The Pharma Innovation Journal 2021; 10(8): 1192-1200

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(8): 1192-1200

www.thepharmajournal.com
Received: 07-06-2021
Accepted: 13-07-2021

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Heterosis for fruit yield and its components traits in Okra (*Abelmoschus esculentus* L. Moench)

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Abstract
Thirty six hybrids of okra along with their nine parental lines in 9 x 9 half diallel fashion excluding reciprocal crosses were studied to assess the extent heterosis effects over better parent, top parent and standard check for yield and fourteen characters. The cross combinations IC 0045993 x GKOKS-4, IC 089835 x GKOKS-4, IC 0090249 x IC 0588162, IC 089835 x IC 0111484, IC 0034124 x IC 0588162 and IC 0369611 x GKOKS-4 displayed the significant positive heterosis for most of the traits in both *kharif* and in summer season. The crosses IC 0010256A x IC 0111484, IC 0369611 x IC 0090249, and IC 089835 x GKOKS-4 exhibited significant negative heterosis under *kharif* season for most of the characters and same cross combination displayed significant negative heterosis in summer season for length of inter node and first fruiting node.

Keywords: Okra, heterosis, yield

Introduction

Okra (*Abelmoschus esculentus* (L.) Moench) has a prominent position in vegetables due to its wider adaptability, year round export potential and high nutritive value. The entire plant is edible and is used to make several foods (Babu and Srinivasan, 1995; Madison, 2008; Lim, 2012; Jain *et al.*, 2012) [4, 16, 15, 8]. Okra is widely used in ethnomedicine in diverse cultures. In Ayurveda, Okra is used as an edible infusion and in different preparation for diuretic effect (Maramag, 2013) [17]. An infusion of the fruit mucilage is also used to treat dysentery and diarrhea in acute inflammation and irritation of the stomach, bowels, and kidneys catarrhal infections ardour urinae, dysuria and gonorrhea. Seeds are used as antispasmodic, cordial and stimulant (Lim, 2012) [15]. Leaves and root extracts are served as demulcent and emollient poultice (Babu and Srinivasan, 1995) [4].

India leads the world in area and production of Okra with 61.68 lakh metric tonnes of production obtained from an area of 5.08 lakh ha under the crop with productivity of 12.1 metric tones per hectare during 2018-19. The area under the crop in Maharashtra during 2019 was 13.98 thousand hectare with the production of 1.39 lakh metric tonnes. However, Maharashtra's productivity (9.97 MT/ha) is much lower than that of the country (11.97 MT/ha) (Anon, 2019) [1].

Relative ease of hybridization in Okra due to its monadelphous nature, higher degree of fruit set and fairly large number of seeds per fruit points to a good scope for commercial hybrid seed production. Selected lines in this experiment are at near homozygous state and can be assessed for exploitation of heterosis. Hence an investigation was carried out with an objective of assessing the magnitude of heterosis and combining ability for yield and quality parameters and yellow vein mosaic in okra.

Materials and Methods

The investigation was conducted at All India Coordinated Research Project on Vegetable Crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri during 2016-17. The experimental field has an altitude of 532 m above MSL, latitude of 19°47' to 19°57' N and longitude of 74°82' to 74°91' E. Nine lines of okra *viz.*, IC 0369611, IC 0034124, IC 0090249, IC 0010256A, IC 0045993, IC 089835, IC 0588162, IC 0111484 and GKOKS-4 were crossed in half diallel fashion. Observations recorded on parameters *viz.*, plant height (cm), number of branches per plant, number of nodes per plant, length of internode (cm), number of ridges per fruit, days to 50% flowering, days required for first harvesting, first fruiting node, number of fruits per plant, average weight of fruit (g), fruit length (cm), fruit diameter (cm), duration of harvest (days from first harvest to last harvest), yield per plot and yield per hectare. Five randomly selected plants from each plot replication were used for recording yield. Heterosis was calculated as percent increase or decrease over better parent, top parent and standard check (Mahyco-64) values. Analysis on heterosis (%) expressed over better parent was done as per methods of Turner (1953) [26] and Hays *et al.*, (1955) [7].

Results and Discussion

The hybrid performed significantly better than the respective parents. Significant heterosis was observed for most of the observed characters. Better parent heterosis and standard heterosis in hybrids varied significantly and could be due to genetic diversity of parents used to generate hybrids. The analysis of variance is presented in table 1. All the parents showed significant difference for the characters studied, which indicated sufficient variability among the parents. Heterosis for growth and yield parameters are presented in table 2.

Table 1: Heterosis percentage over better parent, top parent and hybrid check in 9 x 9 half diallel in Okra

Sr. no.	Hybrids	Plant height				Number of branches per plant			
		Kharif		summer		*Kharif*		summer	
		B.P.	S.C.	B.P.	S.C.	B.P.	S.C.	B.P.	S.C.
1	1 x 2	9.58	-7.67	18.33	-17.88 *	-2.23	21.6	-21.16	166.67**
2	1 x 3	-3.96	-22.29**	15.37	-25.1**	-29.82	-5.56	-4.35	223.53**
3	1 x 4	-10.39	-26.21**	21.29	-19.17 *	-35.98	-20.37	-6.09	217.65**
4	1 x 5	-20.81 **	-25.02**	-0.11	-22.7 **	-27.54	-9.88	-26.29*	180.39**
5	1 x 6	-9.19	-8.39	4.6	-17.7 *	-19.11	0.62	-6.09	217.65**
6	1 x 7	3	-26.57**	65.89 **	-14.26	-26.3	-8.64	40**	372.55**
7	1 x 8	-3.02	-12.43	-8.8	-30.44**	-35.98 *	-20.37	-25.22	152.94**
8	1 x 9	6.4	2.18	28.51**	2.33	-25.56	-7.41	-14.2	190.2**
9	2 x 3	11.85	-5.77	13.87	-20.98*	-19.72	8.02	18.24	294.12**
10	2 x 4	12.54	-5.18	25.15*	-13.15	-28.67	-37.04	-40**	100 *
11	2 x 5	2.39	-3.04	34.67 **	4.22	32.87	17.28	36.08**	417.65**
12	2 x 6	-2.47	-1.61	7.1	-15.73	18.88	4.94	0	233.33**
13	2 x 7	14.24	-3.75	25.65*	-12.81	0	-1.23	-7.06	209.8**
14	2 x 8	22.39 **	10.51	31.33 **	0.18	-21.68	-30.86	20	300**
15	2 x 9	6.16	1.95	32.29 **	5.34	-7.17	-16.05	0	233.33**
16	3 x 4	6.93	-11.95	22.85	-18.13*	-53.21 **	-37.04	-22.73	100
17	3 x 5	6.16	0.52	11.55	-13.67	-53.21 **	-37.04	-47.42 **	100 *
18	3 x 6	-12.19	-11.42	22.95*	-3.26	-37.61 *	-16.05	28.79	233.33**
19	3 x 7	31.28 **	6.23	62.91 **	5.77	-40.83 **	-20.37	-15.13	152.94**
20	3 x 8	-14.06	-22.41**	8.45	-17.27*	-22.02	4.94	28.79	233.33**
21	3 x 9	-0.52	-4.47	24.19*	-1.11	-36.24 *	-14.2	36.36*	252.94**
22	4 x 5	-0.38	-5.66	8.66	-15.91	-61.15 **	-66.67	-73.71 **	0
23	4 x 6	5.3	6.23	19.13	-6.27	-72.13 **	-79.01*	-48.89	-32.84
24	4 x 7	16.02	-4.47	19.73	-20.21*	-16.56	-17.9	-12.83	158.82**
25	4 x 8	16.07*	4.8	1.46	-22.61 **	19.51	-24.69	77.04*	133.33 **
26	4 x 9	16.55*	11.93	28.19**	2.07	-25.6	-32.72	-27.74	9.8
27	5 x 6	2.36	3.26	26.78*	-0.25	-14.39	-26.54	-39.18**	131.37**
28	5 x 7	5.78	0.17	33.33 **	3.19	-30	-30.86	-42.78 **	117.65 **
29	5 x 8	18.83*	12.53	44.44 **	11.79	-11.87	-24.69	-62.11 **	43.14 **
30	5 x 9	18.78**	14.07*	45.78 **	16.08	-1.02	-10.49	13.92	333.33**
31	6 x 7	13.43*	14.43 *	37.48 **	8.17	-31.87	-32.72	-29.61*	109.61**
32	6 x 8	17.67*	18.7**	36.50 **	7.4	39.34	4.94	8.96	43.14
33	6 x 9	9.54	10.51	32.83 **	5.77	18.77	7.41	27.74	94.12**
34	7 x 8	18.04	6.58	34.15 **	2.33	-25.31	-26.54	-89.47 **	-69.12
35	7 x 9	9.13	4.8	26.89*	1.04	-13.12	-14.2	7.24	219.61**
36	8 x 9	11.35	6.94	31.21 **	4.48	-11.6	-20.37	67.1*	152.94**
S.E.±		9.31	9.31	9.31	9.31	0.31	0.31	0.38	0.38
C.D. @5%		18.77	18.77	18.77	18.77	0.63	0.63	0.77	0.77
C.D. @1%		25.07	25.07	25.07	25.07	0.84	0.84	1.04	1.04

Table 1: Contd…

Sr. no.	Parents/ Hybrids	Number of nodes per plant				Length of internode			
		Kharif		summer		*Kharif*		summer	
		B.P.	S.C.	B.P.	S.C.	B.P.	S.C.	B.P.	S.C.
1	1 x 2	-4.76	-15.71	-10.7	-22.71**	17.84	-3.61	38.74 **	1.76
2	1 x 3	-20	-29.17*	-25.02**	-35.1**	13.23	-7.38	21.32	-11.01
3	1 x 4	-20	-29.17*	-22.29**	-32.74**	9.17	-14.1	23.72 *	-9.25
4	1 x 5	-15.56	-25.34 *	-24.06**	-34.28**	29.66	6.07	52.55 **	11.89
5	1 x 6	-11.75	-21.51	-14.04*	-25.6**	39.08 *	13.77	63.66 **	20.04 *
6	1 x 7	-18.1	-27.25*	-30.06 **	-39.47**	45.12 *	4.92	80.00 **	11.01
7	1 x 8	-8.57	-19.03	-2.79	-15.87**	28.66	5.25	51.35 **	11.01
8	1 x 9	9.84	-2.76	0.48	-13.04 *	33.27	9.02	58.26 **	16.08

9	2 x 3	-1.64	-15.65	-14.23*	-26.37**	8.11	-1.64	34.86 **	3.96
10	2 x 4	-14.86	-29.17*	-5.09	-26.25**	50.00 *	18.03	82.35 **	36.56 **
11	2 x 5	-2.05	-19.59	-4.26	-27.02**	19.09	15.57	56.66 **	42.51 **
12	2 x 6	-11.89	-29.17*	-2.09	-25.37**	27.02	18.69	40.15 **	25.33 **
13	2 x 7	-18.49	-33**	-18.48*	-34.93**	68.93 **	22.13	145.71 **	51.54 **
14	2 x 8	16.78	-6.19	33.13 **	1.47	21.45	17.87	33.09 **	21.81*
15	2 x 9	-14.74	-25.34*	-9.87	-24.07**	19.93	16.39	20.58 *	10.35
16	3 x 4	-35.2*	-44.48**	-29.55 **	-39.53**	50.83 *	18.69	96.47 **	47.14 **
17	3 x 5	-34.87*	-44.48**	-30.86 **	-40.65**	30.63	18.85	47.71 **	13.88
18	3 x 6	-19.74	-31.14 *	-25.98**	-36.46**	34.59 *	22.46	82.86 **	40.97 **
19	3 x 7	-19.74	-31.08*	-16.98*	-28.73**	49.66 *	8.2	103.57 **	25.55 **
20	3 x 8	-19.74	-31.08 *	-20.41**	-31.68**	15.5	5.08	57.14 **	21.15 *
21	3 x 9	-25.64	-34.91**	-24.12**	-34.87**	17.12	6.56	59.14 **	22.69 **
22	4 x 5	-3.38	-19.43	3.49	-19.59**	56.25 **	22.95	97.94 **	48.24 **
23	4 x 6	0	-16.95	6.68	-17.11**	62.50 **	27.87	96.47 **	47.14 **
24	4 x 7	16.22	-3.1	15.59*	-7.73	69.84 **	22.79	129.29 **	41.41 **
25	4 x 8	16.89	-2.36	33.49 **	3.72	9.38	-13.93	17.06	-12.33
26	4 x 9	19.87	5.29	-4.76	-19.76**	76.88 **	39.18 *	87.50 **	40.42 **
27	5 x 6	9.59	-10.02	34.95 **	-4.78	22.46	14.43	37.68 **	23.13 **
28	5 x 7	-8.9	25.34*	-10.05	-28.2**	81.41 **	31.15 *	146.79 **	52.2 **
29	5 x 8	11.64	-8.11	21.79**	-7.67	20.43	18.85	36.56 **	24.23 **
30	5 x 9	-1.92	-13.85	1.89	-14.16*	8.2	8.2	32.69 **	20.7 *
31	6 x 7	0	-17.68	15.15*	-8.08	49.66 *	8.2	81.79 **	12.11
32	6 x 8	34.11**	-2.36	21.71**	-7.73	-0.88	-7.38	3.69	-7.27
33	6 x 9	13.46	-0.45	5.04	-11.5	0	-6.56	2.46	-8.37
34	7 x 8	14.38	-6.19	17.74*	-6.02	3.4	-25.25	13.93	-29.74 **
35	7 x 9	7.05	-6.19	8.82	-8.32	33.79	-3.28	26.07	-22.25 **
36	8 x 9	2.56	-10.02	-1.61	-17.11**	23.59	21.97	36.62 **	40.53 **
S.E.±	3.12	3.12	1.44	1.44	0.91	0.91	0.37	0.37	
C.D. @5%		6.29	6.29	2.91	2.91	1.84	1.84	0.74	0.74
C.D. @1%		8.4	8.4	3.89	3.89	2.47	2.47	0.99	0.99

Table 1: Contd…

Sr. no.	Parents/ Hybrids	Number of ridges per fruit				Days to 50% flowering			
		Kharif		summer		*Kharif*		summer	
		B.P.	S.C.	B.P.	S.C.	B.P.	S.C.	B.P.	S.C.
1	1 x 2	27.45 **	30 **	27.45 **	30.00 **	-4.23	7.27	-0.79	4.4
2	1 x 3	30.65 **	62 **	30.65 **	62.00 **	-6.83	4.36	-6.75	-1.87
3	1 x 4	39.22 **	42 **	39.22 **	42.00 **	1.29	13.45	-0.62	4.58
4	1 x 5	23.53 **	26 **	23.53 **	26.00 **	2.3	5.83	-1.52	-3.74
5	1 x 6	62.00 **	62 **	62.00 **	62.00 **	2.1	14.36	1.25	5.73
6	1 x 7	2.9	42 **	2.9	42.00 **	4.54	17.09*	-1.86	3.27
7	1 x 8	13.46 *	18 **	13.46 *	18.00 **	9.8	18.37*	-1.15	2.14
8	1 x 9	25.00 **	30 **	25.00 **	30.00 **	1.25	3.64	-8.16	-5.35
9	2 x 3	23.53 **	26 **	19.61 **	22.00 **	-8.38	8.1	-13.74	-0.98
10	2 x 4	0	2	0	2	-7.7	8.9	-4.41	6.15
11	2 x 5	3.92	6	3.92	6	5.82	9.47	9.12	6.65
12	2 x 6	2	2	4	4	-17.88**	-3.1	-2.9	1.4
13	2 x 7	21.57 **	24 **	21.57 **	24.00 **	-7.86	8.72	-9.11	4.34
14	2 x 8	-1.96	0	-1.96	0	-2.18	5.45	-1.18	2.11
15	2 x 9	-1.96	0	-1.96	0	7.47	10	0.55	3.62
16	3 x 4	15.69 **	18 **	15.69 **	18.00 **	-1.95	18.37*	-0.75	10.22
17	3 x 5	60.78 **	64 **	60.78 **	64.00 **	3.33	6.9	0.4	-1.87
18	3 x 6	56.00 **	56 **	56.00 **	56.00 **	-12.93*	7.65	-6.71	-2.58
19	3 x 7	41.94 **	76 **	41.94 **	76.00 **	-8.18	14.01	-7.26	8.85
20	3 x 8	55.77 **	62 **	55.77 **	62.00 **	4.39	12.54	-2.21	1.04
21	3 x 9	11.54 *	16 **	15.38 **	20.00 **	4.81	7.27	-4.79	-1.87
22	4 x 5	-1.96	0	-1.96	0	12.48	16.36*	10.64	8.14
23	4 x 6	2	2	2	2	-16.57*	0.72	-9.42	-5.41
24	4 x 7	1.96	4	1.96	4	-2.41	17.81*	2.94	14.32
25	4 x 8	7.84	10	7.84	10	-12.3	-5.45	-16.88*	-14.11
26	4 x 9	-1.96	0	-1.96	0	13.69	16.36*	8.99	12.33
27	5 x 6	0	0	0	0	-4.21	-0.91	-3.34	-5.53
28	5 x 7	1.96	4	1.96	4	4.21	7.81	5.05	2.67
29	5 x 8	-1.96	0	-1.96	0	8.97	12.73	10.79	8.29
30	5 x 9	-1.96	0	-1.96	0	9.25	11.82	1.34	-0.95
31	6 x 7	6	6	8	8	-7.94	13.82	-2.59	1.72
32	6 x 8	0	0	0	0	14.68*	23.64**	7.94	11.53

33	6 x 9	4	4	4	4	4.44	6.9	-3.75	-0.8
34	7 x 8	38.46 **	44 **	38.46 **	44.00 **	12.65	21.44**	13.4	17.17*
35	7 x 9	38.46 **	44 **	38.46 **	44.00 **	20.79**	23.64**	17.64	21.24*
36	8 x 9	-3.85	0	-3.85	0	11.02	13.64	-0.81	2.23
S.E.±		0.26	0.26	0.26	0.26	4.21	4.21	4.21	4.21
C.D. @5%		0.53	0.53	0.53	0.53	8.5	8.5	8.5	8.5
C.D. @1%		0.71	0.71	0.71	0.71	11.35	11.35	11.35	11.35

Table 1: Contd…

Sr. no.	Parents/ Hybrids	Days for first harvesting				First fruiting node			
		Kharif		summer		*Kharif*		summer	
		B.P.	**S.C.**	**B.P.**	**S.C.**	**B.P.**	**S.C.**	**B.P.**	**S.C.**
1	1 x 2	-5.93	5.83	0.31	5.88	9.68	-15.00 *	8.57 **	-2.56 **
2	1 x 3	-4.44	7.5	-2.32	3.1	16.13	-10	8.57 **	-2.56 **
3	1 x 4	-1.48	10.83	-0.26	5.28	12.9	-12.5	8.57 **	-2.56 **
4	1 x 5	7.5	7.5	1.78	-0.11	32.26 **	2.5	17.14 **	5.13 **
5	1 x 6	8.87	12.5	4.4	7.3	25.81 **	-2.5	2.86 **	-7.69 **
6	1 x 7	1.48	14.17*	0.39	5.96	29.03 **	0	14.29 **	2.56 **
7	1 x 8	0.78	8.33	-0.08	4.55	25.81 **	-2.5	11.43 **	0
8	1 x 9	1.63	4.17	0.69	-4.9	25.81 **	-2.5	14.71 **	0
9	2 x 3	-8.7	5	-11.28	0.22	0	-12.5	2.63 **	0
10	2 x 4	-14.49*	-1.67	-2.29	6.75	5.88	-10	11.11 **	2.56 **
11	2 x 5	9.17	9.17	7.74	5.75	2.86	-10	2.63 **	0
12	2 x 6	5.65	9.17	-0.19	2.59	0	-12.5	2.56 **	2.56 **
13	2 x 7	-7.25	6.67	-5.16	7.14	2.86	-10	16.67 **	7.69 **
14	2 x 8	-2.33	5	-1.69	2.86	-2.86	-15.00 *	0	2.56 **
15	2 x 9	6.5	9.17	10.38	4.25	17.65 *	0	17.65 **	2.56 **
16	3 x 4	-1.98	15.17*	2.47	11.96	8.82	-7.5	2.78 **	-5.13 **
17	3 x 5	6.67	6.67	3.33	1.42	-2.7	-10	-2.63 **	-5.13 **
18	3 x 6	4.84	8.33	-2.68	0.03	5.26	0	2.63 **	0
19	3 x 7	-9.52	10.83	-5.36	8.66	0	-2.5	13.89 **	5.13 **
20	3 x 8	2.33	10	-2.47	2.04	-2.56	-5	0	-2.56 **
21	3 x 9	7.32	10	7.01	1.06	14.71	-2.5	14.71 **	0
22	4 x 5	13.33*	13.33*	10.43	8.39	20.59 *	2.5	13.89 **	5.13 **
23	4 x 6	-2.42	0.83	-6.44	-3.84	17.65 *	0	11.11 **	2.56 **
24	4 x 7	-2.13	15.00*	4.74	14.43	20.59 *	2.5	13.89 **	5.13 **
25	4 x 8	-9.3	-2.5	-15.93*	-12.04	17.65 *	0	11.11 **	2.56 **
26	4 x 9	12.2	15.00*	18.83*	12.23	14.71	-2.5	14.71 **	0
27	5 x 6	-2.5	-2.5	-2.33	-4.14	8.11	0	5.26 **	2.56 **
28	5 x 7	7.5	7.5	24.56**	22.25**	2.7	-5	5.56 **	-2.56 **
29	5 x 8	11.67	11.67	10.57	8.52	5.41	-2.5	2.63 **	0.00 **
30	5 x 9	17.50**	17.50**	5.94	0.05	14.71	-2.5	14.71 **	0.00 **
31	6 x 7	8.06	11.67	2.25	5.09	7.89	2.5	13.89 **	5.13 **
32	6 x 8	17.74**	21.67**	8.48	11.49	0	-5	-2.56 **	-2.56 **
33	6 x 9	4.07	6.67	6.49	0.57	14.71	-2.5	14.71 **	0
34	7 x 8	8.53	16.67*	11.87	17.05*	-2.5	-2.5	5.56 **	-2.56 **
35	7 x 9	17.07**	20.00**	27.88**	20.78*	-8.82	-22.50 **	17.65 **	2.56 **
36	8 x 9	8.13	10.83	9.03	2.97	17.65 *	0	17.65 **	2.56 **
S.E.±		3.87	3.87	4.21	4.21	0.28	0.28	0	0
C.D. @5%		7.5	7.8	8.5	8.5	0.57	0.57	0	0
C.D. @1%		10.42	10.42	11.35	11.35	0.076	0.076	0	0

Table 1: Contd…

Sr. no.	Parents/ Hybrids	Number of fruits per plant				Average weight of fruit (gm)			
		Kharif		summer		*Kharif*		summer	
		B.P.	**S.C.**	**B.P.**	**S.C.**	**B.P.**	**S.C.**	**B.P.**	**S.C.**
1	1 x 2	4.05	-3.92	12.55*	-8.62	-24.01 **	-33.51**	-29.86 **	-44.08**
2	1 x 3	-10.91	-17.73*	-3.69	-21.81**	-15.43*	-14.87*	-14.99 *	-22.45**
3	1 x 4	-18.26*	-24.52**	-12.68*	-29.11**	-24.29 **	-40.98**	-20.98 *	-48.5**
4	1 x 5	-14.41	-20.97**	3.31	-16.13**	22.02 *	-3.7	35.07 **	-11.97*
5	1 x 6	-0.39	-8.02	1.94	-17.24**	-7.4	-7.4	-9.55	-18.78**
6	1 x 7	3.46	-4.47	2.37	-16.89**	-16.67 *	-9.39	-18.54 **	-18.98**
7	1 x 8	9.08	0.73	-5.56	-23.33**	15.56	-9.91	17.22*	-23.61**
8	1 x 9	6.94	8.8	11.75*	4.16	23.33 **	14.94*	22.74 **	1.7
9	2 x 3	36.73**	3.83	37.95 **	-17.24**	-2.79	-2.14	-2.83	-11.36*
10	2 x 4	5.66	-13.22	27.76 **	-15.52**	-3.47	-15.53*	-8.87	-27.35**
11	2 x 5	19.74	-13.45	34.08 **	-21.6**	-13.86	-24.63**	-19.45**	-35.78**

12	2 x 6	4.82	-3.92	8.51	-12.07**	-22.34 **	-22.34**	-24.02 **	-31.77**
13	2 x 7	40.82 **	6.93	56.65 **	2.79	1.7	10.58	0.55	0
14	2 x 8	67.29 **	29.63**	55.29 **	8.67	27.13 **	11.24	26.11 **	0.54
15	2 x 9	-4.03	-2.37	0.38	-6.44	-10	-16.12	-9.03	-24.63**
16	3 x 4	18.48	-2.69	48.85 **	-1.57	-20.35 **	-19.82**	-24.24 **	-30.88**
17	3 x 5	36.73**	3.83	46.58 **	-12.07**	-21.60 **	-21.08**	-21.55 **	-28.44**
18	3 x 6	4.82	-3.92	10.64	-10.34 *	-19.18 **	-18.64*	-19.84 **	-26.87**
19	3 x 7	18.37	-10.12	34.00 **	-12.07**	-17.14 *	-9.91	-19.97 **	-20.41**
20	3 x 8	16	-10.12	30.72 **	-8.52	-8.74	-8.14	-8.72	-16.73**
21	3 x 9	-7.39	-5.79	1.8	-5.12	-16.68 *	-16.12*	-18.64 **	-25.78**
22	4 x 5	5.94	-12.99	21.17**	-19.88**	22.02 *	-3.7	30.58 **	-17.21**
23	4 x 6	3.98	-4.69	10.7	-10.29 *	2.66	2.66	1.89	-8.5
24	4 x 7	5.66	-13.22	24.62**	-17.6**	0	8.73	-7.59	-8.1
25	4 x 8	15.09	-5.47	14.06*	-20.18**	41.53 **	6.88	43.62 **	-6.6
26	4 x 9	5.11	6.93	10.61*	3.09	20.00 *	11.83	22.41 **	1.43
27	5 x 6	-0.6	-8.89	8.51	-12.07**	-9.32	-9.32	-8.26	-17.62**
28	5 x 7	15.13	-12.58	28.75 **	-15.52**	-11.43	-3.7	-14.57 *	-15.03**
29	5 x 8	30.00 **	0.73	35.87 **	-4.92	9.84	-13.31	21.97 *	-20.68**
30	5 x 9	-4.03	-2.37	-2.07	-8.72 *	23.49 **	15.09 *	22.82 **	1.77
31	6 x 7	6.51	-2.37	10.64	-10.34 *	-22.86 **	-16.12*	-24.69 **	-25.1**
32	6 x 8	16.66	6.93	23.47 **	0.05	16.79 **	16.79*	11.36	0
33	6 x 9	8.15	10.03	17.52 **	9.53 *	14.79*	14.79*	11.59	0.2
34	7 x 8	8	-16.32*	6.01	-25.81**	0	8.73	-7.59	-8.1
35	7 x 9	11.2	13.13	-12.79**	-18.71**	-11.97	-4.29	-15.53**	-15.99**
36	8 x 9	-5.56	-3.92	2.07	-4.87	-12.7	-18.64*	-10.51	-25.85**
S.E.±		2.51	2.51	1.24	1.24	1.11	1.11	0.95	0.95
C.D. @5%		5.05	5.05	2.51	2.51	2.25	2.25	1.92	1.92
C.D. @1%		6.75	6.75	3.36	3.36	3.01	3.01	2.56	2.56

Table 1: Contd…

Sr. no.	Parents/ Hybrids	Fruit length				Fruit Diameter			
		Kharif		summer		*Kharif*		summer	
		B.P.	S.C.	B.P.	S.C.	B.P.	S.C.	B.P.	S.C.
1	1 x 2	-12.47	-30.30 **	-13.36 *	-29.15 **	-12.31 **	-13.64 **	-7.23 *	-12.00 **
2	1 x 3	-5.65	-41.85 **	-4.94	-40.31 **	-4.1	-5.56	-2.91	-4.57
3	1 x 4	-34.96 *	-52.59 **	-31.84 **	-51.71 **	-13.33 **	-14.65 **	-9.04 **	-13.71 **
4	1 x 5	-3.28	-25.63 *	-0.1	-23.10 **	-6.67	-8.08 *	2.4	-2.29
5	1 x 6	-12.6	-27.04 *	-10.3	-25.74 **	-20.20 **	-20.20 **	-12.00 **	-12.00 **
6	1 x 7	-9.38	-36.30 **	-8.81	-37.44 **	-36.00 **	-3.03	-31.40 **	1.14
7	1 x 8	-26.70 *	-41.04 **	-21.01 **	-39.07 **	-2.05	-3.54	0	-5.14
8	1 x 9	21.59	2.22	19.78 **	2.33	-7.69 *	-9.09 **	-13.74 **	-10.29 **
9	2 x 3	18.14	-5.93	19.62 **	-2.17	0.53	-4.04	3.49	1.71
10	2 x 4	-1.21	-21.33	-13.65 *	-29.38 **	-5.82	-10.10 **	-12.12 **	-17.14 **
11	2 x 5	8	-14	-5.5	-22.71 **	-16.30 **	-22.22 **	-20.36 **	-24.00 **
12	2 x 6	12.6	-6	-1.5	-18.45 **	-19.19 **	-19.19 **	-16.00 **	-16.00 **
13	2 x 7	28.37 *	2.22	24.17 **	1.55	-36.67 **	-4.04	-28.29 **	5.71 *
14	2 x 8	24.31	0	24.08 **	1.47	-2.56	-4.04	10.49 **	2.29
15	2 x 9	23.17	3.56	18.51 **	1.24	-12.30 **	-17.17 **	-11.54 **	-8.00 **
16	3 x 4	-3.96	-30.00 **	-0.22	-29.30 **	1.59	-3.03	-2.33	-4
17	3 x 5	-20.91	-39.19 **	-17.72 **	-36.67 **	-5.82	-10.10 **	-11.05 **	-12.57 **
18	3 x 6	-20.76	-33.85 **	-18.07 **	-32.17 **	4.55	4.55	2.29	2.29
19	3 x 7	-5.27	-33.41 **	-1.58	-32.48 **	-31.00 **	4.55	-34.11 **	-2.86
20	3 x 8	0.37	-19.26	7.24	-17.29 **	4.1	2.53	12.79 **	10.86 **
21	3 x 9	-13.22	-27.04 *	-14.70 **	-27.13 **	-3.7	-8.08 *	-14.29 **	-10.86 **
22	4 x 5	12.24	-13.7	12.19 *	-13.64 **	-8.47 *	-12.63 **	-7.19 *	-11.43 **
23	4 x 6	7.81	-10	16.20 **	-3.8	-4.04	-4.04	-13.14 **	-13.14 **
24	4 x 7	25.2	-8.74	32.39 **	-6.2	-39.67 **	-8.59 **	-44.19 **	-17.71 **
25	4 x 8	15.29	-7.26	21.71 **	-6.12	-11.79 **	-13.13 **	-15.15 **	-20.00 **
26	4 x 9	19.47	0.44	17.60 **	0.47	6.35	1.52	-3.3	0.57
27	5 x 6	14.64	-4.3	11.99 *	-7.29	-23.23 **	-23.23 **	-22.29 **	-22.29 **
28	5 x 7	18.88	-8.59	28.70 **	-0.93	-46.33 **	-18.69 **	-44.57 **	-18.29 **
29	5 x 8	5.16	-15.41	11.86 *	-13.72 **	-21.54 **	-22.73 **	-27.54 **	-30.86 **
30	5 x 9	15.33	-3.04	13.61 *	-2.95	12.30 **	6.06	3.85	8.00 **
31	6 x 7	0.89	-15.78	3	-14.73 **	-34.00 **	0	-29.46 **	4
32	6 x 8	19.79	0	20.97 **	0.16	-12.12 **	-12.12 **	-10.86 **	-10.86 **
33	6 x 9	21.76	2.37	18.87 **	1.55	0	0	1.1	5.14
34	7 x 8	10.87	-10.81	20.70 **	-6.9	-22.33 **	17.68 **	-17.83 **	21.14 **

35	7 x 9	4.05	-12.52	-10.07	-23.18 **	-12.00 **	33.33 **	-22.09 **	14.86 **
36	8 x 9	-0.97	-16.74	1.36	-13.41 **	-16.41 **	-17.68 **	-12.64 **	-9.14 **
S.E.±		1.43	1.43	0.57	0.57	0.06	0.06	0.04	0.04
C.D. @5%		2.89	2.89	1.15	1.15	0.13	0.13	0.09	0.09
C.D. @1%		3.86	3.86	1.54	1.54	0.17	0.17	0.13	0.13

Table 1: Contd…

Sr. no.	Parents/ Hybrids	Duration of harvest (days from first harvest to last harvest)				Yield per plot			
		Kharif		**summer**		***Kharif***		**summer**	
		B.P.	**S.C.**	**B.P.**	**S.C.**	**B.P.**	**S.C.**	**B.P.**	**S.C.**
1	1 x 2	-7.49	17.76 *	-2.8	10.56	-16.58*	-28.45**	-40.60 **	-32.91**
2	1 x 3	-8.43	7.66	-4.69	3.85	-13.56	-25.3**	-31.23 **	-22.33 **
3	1 x 4	-3.66	13.27	-9.72	-1.62	-33.67 **	-43.1**	-54.80 **	-48.95**
4	1 x 5	-6.61	13.64	-6.39	7.17	-4.5	-18.08 **	-17.92*	-7.29
5	1 x 6	-2.86	14.21	-7.48	0.82	-11.65	-16.51**	-24.70 **	-14.95
6	1 x 7	2.7	20.75 **	0.75	9.79	-5.59	-13.01 *	-15.25*	-4.28
7	1 x 8	-2.38	14.77 *	-2.31	6.46	-9.88	-22.37**	-29.06 **	-19.87 *
8	1 x 9	-1.43	15.89 *	-3.56	5.1	22.20**	9.79	2.82	16.13 *
9	2 x 3	-16.89 **	5.79	-10.13	2.22	2.56	-11.37	12.7	-8.57
10	2 x 4	-16.89 **	5.79	-13.93 *	-2.11	-0.18	-21.66**	5.64	-21.51 *
11	2 x 5	-10.72	13.64	-9.63	3.47	-11.39	-30.52**	-10.66	-33.55**
12	2 x 6	-13.07 *	10.65	-11.89	0.22	-9.53	-14.51*	10.4	-11.94
13	2 x 7	-13.07 *	10.65	-4.28	8.88	20.64**	11.15	33.89 **	16.68 *
14	2 x 8	-16.30 **	6.54	-11.68	0.45	32.70 **	14.30*	36.14**	13.67
15	2 x 9	-12.63 *	11.21	-11.29	0.9	6.84	-4.00	14.96	0.18
16	3 x 4	-2.03	8.22	-5.97	-6.43	-5.46	-18.30**	4.49	-15.22 *
17	3 x 5	-5.99	14.39	-9.29	3.86	-6.2	-18.94**	-1.01	-19.69 *
18	3 x 6	1.94	8.04	-1.93	-2.41	-16.04*	-20.66 **	-4.38	-22.42 **
19	3 x 7	-3.37	12.71	-2.1	1.61	2.87**	-5.22 *	38.70**	20.88**
20	3 x 8	-16.24 *	-2.62	-17.93 **	-10.64	1.65	-12.15*	13.65	-5.1
21	3 x 9	-3	2.8	-0.82	-1.3	-7.4	-16.80**	1.57	-11.49
22	4 x 5	-8.6	11.21	-12.99 *	-0.38	14.03	-10.51	12.99	-15.95*
23	4 x 6	-4.23	5.79	2.47	-1.72	-0.53	-6	30.86**	4.38
24	4 x 7	-7.53	7.85	-7.42	-3.91	2.17	-5.86	8.26	-5.65
25	4 x 8	2.89	19.63 **	16.00 *	26.30 **	10.46	-4.86	27.84**	6.75
26	4 x 9	-2.71	7.48	-6.56	-10.82	22.20**	9.79	31.28 **	14.4
27	5 x 6	-3.23	17.76 *	-1.33	12.98	-16.87**	-21.44**	7.43	-14.31
28	5 x 7	-2.15	19.07 *	2.34	17.17	-10.55	-17.58 **	-1.78	-14.4
29	5 x 8	-5.53	14.95 *	-10.08	2.95	9.21	-5.93	32.42 **	10.57
30	5 x 9	-7.83	12.15	-6.21	7.38	28.16 **	15.15 *	46.23 **	27.44**
31	6 x 7	-0.8	15.70 *	4.58	8.54	-16.64*	-21.23**	-15.69	-26.53 **
32	6 x 8	2.09	18.69 *	-1.65	7.08	22.31 **	15.58 *	41.48 **	18.14 *
33	6 x 9	-7.61	-2.43	-3.42	-7.37	25.42 **	18.51 **	45.29 **	26.62**
34	7 x 8	-3.53	12.52	-6.87	1.4	-10.09	-17.16 **	-1.15	-13.86
35	7 x 9	-4.65	11.21	-6.47	-2.93	-3.49	-11.08	-1.46	-14.13
36	8 x 9	-1.13	14.95 *	-1.52	7.22	-6.28	-15.8 *	1.36	-11.67
S.E.±		3.87	3.87	3.94	3.94	1.44	1.44	1.44	1.44
C.D. @5%		7.8	7.8	7.94	7.94	2.91	2.91	2.91	2.91
C.D. @1%		10.42	10.42	10.6	10.6	3.89	3.89	3.89	3.89

Table 1: Contd…

Sr. no.	Parents/ Hybrids	Yield per hectare			
		Kharif		**Summer**	
		B.P.	S.C.	B.P.	S.C.
1	1 x 2	-22.67 **	-28.41**	-40.62 **	-32.91**
2	1 x 3	-19.36 **	-25.35**	-31.22 **	-22.29**
3	1 x 4	-38.57 **	-43.13**	-54.80 **	-48.94**
4	1 x 5	-11.48**	-18.05**	-17.90 **	-7.24
5	1 x 6	-11.68**	-16.57**	-24.66 **	-14.88 **
6	1 x 7	-6.08	-13.06 **	-15.30 **	-4.31
7	1 x 8	-16.20 **	-22.42**	-29.08 **	-19.87**
8	1 x 9	18.58 **	9.77 *	2.8	16.14 **
9	2 x 3	2.5	-11.44**	12.67*	-8.56
10	2 x 4	-0.17	-21.66**	5.64	-21.48**
11	2 x 5	-11.48*	-30.57**	-10.66	-33.54**
12	2 x 6	-9.53*	-14.54**	10.44	-11.89 **
13	2 x 7	20.73 **	11.17 **	33.95 **	16.71 **

14	2 x 8	32.67 **	14.27***	36.11 **	13.67 **
15	2 x 9	6.81	-4.01	14.96**	0.17
16	3 x 4	-5.47	-18.33**	4.46	-15.22 **
17	3 x 5	-6.2	-18.96**	-1.06	-19.7**
18	3 x 6	-16.02 **	-20.67**	-4.46	-22.46**
19	3 x 7	21.76 **	12.11 **	38.76 **	20.91**
20	3 x 8	1.62	-12.20**	13.62*	-5.11
21	3 x 9	-7.46	-16.84**	1.58	-11.49 *
22	4 x 5	14.00**	-10.54 **	12.97*	-15.97**
23	4 x 6	-0.48	-5.99	30.89 **	4.42
24	4 x 7	2.2	-5.9	8.31	-5.63
25	4 x 8	10.45*	-4.86	27.85 **	6.78
26	4 x 9	22.14 **	9.77*	31.38 **	14.47**
27	5 x 6	-16.87 **	-21.48**	7.34	-14.36 **
28	5 x 7	-10.51*	-17.6**	-1.71	-14.36 **
29	5 x 8	9.20*	-5.94	32.39 **	10.57 *
30	5 x 9	28.16 **	15.17**	46.28 **	27.46**
31	6 x 7	-16.59 **	-21.21**	-15.69**	-26.54**
32	6 x 8	22.35 **	15.58**	41.47 **	18.15**
33	6 x 9	25.45 **	18.51**	45.35 **	26.65**
34	7 x 8	-10.02*	-17.15**	-1.19	-13.90**
35	7 x 9	-3.47	-11.12 **	-1.38	-14.07**
36	8 x 9	-6.31	-15.8**	1.45	-11.60*
S.E.±		1.44	1.44	1.44	1.44
C.D. @5%		2.91	2.91	2.91	2.91
C.D. @1%		3.89	3.89	3.89	3.89

Note: * Significant at 5% level of significance, ** Significant at 1% level of significance

Parents: 1) IC 0369611, 2) IC 0034124, 3) IC 0090249, 4) IC 0010256A, 5) IC 0045993, 6) IC 089835, 7) IC 0588162, 8) IC 0111484, 9) GKOKS-4

1. Plant height

Out of 36 crosses, 9 cross combinations displayed significant positive heterosis over better parent and two cross combinations over top parent and 3 cross combination displayed the significant positive heterosis over standard hybrid check in *kharif* season. While 21 crosses displayed significant positive heterosis over better parent and 18 crosses over top parent and none cross combination displayed the significant positive heterosis over standard hybrid check in summer season. Cross combination IC 089835 x IC 0111484 (18.7) in *kharif* exhibited significant positive heterosis over standard hybrid check for plant height and in summer cross combination IC 0045993 x GKOKS-4 (16.08) exhibited significant positive heterosis over standard hybrid check for plant height.

The result was in correspondence with Neetu *et al.*, (2015) [20], Patel (2015) [22], Tiwari *et al.*, (2015) [25], Verma and sood (2015) [27], Nimbalkar *et al.*, (2017) [21], Hadia *et al.*, (2018) [6] and Kavya *et al.*, (2019) [11].

2. Number of branches per plant

Out of 36 crosses, none of the cross combination displayed significant positive heterosis over better parent and standard hybrid check in *kharif* season. While 5 cross combinations displayed significant positive heterosis over better parent and 31 cross combinations displayed the significant positive heterosis over standard hybrid check in summer season. The cross IC 0034124 x IC 0045993 (417.65) showed highest positive heterosis over standard hybrid check during summer season.

Vegetative growth is essential for higher yield and number of branches directly related to the number of fruits per plant hence significant and positive heterosis is desirable for number of branches per plant. The result obtained is in consonance with Ashwini kumar *et al.*, (2013) [3], Joshi and Murugan *et al.*, (2012) [10] and Tiwari *et al.*, (2015) [25].

3. Number of nodes per plant

Out of 36 crosses, only one cross combination IC 089835 x IC 0111484 (34.11) displayed significant positive heterosis over better parent and none of the cross combinations displayed significant positive heterosis over standard hybrid check in *kharif* season. While 8 cross combinations displayed significant positive heterosis over better parent and none of the cross combination displayed the significant positive heterosis over standard hybrid check in summer season.

Number of nodes per plant directly related to the number of fruits per plant hence significant and positive heterosis is desirable this character. Similar result were obtained by Kumar *et al.*, (2013 a) [12] and Medagam *et al.*, (2013) [18].

4. Length of internode (cm)

A cultivar having less internodal length is immense value in breeding programme. Out of 36 crosses, no cross combinations displayed significant negative heterosis over better parent and standard hybrid check in both *kharif* and summer season.

Length of internode is inversely proportional to the number of nodes per plant hence significant and negative heterosis is desirable this character. Similar result were obtained by Kumar *et al.*, (2013 b) [13], Medagam *et al.*, (2013) [18], Neetu *et al.*, (2015) [20], Verma and Sood (2015) [27].

5. Number of ridges per fruit

Out of 36 crosses, 17 cross combinations over better parent and 18 cross combinations standard hybrid check displayed the significant positive heterosis respectively in *kharif* season. While 17 cross combinations displayed significant positive heterosis over better parent and 18 cross combinations displayed the significant positive heterosis over standard hybrid check in summer season.

Cross combination IC 0090249 x IC 0588162 (76.00) exhibited significant positive heterosis over standard hybrid check for number of ridges per fruit in both *kharif* and summer season. Akotkar *et al.*, (2014) [2] and Mulge and Khot (2018) [19] also reported similar results.

6. Days to 50% flowering
Out of 36 crosses, 3 cross combination displayed significant negative heterosis over better parent and none of the cross combinations over standard hybrid check in *kharif* season. While only one cross combination IC 0010256A x IC 0111484 (16.88) displayed significant negative heterosis over better parent and none of the other cross combinations over standard hybrid check in summer season had negative heterosis for days to 50% flowering.

7. Days required for first harvest
Out of 36 crosses, only cross combination IC 0034124 x IC 0010256A (14.49) displayed significant negative heterosis over better parent, and no cross displayed significant negative heterosis standard hybrid check in *kharif* season. Similarly only one cross combination IC 0010256A x IC 0111484 (15.93) displayed significant negative heterosis over better parent and none of the cross combinations displayed significant negative heterosis over standard hybrid check in summer season. These results are in consonance with Sugani Devi *et al.*, (2017) [23].

8. First fruiting node
As regards to first fruiting node, out of 36 crosses, no cross combinations displayed significant negative heterosis over better parent and cross combination IC 0588162 x GKOKS-4 (22.50) displayed the significant negative heterosis over standard hybrid check in *kharif* season. While two cross combinations displayed significant negative heterosis over better parent and 10 cross combinations displayed the significant negative heterosis over standard hybrid check in summer season, among that cross IC 0369611 x IC 089835 (7.69) showed highest negative heterosis over standard hybrid check.
Lower first fruiting node is desirable for minimum days to 50% flowering and earliness. These results are in consonance with Medagam *et al.*, (2013) [18], Kavya *et al.*, (2019) [11].

9. Number of fruits per plant
Out of 36 crosses, 5 cross combinations displayed significant positive heterosis over better parent and 1 cross combination displayed the significant positive heterosis over standard hybrid check in *kharif* season. The cross combination IC 0034124 x IC 0111484 (29.63) displayed highest significant positive heterosis over standard hybrid check, during *kharif* season. While 19 cross combinations displayed significant positive heterosis over better parent and cross combination IC 089835 x GKOKS-4 (9.53) displayed significant positive heterosis over standard hybrid check, during summer season.
Similar results were obtained by Jagan *et al.*, (2013 b) [9], Bhatt *et al.*, (2016) [5] and Kavya *et al.*, (2019) [11].

10. Average fruit weight (g)
Out of 36 crosses, 9 cross combinations displayed significant positive heterosis over better parent and 4 cross combinations standard hybrid check in *kharif* season. The cross IC 089835 x IC 0111484 (16.79) showed highest positive heterosis over standard hybrid check during *kharif* season. While 9 cross combinations displayed significant positive heterosis over better parent and no cross combinations over standard hybrid check in summer season.
Correspondence result for significant positive heterosis for average weight of fruit in okra were also reported by Kumar *et al.*, (2013 a) [12], Bhatt *et al.*, (2016) [5] and Mulge and Khot (2018) [19].

11. Fruit length (cm)
Out of 36 crosses, cross combination IC 0034124 x IC 0588162 (28.37) displayed significant positive heterosis over better parent and no cross combination displayed significant positive heterosis standard hybrid check in *kharif* season. While 17 cross combinations displayed significant positive heterosis over better parent and no cross combinations displayed the significant positive heterosis over standard hybrid check in summer season.

12. Fruit diameter (cm)
Out of 36 crosses, no cross combinations displayed significant positive heterosis over better parent while 2 cross combinations displayed the significant positive heterosis over standard hybrid check in *kharif* season. While 2 cross combinations displayed significant positive heterosis over better parent and 3 cross combinations displayed the significant positive heterosis over standard hybrid check in summer season.
The cross combination IC 0588162 x GKOKS-4 (33.33) followed by IC 0588162 x IC 0111484 (17.68) displayed highest significant positive heterosis over standard hybrid check, during *kharif* season. In summer season, the cross combination IC 0588162 x IC 0111484 (21.14) followed by IC 0588162 x GKOKS-4 (14.86) displayed highest significant positive heterosis over standard hybrid check during summer season.
The results obtained for length and diameter of fruit were in agreement with results obtained by Kumar *et al.*, (2013), Thirupathi *et al.*, (2012) [24], Verma and Sood (2015) [27] and Mulge and Khot., (2018) [19] for fruit length and diameter.

13. Duration of harvest (days from first harvest to last harvest)
Out of 36 crosses, no cross combinations displayed significant positive heterosis over better parent while IC 0369611 x IC 0588162 (20.75), IC 0010256A x IC 0111484 (19.63) and 9 other cross combinations displayed the significant positive heterosis over standard hybrid check in *kharif* season. While cross combination IC 0010256A x IC 0111484 (26.30) displayed significant positive heterosis over better parent while cross combination IC 0010256A x IC 0111484 (26.30) displayed the significant positive heterosis over standard hybrid check in summer season.

14. Yield per plot (kg)
As regards, the yield per plot 8 crosses showed positive heterosis over better parent, while 4 cross combinations displayed significant positive heterosis over standard hybrid check during *kharif* season. While 10 cross combinations displayed significant positive heterosis over better parent and 3 cross combinations displayed the significant positive heterosis over standard hybrid check in summer season.
In *kharif* the cross IC 089835 x GKOKS-4 (18.51) showed significant positive heterosis over standard hybrid check. In summer the cross IC 0090249 x IC 0588162 (20.88) showed significant positive heterosis over standard hybrid check.

15. Yield per hectare (t)

Out of 36 crosses, 10 cross combinations displayed significant positive heterosis over better parent and 6 cross combinations displayed the significant positive heterosis over standard hybrid check in *kharif* season. While 15 cross combinations displayed significant positive heterosis over better parent and 8 cross combinations displayed the significant positive heterosis over standard hybrid check in summer season.

In *kharif* the cross IC 089835 x GKOKS-4 (18.51) showed significant positive heterosis over standard hybrid check. In summer the crosses IC 0045993 x GKOKS-4 (27.46) followed by IC 089835 x GKOKS-4 (26.65) and IC 0090249 x IC 0588162 (20.91) showed significant positive heterosis over standard hybrid check.

Fruit yield being a complex trait and it is a multiplicative product of several other contributing characters like average weight of fruit and number of fruits per plant. Hence, positive and significant heterosis value is desirable for exploitation of hybrid vigour in breeding programme. Performance of these cross combinations can be attributed to high *per se* performance and higher significant sca effect for *kharif* and summer season. The results are alike on significantly positive heterosis for yield per plot and yield per hectare with the findings of Patel (2015) [25], Bhatt *et al.*, (2016) [5], Nimbalkar *et al.*, (2017) [21], Hadia *et al.*, (2018) [6] and Kavya *et al.*, (2019) [11].

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