better parent and standard check (GJOH-3) were studied for 11 characters in all 32 crosses (Table 1).

For days to 50% flowering, earliness is preferred; hence negative heterosis is desirable. The heterosis over better parent and standard check ranged from -25.68 to 5.11 and -16.15 to 23.08 per cent, respectively. Highest heterosis was observed in JOL-09-07 x GAO-5 (-25.68) and Arka-Anamika x GAO-5 (-16.15) over the better parenrt and standard check. Reported by Chaubey *et al.* (2014) [1], Patel (2015) [11] and Patel (2016) [12].

In okra, tall plant stature is desirable over dwarf one, as in increase number fruits per plant. The estimate of of heterobeltiosis for plant height ranged between -12.02 to 34.87 and -33.71 to 22.12 per cent over better parent and standard check, respectively. The maximum heterosis was recorded in the cross AOL-03-1 x GAO-5 (34.87%) and Arka-Anamika x GAO-5 (22.12%) over the standard check. Heterosis for this traits was also reported by Layghdoh *et al.* (2013) [8] and Patel (2016) [12].

In case of number of internodes per plant, the variation of heterosis was ranged from -23.72 to 21.71 per cent and -30.25 to 13.18 per cent over better parent and standard check, respectively. Maximum heterosis observed in AOL-03-1 x GO-2 (21.13%) and JOL-11-12 x GAO-5 (13.18%) over the better parent and standard check. Similar results were also reported by Javia (2013) [4] and Patel (2013) [10].

Table 1: Magnitude of heterosis over better parent and standard heterosis for various characters in okra

Sr. No.	Crosses/ Hybrid	Days to 50% flowering		Plant height (cm)		Number of internodes per plant	
		BP	SC	BP	SC	BP	SC
1	JOL-09-07 x GO-2	-10.81 **	1.54	14.06 **	-7.81 *	-17.96 *	-28.72 **
2	JOL-09-07 x GJO-3	-11.49 **	0.77	9.05 *	-14.61 **	-12.72	-16.70 *
3	JOL-09-07 x GAO-5	-25.68 **	-15.38 **	17.84 **	-1.02	14.29	2.78
4	JOL-09-07 x VRO-6	-9.46 *	3.08	3.27	-19.14 **	-7.89	-14.35
5	JOL-11-12 x GO-2	-14.18 **	-6.92	11.44 **	4.04	-11.78	-8.78
6	JOL-11-12 x GJO-3	-4.35	1.54	-1.66	-8.19 **	1.48	4.93
7	JOL-11-12 x GAO-5	-6.02	-3.85	28.39 **	19.86 **	9.47	13.18
8	JOL-11-12 x VRO-6	5.11	10.77 *	7.44 *	0.3	-11.83	-8.84
9	JOL-13-07 x GO-2	-4.96	3.08	6.87	-13.63 **	-13.44	-13.67
10	JOL-13-07 x GJO-3	-2.17	3.85	27.40 **	-2.45	-8.4	-8.66
11	JOL-13-07 x GAO-5	-3.82	-3.08	-1.44	-17.21 **	3.68	3.4
12	JOL-13-07 x VRO-6	-3.65	1.54	17.00 **	-10.42 **	-5.46	-5.72
13	JF-55 x GO-2	-15.57 **	8.46	1.07	-18.31 **	-2.65	-10.06
14	JF-55 x GJO-3	-8.38 *	17.69 **	21.70 **	-9.70 **	-0.64	-5.17
15	JF-55 x GAO-5	-19.16 **	3.85	0.27	-15.78 **	3.41	-4.47
16	JF-55 x VRO-6	-15.57 **	8.46	4.78	-25.52 **	-0.86	-7.8
17	JF-108-02 x GO-2	-15.79 **	10.77 *	0.05	-19.14 **	7.16	1.62
18	JF-108-02 x GJO-3	-14.04 **	13.08 **	-12.02 **	-33.71 **	-3.85	-8.23
19	JF-108-02 x GAO-5	-19.30 **	6.15	4.85	-11.93 **	-12.29	-16.82 *
20	JF-108-02 x VRO-6	-6.43	23.08 **	-3.66	-27.41 **	5.94	0.46
21	AOL-03-1 x GO-2	-7.8	0	21.90 **	7.13 *	21.13 *	5.23
22	AOL-03-1 x GJO-3	-1.45	4.62	19.53 **	5.06	-23.72 **	-27.19 **
23	AOL-03-1 x GAO-5	-3.79	-2.31	34.87 **	18.54 **	-22.45 *	-30.25 **
24	AOL-03-1 x VRO-6	0.73	6.15	4.03	-8.57 **	-9.87	-16.18 *
25	KS-404 x GO-2	-3.55	4.62	22.83 **	11.89 **	-9.27	-16.18 *
26	KS-404 x GJO-3	-5.8	0	3.94	-5.32	-10.9	-14.96
27	KS-404 x GAO-5	-16.42 **	-13.85 **	27.87 **	16.48 **	-7.28	-14.35
28	KS-404 x VRO-6	-18.25 **	-13.85 **	9.49 **	-0.26	-13.82	-19.85 *
29	Arka-Anamika x GO-2	-7.8	0	17.41 **	9.57 **	-8.92	-12.51
30	Arka-Anamika x GJO-3	-5.8	0	10.96 **	3.55	-5.03	-8.78
31	Arka-Anamika x GAO-5	-16.79 **	-16.15 **	30.87 **	22.12 **	17.29 *	12.66
32	Arka-Anamika x VRO-6	-6.57	-1.54	8.92 **	1.64	-2.55	-6.39
	Minimum	-25.68	-16.15	-12.02	-33.71	-23.72	-30.25
	Maximum	5.11	23.08	34.87	22.12	21.13	13.18
	SE ±	1.94	1.94	2.67	2.67	0.84	0.84

* Significant at 5 % level,** Significant at 1 % level

The hybrids with positive heterosis are desirable for fruit length at harvest. Heterosis for fruit length at harvest ranged from -20.22 to 23.56 and -9.65 to 31.87 per cent over the better parent and standar check, respectively. The highest heterosis was recorded in the hybrid JF-55 x GO-2 both over better parent and standard check for this trait. Heterosis for this traits was also reported by Nagesh *et al.* (2014) [9], Kumar and Reddy (2014) and Patel (2016) [12].

Heterotic effect over better parental value and standard heterosis for fruit girth varied from -17.75 to 15.85 and -16.29 to 21.61 per cent respectively. The maximum heterosis were found in KS-404 x GJO-3 (15.85%) and JF-55 x GAO-5 (21.61%) over the better parent and standard check respectively. Almost identical results have been reported by Solankey *et al*. (2013) [15] and Kumar and Reddy (2015).

The range of heterobeltiosis and standard heterosis for fruit weight was from -56.20 to 18.82 and -14.60 to 13.38 per cent respectively. The hybrid JOL-11-12 x GAO-5 showed the highest heterosis both over better parent and standard check. The present findings are in uniformity with the results reported by Kumar and Singh (2012) [6] and Kumar and Reddy (2015).

The variation observed in heterobeltiosis and standard heterosis for number of fruits per plant was 3.63 to 66.88 and -31.76 to 10.71 per cent respectively. The number of fruits per plant is one of the most important components of yield in respect of which is a positive heterosis are desirable. The best F_1 hybrid AOL-03-1 x GAO-5 (66.68%) and JOL-11-12 x GAO-5 (10.71%) showed the highest value of better parent and standard heterosis, respectively. Similar results have been reported by Solankey *et al*. (2013) [15], Kumar and Reddy (2015) and Patel (2016) [12].

The fruit yield per plant is an attributes of economic importance which the breeders attempt to improve by evolving new high yielding hybrids. The results revealed that heterobeltiosis and standard heterosis ranged from -16.89 to 67.09 and -31.69 to 12.85 per cent respectively. The maximum heterosis were found in KS-404 x GAO-5 (67.09%) and JOL-11-12 x GAO-5 (12.85) per cent over the better parent and standard check. Similar result has been reported by Das *et al*. (2013) [2], Patel (2015) [11] and Patel (2016) [12].

Table 1: Conti….

Sr. No.	Crosses/ Hybrid	Fruit length (cm)		Fruit girth (cm)		Fruit weight (g)	
		BP	SC	BP	SC	BP	SC
1	JOL-09-07 x GO-2	6.07	20.03 *	-9.39	-1.94	-0.77	-6.52
2	JOL-09-07 x GJO-3	-9.28	2.66	9.23	14.52	0.98	-7.2
3	JOL-09-07 x GAO-5	-13.44	-2.05	-5.86	-4.19	1.35	-4.82
4	JOL-09-07 x VRO-6	-6.98	5.26	8.81	17.58 *	-5.77	-13.41
5	JOL-11-12 x GO-2	6.03	13.16	5.66	14.35	1.4	-3.24
6	JOL-11-12 x GJO-3	-2.74	3.8	3.54	8.55	5.23	0.41
7	JOL-11-12 x GAO-5	-17.38 *	-9.65	-6.97	-5.32	18.82	13.38
8	JOL-11-12 x VRO-6	1.67	8.51	-3.88	3.87	-3.24	-7.66
9	JOL-13-07 x GO-2	8.47	19.88 *	-1.19	6.94	-52.86 **	-3.58
10	JOL-13-07 x GJO-3	11.32	23.04 **	11.85	17.26 *	-53.38 **	-4.65
11	JOL-13-07 x GAO-5	10.05	21.64 **	-8.56	-6.94	-50.49 **	1.27
12	JOL-13-07 x VRO-6	11.01	22.69 **	1.79	10	-56.20 **	-10.41
13	JF-55 x GO-2	23.56 **	31.87 **	3.95	18.87 *	-4.03	-9.59
14	JF-55 x GJO-3	5.85	10.53	4.51	19.52 *	-0.51	-10
15	JF-55 x GAO-5	15.35 *	26.14 **	6.35	21.61 **	7.67	1.12
16	JF-55 x VRO-6	4.65	9.27	4.37	19.35 *	-1.76	-14.60
17	JF-108-02 x GO-2	13.97	21.64 **	-5.96	1.77	-0.96	-6.69
18	JF-108-02 x GJO-3	20.83 **	27.19 **	9.08	14.35	2.99	-6.84
19	JF-108-02 x GAO-5	-2.83	6.26	11.25	13.23	4.87	-1.51
20	JF-108-02 x VRO-6	10	15.79	-5.97	1.61	11.61	-6.93
21	AOL-03-1 x GO-2	9.01	16.35 *	-5.5	5.32	7.8	1.56
22	AOL-03-1 x GJO-3	16.28 *	20.50 *	-8.97	1.45	10.63	3.28
23	AOL-03-1 x GAO-5	-12.83	-4.68	-15.63 *	-5.97	12.1	5.28
24	AOL-03-1 x VRO-6	21.08 **	24.27 **	-11.14	-0.97	5.03	-1.95
25	KS-404 x GO-2	8.77	16.08 *	2.09	10.48	11.05	4.62
26	KS-404 x GJO-3	0.06	3.68	15.85 *	21.45 **	10.73	1.22
27	KS-404 x GAO-5	-10.43	-2.05	-17.75 *	-16.29 *	17.62	10.46
28	KS-404 x VRO-6	7.12	9.94	3.73	12.1	7.35	-1.87
29	Arka-Anamika x GO-2	-16.95 *	0.29	4.17	12.74	10.33	5.52
30	Arka-Anamika x GJO-3	-12.83	5.26	8.31	13.55	4.78	0.22
31	Arka-Anamika x GAO-5	-20.22 **	-3.65	-14.58	-13.06	18.47	13.31
32	Arka-Anamika x VRO-6	-8.23	10.82	-7.76	-0.32	5.7	1.09
	Minimum	-20.22	-9.65	-17.75	-16.29	-56.20	-14.60
	Maximum	23.56	31.87	15.85	21.61	18.82	13.38
	SE ±	0.91	0.91	0.16	0.16	1.64	1.64

* Significant at 5 % level,** Significant at 1 % level

Table 1: Conti….

Sr. No.	Crosses/ Hybrid	No. of fruits/plant		Fruit yield/plant (g)		Fruit dry weight (mg/100g)	
		BP	SC	BP	SC	BP	SC
1	JOL-09-07 x GO-2	36.29 **	-10.24	45.69 **	-10.16 *	7.60 **	-3.87 **
2	JOL-09-07 x GJO-3	42.15 **	-12.42 *	6.4	-12.35 *	4.84 **	-6.44 **
3	JOL-09-07 x GAO-5	56.97 **	-3.29	57.01 **	-3.18	13.19 **	1.46
4	JOL-09-07 x VRO-6	46.83 **	-9.53	46.86 **	-9.43	3.09 **	-8.01 **
5	JOL-11-12 x GO-2	41.44 **	-2.47	41.27 **	-2.46	12.61 **	0.85
6	JOL-11-12 x GJO-3	45.28 **	0.18	21.55 **	0.13	-0.15	-10.58 **
7	JOL-11-12 x GAO-5	60.55 **	10.71	63.44 **	12.85 *	17.75 **	5.54 **

8	JOL-11-12 x VRO-6	31.52 **	-9.31	35.87 **	-6.19	8.56 **	-2.78 **
9	JOL-13-07 x GO-2	32.31 **	-12.87 *	37.73 **	-12.81 *	0.8	-9.86 **
10	JOL-13-07 x GJO-3	35.12 **	-15.22 **	3.01	-15.14 **	-6.05 **	-15.99 **
11	JOL-13-07 x GAO-5	45.90 **	-8.46	44.73 **	-8.37	5.24 **	-5.67 **
12	JOL-13-07 x VRO-6	17.34	-26.38 **	17.43 *	-25.66 **	-0.21	-10.76 **
13	JF-55 x GO-2	3.63	-31.76 **	14.78	-31.69 **	-8.90 **	-18.61 **
14	JF-55 x GJO-3	14.72	-31.60 **	-16.89 **	-31.54 **	-3.23 **	-17.39 **
15	JF-55 x GAO-5	30.49 **	-22.20 **	30.68 **	-22.13 **	-4.53 **	-14.42 **
16	JF-55 x VRO-6	26.03 **	-24.86 **	26.38 **	-24.79 **	-20.92 **	-30.43 **
17	JF-108-02 x GO-2	9.99	-27.57 **	23.73 **	-27.50 **	-6.68 **	-16.62 **
18	JF-108-02 x GJO-3	23.95 *	-27.48 **	-11.88	-27.41 **	-0.94	-16.49 **
19	JF-108-02 x GAO-5	38.06 **	-17.78 **	38.11 **	-17.70 **	-2.16	-12.30 **
20	JF-108-02 x VRO-6	31.85 **	-22.86 **	37.68 **	-22.78 **	-11.21 **	-21.90 **
21	AOL-03-1 x GO-2	53.11 **	0.83	57.87 **	2.59	-1.19	-11.72 **
22	AOL-03-1 x GJO-3	53.20 **	-2.67	18.27 **	-2.58	7.52 **	-4.88 **
23	AOL-03-1 x GAO-5	66.88 **	6.02	63.29 **	6.12	15.76 **	3.76 **
24	AOL-03-1 x VRO-6	49.04 **	-5.31	45.84 **	-5.22	-0.06	-11.59 **
25	KS-404 x GO-2	42.53 **	-6.13	55.77 **	-6.05	8.78 **	-2.81 **
26	KS-404 x GJO-3	49.64 **	-3.87	16.81 **	-3.78	8.68 **	-4.08 **
27	KS-404 x GAO-5	56.73 **	0.69	67.09 **	0.78	19.02 **	6.68 **
28	KS-404 x VRO-6	41.61 **	-9.02	50.98 **	-8.94	8.71 **	-4.06 **
29	Arka-Anamika x GO-2	36.77 **	-0.81	36.93 **	-0.7	4.54 **	0.77
30	Arka-Anamika x GJO-3	31.42 **	-4.69	17.09 **	-3.54	-2.09 *	-5.62 **
31	Arka-Anamika x GAO-5	44.63 **	4.89	50.90 **	9.43	11.96 **	7.93 **
32	Arka-Anamika x VRO-6	18.39 *	-14.14 *	26.57 **	-8.21	-7.18 **	-10.52 **
	Minimum	3.63	-31.76	-16.89	-31.69	-20.92	-30.43
	Maximum	66.68	10.71	67.09	12.85	19.02	7.93
	SE ±	1.68	1.68	18.04	18.04	0.12	0.12

* Significant at 5 % level,** Significant at 1 % level

Table 1: Conti….

Sr. No.	Crosses/ Hybrid	Total sugar (%)		Total phenol (%)	
		BP	SC	BP	SC
1	JOL-09-07 x GO-2	-4.54	4.77	-23.20 **	137.99 **
2	JOL-09-07 x GJO-3	31.27 **	21.55 **	-51.60 **	50.00 **
3	JOL-09-07 x GAO-5	-8.22 **	18.49 **	-26.57 **	127.54 **
4	JOL-09-07 x VRO-6	1.08	-33.43 **	-28.72 **	120.89 **
5	JOL-11-12 x GO-2	-19.12 **	17.34 **	93.04 **	261.65 **
6	JOL-11-12 x GJO-3	12.42 **	63.10 **	25.60 **	135.30 **
7	JOL-11-12 x GAO-5	2.59	48.84 **	-63.69 **	-31.98 **
8	JOL-11-12 x VRO-6	-5.33 **	37.34 **	110.80 **	294.92 **
9	JOL-13-07 x GO-2	-8.43 **	0.5	-4.66 **	289.28 **
10	JOL-13-07 x GJO-3	61.97 **	49.97 **	-49.59 **	105.82 **
11	JOL-13-07 x GAO-5	-46.72 **	-31.21 **	-46.13 **	119.96 **
12	JOL-13-07 x VRO-6	-92.98 **	-95.38 **	1.65	315.06 **
13	JF-55 x GO-2	9.30 **	54.00 **	198.49 **	247.60 **
14	JF-55 x GJO-3	-32.94 **	-5.51 *	22.80 **	11
15	JF-55 x GAO-5	-21.86 **	10.11 **	63.20 **	178.28 **
16	JF-55 x VRO-6	-9.38 **	27.68 **	-49.82 **	-11.18
17	JF-108-02 x GO-2	-11.83 **	0.77	115.24 **	150.65 **
18	JF-108-02 x GJO-3	-7.55 **	5.66 *	217.85 **	184.66 **
19	JF-108-02 x GAO-5	-8.65 **	17.93 **	24.66 **	112.57 **
20	JF-108-02 x VRO-6	3.71	18.52 **	-47.52 **	-7.12
21	AOL-03-1 x GO-2	21.52 **	33.37 **	21.26 **	106.10 **
22	AOL-03-1 x GJO-3	17.99 **	9.25 **	6.04	80.22 **
23	AOL-03-1 x GAO-5	-3.44	24.66 **	-26.99 **	24.49 **
24	AOL-03-1 x VRO-6	53.29 **	0.95	9.66 *	94.09 **
25	KS-404 x GO-2	21.64 **	42.59 **	93.10 **	124.86 **
26	KS-404 x GJO-3	32.29 **	55.07 **	165.22 **	137.52 **
27	KS-404 x GAO-5	-9.07 **	17.40 **	-5.91	60.44 **
28	KS-404 x VRO-6	-27.69 **	-15.23 **	-57.65 **	-25.05 **
29	Arka-Anamika x GO-2	-28.65 **	-21.70 **	-42.05 **	-19.13 **
30	Arka-Anamika x GJO-3	-8.03 **	-14.85 **	7.75	50.37 **
31	Arka-Anamika x GAO-5	-15.31 **	9.34 **	-21.63 **	33.64 **
32	Arka-Anamika x VRO-6	42.26 **	-5.72 *	-54.36 **	-19.22 **
	Minimum	-92.98	-95.38	-63.69	-31.98
	Maximum	61.97	63.10	217.85	315.06
	SE ±	0.30	0.30	0.25	0.25

* Significant at 5 % level, ** Significant at 1 % level

In case of fruit dry weight, the variation of heterosis was ranged from -20.92 to 19.02 and -30.43 to 7.93 per cent over the better parent and standard check, respectively. The maximum heterosis was recorded in the cross combinations KS-404 x GAO-5 (19.02%) and Arka-Anamika x GAO-5 (7.93%) over the better parent and standard check respectively. Similar result has been reported by Patel (2016) [12].

For total sugar negative direction is desirable. The heterosis over better parent and standard heterosis ranged from -92.98 to 61.97 and -95.38 to 63.10 percent, respectively. In the present study, the cross JOL-13-07 x VRO-6 (-92.98%) recorded highest heterosis over both better parent and standard check respectively. The present findings are uniformity with the results reported by Patel (2016) [12].

The high phenol content is desirable for lower incidence of shoot and fruit borer incidence. The range of better parent and standard heterosis was from -63.69 to 217.85 and-31.98 to 315.06 percent respectively. The hybrid JF-108-02 x GJO-3 (217.85%) and JOL-13-07 x VRO-6 (315.06%) showed the highest heterosis over better parent and standard check. Similar result has been reported by Patel (2016) [12].

Conclusion

Out of thirty two hybrids, only one hybrid exhibited significant positive standard heterosis over check GJOH-3 for fruit yield per plant. Among the hybrids, JOL-11-12 x GAO-5 depicted as the best hybrid for fruit yield per plant. The highest heterobeltiosis for fruit yield per plant was recorded by twenty seven hybrid among these, the hybrids KS-404 x GAO-5 recorded highest heterobeltiosis followed by JOL-11-12 x GAO-5, AOL-03-1 x GAO-5 and AOL-03-1 x GO-2 reported as best crosses over better parent. High heterotic response for fruit yield per plant was mainly obtain due to high heterotic response observed for other related characters like plant height, number of internodes per plant, fruit weight, fruit girth, fruit length, fruit dry weight and number of fruits per plant.

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