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HETEROSIS IN SINGLE CROSS INTER AND INTRA-SPECIFIC HYBRIDS OF *DESI* COTTON IN RELATION TO SEED COTTON YIELD AND IT'S CONTRIBUTING CHARACTERS

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ABSTRACT

Forty five inter and intra-specific hybrids between *G. arboreum* and *G. herbaceum* derived from ten genotypes (five *G. arboreum* and five *G. herbaceum*) in half diallel mating design were evaluated to study heterosis for seed cotton yield and its component traits. For seed cotton yield, 17 crosses showed significant positive heterosis over better parent and five crosss showed significant positive standard heterosis over commercial check, G. Cot DH-7. In order of merit F_1 hybrids GBhv- 282 x G 27 (67.36%), GBhv- 287 x 824 (58.14%), GBhv- 282 x GAM- 173 (35.00%), GBhv- 286 x G 27 (20.50%), and GBhv- 283 x 824 (18.75%) recorded highest significant positive standard heterosis while the maximum heterobeltiosis for seed cotton yield per plant was exhibited by the hybrid GBhv- 287 x 824 (155.60 %) followed by GBhv- 282 x G 27 (151.29%) and GBhv- 282 x GAM- 173 (130.30%). Similar trend of heterosis for numbers of boll per plant were observed in above hybrids. The present study reveals good scope for isolation of pure lines from the progenies of heterotic F_1s as well as commercial exploitation of heterosis in *desi* (diploid) cotton.

INTRODUCTION

Cotton, 'King of Apparel fibre' is the premier cash crop in India play a vital role in agriculture, industry, social and monetary affairs of country's economy. Cotton, through cloth, has influenced the culture and civilizations. Cotton is providing livelihood directly and indirectly to over 60 million people and accounting for about 16 per cent of India's export earnings. Cotton is one of the few crops which are accessible to development of genotypes as varieties and at the same time amenable for commercial exploitation of heterosis. Development of hybrid varieties is considered to be the quickest breeding method for exploiting the heterosis to improve yield potential of crop plants (Nassimi *et al.*, 2006; Radoev *et al.*, 2008 and Rameeh 2011). A noticeable heterosis for seed cotton yield has been reported by Khadi *et al.* (1995), Khosla *et al.* (2007) and Tuteja *et al.* (2011a, b). Exploiting heterosis is one of the methods used to increase cotton yields that have stagnated in recent years. The important reasons attributed for this is the lack of systematic efforts made to develop hybrid oriented populations, derived lines with improved combining ability and develop new hybrids based on such genetically diverse high combiner lines. The *desi* or diploid cotton varieties are still preferred in low rainfall areas because of their strong resistance to many biotic and abiotic stresses. These aroused the interest for developing superior hybrids in Asiatic cotton. Hybrids have occupied nearly 90% area of cotton cultivated in India. There is a constant need to develop more potential hybrids and adopt novel approaches for improving hybrid performance. Considerable success in developing superior *desi* cotton hybrids for rainfed farming has been achieved by releasing *desi* cotton hybrids *viz.*, G. Cot DH- 7, G. Cot DH- 9, DDH- 2, G. Cot MDH- 11 and PKV DH- 1 for cultivation. The studies on heterosis in diploid cotton has also been done by Patil *et al.* (2009), Jyotiba *et al.* (2010), Patel *et al.* (2010), Saravanan and Koodalingam *et al.* (2011), Sekhar babu *et al.* (2011), Solanki *et al.* (2014) and Tyagi *et al.* (2014). Keeping in view the general rule of breeding and the necessity of finding out superior heterotic crosses, we, therefore conducted this study with the objective of estimating the extent of heterosis in various intra and inter specific crosses of *desi* cotton obtained through half diallel mating scheme.

MATERIALS AND METHODS

The genetic materials used for this study consisted of ten genotypes including five promising lines of *Gossipium herbaceum* and five lines of *G. arboreum* cotton. Crosses were made between parents in a 10 x 10 diallel mating design excluding reciprocals (Griffing, 1956, Method II model I). The conventional hand emasculation and pollination method developed by Dock and Moll (1934) was followed. A complete set of 56 entries comprising of ten parents and their resultant 45 F_1's and one standard check (G. Cot DH- 7) were sown during *kharif* 2012 at Main Cotton Research Station, Navsari Agricultural University, Surat. All entries were raised in a randomized block design (RBD) with three replications each comprising single row at 120 x 45 cm spacing. Data on five randomly selected plants in each replication were recorded for seed cotton yield per plant and its attributing characters. Heterosis was estimated over the better parent (BP) as per the standard procedure of Meredith and Bridge (1972) and useful heterosis as per standard method suggested by Rai (1978) over the standard check (SC) hybrid G. Cot DH- 7.

RESULTS AND DISCUSSION

The results and discussion of nine quantitative traits are grouped into plant morphological traits, yield and yield attributing traits and economic traits. Mean performance, heterobeltiosis and standard check for nine characters is presented in Table 1. The results indicated that the phenomenon of heterosis was of a general occurrence for almost all the characters, under study. However, the magnitude

Table 1: *Per se* performance and heterosis over better parent (BP) and Standard check (SC) for seed cotton yield and its contributing traits of *desi* cotton hybrids

Sr. No	Crosses	Plant Height (cm)			Monopods/ plant			Sympodia/ plant		
		Mean	BP	SC	Mean	BP	SC	Mean	BP	SC
1	GShv- 273/07 x GBhv -282	163.56	9.51	-10.37*	5.33	-3.61	48.15**	24.80	5.98	-22.82
2	GShv- 273/07 x GBhv- 283	149.74	0.31	-17.94**	4.07	-27.38**	12.96	21.47	-8.26	-33.20**
3	GShv- 273/07 x GBhv- 286	159.42	6.16	-12.64**	5.00	-8.54	38.89**	22.53	-3.70	-29.88**
4	GShv- 273/07 x GBhv- 287	164.93	9.83	-9.62*	5.33	15.94*	48.15**	20.00	-14.53	-37.76**
5	GShv- 273/07 x 824	177.72	18.35**	-2.61	4.07	60.53**	12.96	28.13	20.23**	-12.45*
6	GShv- 273/07 x G 27	179.66	19.64**	-1.55	3.00	0.00	-16.67	30.07	25.63**	-6.43
7	GShv- 273/07 x GAM- 141	170.21	14.15*	-6.72	5.07	68.89**	40.74**	28.00	19.66**	-12.86*
8	GShv- 273/07 x GAM- 165	163.42	8.82	-10.44*	4.07	15.09	12.96	23.40	-4.62	-27.18**
9	GShv- 273/07 x GAM- 173	159.87	6.46	-12.39**	4.00	53.85**	11.11	24.93	6.55	-22.41**
10	GBhv- 282 x GBhv- 283	155.55	4.21	-14.76**	6.00	8.43	66.67**	22.20	0.91	-30.91**
11	GBhv- 282 x GBhv- 286	157.31	5.33	-13.79**	5.40	-1.22	50.00**	21.47	-2.42	-33.20**
12	GBhv- 282 x GBhv- 287	153.42	2.73	-15.93**	6.07	31.88**	68.52**	22.13	0.61	-31.12**
13	GBhv- 282 x 824	168.21	12.63**	-7.82	3.20	26.32*	-11.11	23.67	7.25	-26.35**
14	GBhv- 282 x G 27	179.22	20.00**	-1.79	2.47	-17.78	-31.48**	28.27	18.11*	-12.03*
15	GBhv- 282 x GAM- 141	182.64	22.49**	0.09	3.53	17.78	-1.85	29.53	34.24**	-8.09
16	GBhv- 282 x GAM- 165	163.42	9.42	-10.44*	3.00	-15.09	-16.67	23.27	-5.16	-27.59**
17	GBhv- 282 x GAM- 173	167.89	12.41*	-8.00	4.00	53.85**	11.11	30.00	36.36**	-6.64
18	GBhv- 283 x GBhv- 286	160.18	7.31	-12.22*	6.00	9.76	66.67**	23.60	15.69	-26.56**
19	GBhv- 283 x GBhv- 287	154.63	3.59	-15.26**	5.00	8.70	38.89**	24.53	13.58	-23.65**
20	GBhv- 283 x 824	165.23	10.69	-9.45	3.40	34.21**	-5.56	26.33	19.34*	-18.05**
21	GBhv- 283 x G 27	181.41	21.53**	-0.59	3.60	20.00	0.00	22.07	-7.80	-31.33**
22	GBhv- 283 x GAM- 141	159.18	6.75	-12.77**	4.60	53.33**	27.78**	20.00	-4.76	-37.76**
23	GBhv- 283 x GAM- 165	164.54	10.23	-9.83*	4.00	13.21	11.11	17.53	-28.53**	-45.44**
24	GBhv- 283 x GAM- 173	156.66	4.95	-14.15**	4.47	71.92*	24.17**	24.07	17.97*	-25.10**
25	GBhv- 286 x GBhv- 287	165.13	7.51	-9.51*	6.00	30.43**	66.67**	28.00	29.63**	-12.86*
26	GBhv- 286 x 824	168.92	9.98	-7.43	4.00	57.89**	11.11	29.00	31.42**	-9.75
27	GBhv- 286 x G 27	169.31	10.24	-7.22	3.80	26.67**	5.56	24.40	1.95	-24.07**
28	GBhv- 286 x GAM- 141	151.61	1.68	-16.92**	3.00	0.00	-16.67	27.33	30.16**	-14.94**
29	GBhv- 286 x GAM- 165	160.31	4.75	-12.15*	2.60	-26.42**	-27.78**	23.07	-5.98	-28.22**
30	GBhv- 286 x GAM- 173	155.00	0.92	-15.06**	2.47	-5.13	-31.48**	24.93	30.77**	-22.41**
31	GBhv- 287 x 824	156.17	-0.91	-14.42**	3.00	18.42	-16.67	29.00	31.42**	-9.75
32	GBhv- 287 x G 27	153.11	-2.86	-16.09**	2.00	-33.33**	-44.44**	22.07	-7.80	-31.33**
33	GBhv- 287 x GAM- 141	150.84	1.16	-17.34**	2.60	-13.33	-27.78**	23.33	8.02	-27.39**
34	GBhv- 287 x GAM- 165	158.39	3.50	-13.20**	3.00	-15.09	-16.67	26.00	5.98	-19.09**
35	GBhv- 287 x GAM- 173	149.44	-4.77	-18.11**	2.60	0.00	-27.78	24.40	12.96	-24.07**
36	824 x G 27	158.16	-0.06	-13.33**	2.00	-21.05	-44.44**	21.33	-10.86	-33.61**
37	824 x GAM- 141	160.46	7.61	-12.07*	2.47	-2.63	-31.48**	20.07	-9.06	-37.55**
38	824 x GAM- 165	153.20	0.10	-16.05**	2.53	0.00	-29.63**	23.47	-4.35	-26.97**
39	824 x GAM- 173	164.62	4.90	-9.79*	2.00	-21.05	-44.44**	20.07	-9.06	-37.55**
40	G 27 x GAM- 141	160.80	7.84	-11.88*	2.60	-13.33	-27.78**	22.20	-7.24	-30.91**
41	G 27 x GAM- 165	153.33	0.19	-15.97**	3.00	0.00	-16.67	24.00	-2.17	-25.31**
42	G 27 x GAM- 173	159.45	1.61	-12.62**	2.53	-2.56	-29.63**	20.93	-12.53	-34.85**
43	GAM- 141 x GAM- 165	161.62	8.39	-11.43*	2.60	-13.33	-27.78**	26.20	6.79	-18.46**
44	GAM- 141 x GAM- 173	158.22	6.11	-13.29**	3.00	15.38	-16.67	22.53	-7.20	-29.88**
45	GAM- 165 x GAM- 173	153.65	0.40	-15.80**	2.60	0.00	-27.78**	20.20	-17.66**	-37.14**
	S.E. (d) ±		8.57	8.57		0.30	0.30		1.72	1.72
	CD 0.05		16.98	16.98		0.60	0.60		3.42	3.42
	CD 0.01		22.46	22.46		0.80	0.80		4.52	4.52

*, ** Significant at 5 % and 1 % levels, respectively

of heterosis varied with characters. .

Plant morphological traits

Plant height is an important morphological character in cotton which provides the seat for nodes and internodes ultimately determining total yielding potential of a genotype. The variation for plant height in cross combinations was ranged from 149.44 cm (GBhv- 287 x GAM- 173) to 182.64 cm (GBhv- 282 x GAM- 141). Eight hybrids registered significant positive (desirable) heterobeltiosis while none of the hybrids showed significant positive standard heterosis. The hybrid GBhv- 282 x GAM- 141 recorded maximum heterobetiosis (22.49 %) for plant height. The results are akin to the findings of Sekhar babu *et al.* (2011).

The range of mean value among the cross combinations for no. of monopods varied from 2.00 (GBhv- 287 x G 27, 824 x G 27 and 824 x GAM- 173) to 6.07 (GBhv- 282 x GBhv- 287). Three and 13 hybrids hybrids showed significant negative heterobeltiosis and economic heterosis in desired direction for no. of monopodes, respectively. The promising hybrids for no. of monopods were GBhv-287 x G 27 and GBhv- 286 x GAM- 165 because they recorded high value for both type heterosis. Same results were also obtained by Jyotiba *et al.* (2010) and Sekhar babu *et al.* (2011).

The range of variation for no. of sympodia/ plant in cross

Table 1: Cont...

Sr. No	Crosses	No. of Bolls/ plant			Boll weight (g)			Seed cotton yield/ plant (g)		
		Mean	BP	SC	Mean	BP	SC	Mean	BP	SC
1	GShv- 273/07 x GBhv -282	39.11	-7.38	-40.52**	2.31	5.48	13.79*	90.62	3.84	-32.03**
2	GShv- 273/07 x GBhv- 283	29.69	-25.60*	-54.85**	2.29	2.23	12.81*	66.83	-23.42*	-49.88**
3	GShv- 273/07 x GBhv- 286	30.82	-22.76*	-53.13**	2.26	13.74**	11.33*	69.81	-20.01	-47.64**
4	GShv- 273/07 x GBhv- 287	26.73	-33.02**	-59.35**	2.81	20.60**	38.42**	74.88	-14.19	-43.84**
5	GShv- 273/07 x 824	68.60	71.92**	4.33	2.20	0.46	8.37	151.28	73.35**	13.46
6	GShv- 273/07 x G 27	71.70	67.46**	9.05	1.91	-12.79*	-5.91	136.76	54.00**	2.57
7	GShv- 273/07 x GAM- 141	56.85	42.47**	-13.54*	2.17	-11.07*	6.90	123.67	41.71**	-7.25
8	GShv- 273/07 x GAM- 165	39.78	-0.31	-39.50**	2.42	-5.47	19.21**	96.00	-1.73	-28.00**
9	GShv- 273/07 x GAM- 173	44.05	10.39	-33.01**	2.25	-1.75	10.84*	98.84	13.26	-25.87**
10	GBhv- 282 x GBhv- 283	22.66	-46.34**	-65.54**	2.65	18.30**	30.54**	59.46	-23.93	-55.41**
11	GBhv- 282 x GBhv- 286	34.60	-18.05	-47.38**	2.23	-14.89**	9.85	76.78	-1.77	-42.42**
12	GBhv- 282 x GBhv- 287	38.97	-7.70	-40.72**	2.20	-5.58	8.37	85.87	9.08	-35.60**
13	GBhv- 282 x 824	36.15	-14.40	-45.03**	2.09	-2.34	2.96	75.66	-8.28	-43.26**
14	GBhv- 282 x G 27	97.40	127.48**	48.14**	2.29	10.10	12.81*	223.15	151.29**	67.36**
15	GBhv- 282 x GAM- 141	62.00	46.85**	-5.70	2.47	1.23	21.67**	152.33	87.30**	14.25
16	GBhv- 282 x GAM- 165	44.73	5.94	-31.96**	2.62	2.34	29.06**	117.18	19.95	-12.12
17	GBhv- 282 x GAM- 173	83.86	98.60**	27.54**	2.14	-6.40	5.58	180.00	130.30**	35.00**
18	GBhv- 283 x GBhv- 286	39.08	49.08**	-40.56**	2.42	-7.63	19.21**	95.00	63.40**	-28.75**
19	GBhv- 283 x GBhv- 287	42.68	25.97*	-35.09**	2.17	-6.87	6.90	92.33	17.28	-30.75**
20	GBhv- 283 x 824	76.56	98.37**	16.44*	2.07	-7.59	1.97	158.33	91.93**	18.75*
21	GBhv- 283 x G 27	54.56	27.42**	-17.02*	1.94	-13.39**	-4.43	105.57	18.88	-20.82**
22	GBhv- 283 x GAM- 141	34.29	2.43	-47.85**	2.76	13.11**	35.96**	95.01	16.82	-28.74**
23	GBhv- 283 x GAM- 165	22.41	-41.36**	-65.91**	2.94	14.84**	44.83**	65.86	-32.59**	-50.61**
24	GBhv- 283 x GAM- 173	38.27	45.99**	-41.79**	1.95	-14.85**	-3.94	73.99	27.26	-44.51**
25	GBhv- 286 x GBhv- 287	50.94	50.34**	-22.53**	2.18	-16.79**	7.39	111.00	40.99**	-16.75*
26	GBhv- 286 x 824	61.70	59.86**	-6.16	1.98	-24.43**	-2.46	122.22	48.16**	-8.34
27	GBhv- 286 x G 27	79.59	85.89**	21.05**	2.02	-23.03**	-0.66	160.67	80.92**	20.50**
28	GBhv- 286 x GAM- 141	48.35	44.43**	-26.47**	1.86	-29.01**	-8.37	89.60	10.16	-32.80**
29	GBhv- 286 x GAM- 165	29.09	-23.88*	-55.75**	1.89	-27.86**	-6.90	54.93	-43.77**	-58.80**
30	GBhv- 286 x GAM- 173	37.36	59.85**	-43.17**	2.13	-18.70**	4.93	79.33	47.78*	-40.50**
31	GBhv- 287 x 824	93.09	141.22**	41.59**	2.30	-1.29	13.30*	210.86	155.60**	58.14**
32	GBhv- 287 x G 27	72.29	68.83**	9.94	2.02	-13.30**	-0.49	146.73	65.23**	10.04
33	GBhv- 287 x GAM- 141	72.73	114.68**	10.62	2.07	-15.16**	1.97	150.57	85.12**	12.92
34	GBhv- 287 x GAM- 165	62.83	64.39**	-4.44	2.05	-19.92**	0.99	128.74	31.78**	-3.45
35	GBhv- 287 x GAM- 173	68.84	103.18**	4.69	1.96	-15.88**	-3.45	134.63	71.01**	0.97
36	824 x G 27	35.85	-16.27	-45.48**	2.10	-2.02	3.28	73.16	-17.62	-45.13**
37	824 x GAM- 141	38.23	-0.94	-41.86**	1.90	-22.13**	-6.40	73.00	-11.51	-45.25**
38	824 x GAM- 165	42.37	9.78	-35.56**	1.93	-22.48**	-4.76	81.64	-16.43	-38.77**
39	824 x GAM- 173	32.53	-15.71	-50.52**	1.68	-26.64**	-17.24**	54.50	-33.93**	-59.13**
40	G 27 x GAM- 141	39.52	-7.72	-39.90**	1.77	-27.46**	-12.81*	70.10	-21.06	-47.43**
41	G 27 x GAM- 165	45.90	7.21	-30.19**	1.88	-26.56**	-7.39	86.33	-11.63	-35.25**
42	G 27 x GAM- 173	31.50	-26.43**	-52.09**	1.62	-29.26**	-20.20**	51.16	-42.39**	-61.63**
43	GAM- 141 x GAM- 165	50.87	33.10**	-22.63**	1.81	-29.30**	-10.84*	92.14	-5.68	-30.90**
44	GAM- 141 x GAM- 173	36.06	7.73	-45.16**	1.73	-29.10**	-14.78**	62.28	-22.43	-53.29**
45	GAM- 165 x GAM- 173	29.11	-23.84*	-55.73**	1.99	-22.27**	-1.97	58.20	-40.43**	-56.35**
	S.E. (d) ±		4.29	4.29		0.11	0.11		9.97	9.97
	CD 0.05		8.50	8.50		0.21	0.21		19.76	19.76

*, ** Significant at 5 % and 1 % levels, respectively

Table 1: Cont...

Sr. No	Crosses	Ginning percentage (%)			Seed index (g)			Lint index(g)		
		Mean	BP	SC	Mean	BP	SC	Mean	BP	SC
1	GShv- 273/07 x GBhv -282	32.30	-3.64	-6.70*	6.16	-2.38	0.65	2.94	1.20	-2.54
2	GShv- 273/07 x GBhv- 283	34.20	4.59	-1.21	6.75	6.97*	10.29**	3.51	26.64**	16.35**
3	GShv- 273/07 x GBhv- 286	34.90	-10.67**	0.81	6.80	1.80	11.11**	3.65	-0.18	-14.94**
4	GShv- 273/07 x GBhv- 287	36.10	4.76	4.27	6.47	2.54	5.72	3.66	20.55**	19.89**
5	GShv- 273/07 x 824	33.00	1.95	-4.68	7.36	16.64**	20.26**	3.63	21.05**	20.11**
6	GShv- 273/07 x G 27	35.60	1.40	2.83	6.98	10.62**	14.05**	3.86	32.38**	27.85**
7	GShv- 273/07 x GAM- 141	34.10	2.31	-1.50	6.36	0.79	3.92	3.29	14.75**	9.17
8	GShv- 273/07 x GAM- 165	34.70	1.79	0.23	6.88	7.50*	12.42**	3.66	15.53**	10.36
9	GShv- 273/07 x GAM- 173	34.60	0.46	-0.06	6.42	1.74	4.90	3.40	12.22*	11.86*
10	GBhv- 282 x GBhv- 283	33.00	-1.55	-4.68	5.51	-0.54	-9.97**	2.71	2.13	-2.74
11	GBhv- 282 x GBhv- 286	34.50	-11.70**	-0.35	6.18	-7.49*	0.98	3.26	-8.05	-24.05**
12	GBhv- 282 x GBhv- 287	34.90	1.28	0.81	5.79	-0.17	-5.39	3.10	6.22	1.75
13	GBhv- 282 x 824	32.50	-3.04	-6.12*	5.90	-5.75	-3.59	2.84	-1.45	-4.38
14	GBhv- 282 x G 27	34.50	-1.74	-0.35	5.79	4.51	-5.39	3.05	8.86	8.54
15	GBhv- 282 x GAM- 141	38.50	14.86**	11.21**	5.98	7.94*	-2.29	3.74	35.71**	34.01**
16	GBhv- 282 x GAM- 165	34.90	2.38	0.81	6.50	1.56	6.21	3.48	14.08**	5.13
17	GBhv- 282 x GAM- 173	34.80	1.05	0.52	6.52	12.80**	6.54	3.48	19.38**	14.60*
18	GBhv- 283 x GBhv- 286	32.70	-16.30**	-5.55*	6.07	-9.13**	-0.82	2.95	-13.36**	-31.13**
19	GBhv- 283 x GBhv- 287	35.50	3.02	2.54	6.26	7.93*	2.29	3.45	23.49**	12.90*
20	GBhv- 283 x 824	34.70	6.12*	0.23	6.53	4.31	6.70	3.47	26.26**	16.84**
21	GBhv- 283 x G 27	34.60	-1.45	-0.06	6.53	25.58**	6.70	3.45	29.54**	23.01**
22	GBhv- 283 x GAM- 141	33.60	0.81	-2.95	6.33	16.15**	3.43	3.20	22.03**	17.63**
23	GBhv- 283 x GAM- 165	35.00	2.67	1.10	5.68	-11.25**	-7.19*	3.06	4.79	-7.65
24	GBhv- 283 x GAM- 173	32.50	-5.63*	-6.12*	6.52	12.80**	6.54	3.14	12.76*	3.29
25	GBhv- 286 x GBhv- 287	33.30	-14.77**	-3.81	6.66	-0.30	8.82*	3.33	-9.36*	-22.41**
26	GBhv- 286 x 824	34.60	-11.44**	-0.06	7.42	11.08**	21.24**	3.93	8.27	-8.33*
27	GBhv- 286 x G 27	36.96	-5.40*	6.76*	5.87	-12.13**	-4.08	3.44	-3.01	-19.69**
28	GBhv- 286 x GAM- 141	36.91	-5.53*	6.61*	5.98	-10.48**	-2.29	3.50	-0.10	-18.29**
29	GBhv- 286 x GAM- 165	37.38	-4.33	7.97**	5.50	-17.66**	-10.13**	3.28	-13.47**	-23.27**
30	GBhv- 286 x GAM- 173	32.80	-16.05**	-5.26	6.28	-5.99	2.61	3.07	-16.21**	-28.40**
31	GBhv- 287 x 824	34.48	0.06	-0.40	7.02	12.14**	14.71**	3.69	22.70**	21.09**
32	GBhv- 287 x G 27	37.45	6.66*	8.17**	5.78	-0.34	-5.56	3.46	18.09**	13.44*
33	GBhv- 287 x GAM- 141	35.21	2.18	1.70	5.92	2.07	-3.27	3.22	11.43*	5.46
34	GBhv- 287 x GAM- 165	34.93	1.36	0.90	6.35	-0.78	3.76	3.41	7.18	2.92
35	GBhv- 287 x GAM- 173	36.39	5.60*	5.11	6.24	7.59*	1.96	3.57	17.42**	17.16**
36	824 x G 27	34.52	-1.68	-0.29	6.98	11.50**	14.05**	3.68	27.34**	23.91**
37	824 x GAM- 141	34.78	4.35	0.46	5.77	-7.83*	-5.72	3.08	8.08	3.59
38	824 x GAM- 165	33.55	-1.58	-3.09	6.18	-3.44	0.98	3.12	-0.69	-5.84
39	824 x GAM- 173	34.33	-0.32	-0.84	5.87	-6.23	-4.08	3.07	2.22	1.10
40	G 27 x GAM- 141	32.51	-7.41**	-6.09*	5.36	-1.65	-12.42**	2.58	-6.63	-8.07
41	G 27 x GAM- 165	34.20	-2.59	-1.21	5.83	-8.91**	-4.74	3.03	-1.03	-8.55
42	G 27 x GAM- 173	35.53	1.20	2.63	6.12	5.88	0.00	3.37	15.39**	11.09
43	GAM- 141 x GAM- 165	34.80	2.08	0.52	5.38	-15.94**	-12.09**	2.87	-4.91	-13.38*
44	GAM- 141 x GAM- 173	35.71	3.69	3.15	5.67	-1.90	-7.35*	3.15	9.37	3.73
45	GAM- 165 x GAM- 173	33.98	-1.34	-1.85	5.73	-10.47**	-6.37	2.95	-7.09	-10.97*
	S.E. (d) ±		0.93	0.93		0.21	0.21		0.15	0.18
	CD 0.05		1.83	1.83		0.42	0.42		0.31	0.35
	CD 0.01		2.43	2.43		0.55	0.55		0.41	0.47

*, ** Significant at 5 % and 1 % levels, respectively

combination was in between 17.53 to 30.07 and crosses GBhv- 283 x GAM- 165 and GShv- 273/07 x G 27 represented lowest and highest number of sympodial branches/ plant, respectively. Cross combination GBhv- 282 x GAM- 173 (36.36 %) had the highest heterobeltiosis for this trait. None of the cross combinations showed the significant positive standard heterosis in desirable direction.

Yield and yield attributing characters

The seed cotton yield of diploid cotton is generally contributed by boll number and boll weight in intraspecific hybrids and number of bolls in interspecific hybrids (Singh et al., 1975 and Bhatade, 1983). Hence in the present study, the results of three traits *viz.*, seed cotton yield, number of bolls and boll weight are discussed below.

For no. of bolls/ plant, mean range varied from 22.41 (GBhv- 283 x GAM- 165) to 97.40 (GBhv- 282 x G 27). Among 45 hybrids, 22 hybrids exhibited significant positive heterotic effect over their respective better parent. The cross GBhv- 287 x 824 was associated with maximum heterobeltiosis (141.22 %). Five hybrids demonstrated positive siginificant standard heterosis for no. of bolls/ plant. According to standard heterosis, promising cross combinations for no. of bolls/ plant were GBhv-

282 x G 27 (48.14 %), GBhv- 287 x 824 (41.59 %), GBhv- 282 x GAM- 173 (27.54 %) and GBhv- 286 x G 27 (21.05 %). Such high heterotic response would be useful for obtaining more no. of bolls/ plant which ultimately results in higher seed cotton yield. The same result assembled by other researchers Patil *et al.* (2009), Jyotiba *et al.* (2010), Patel *et al.* (2010) and Sekhar babu *et al.* (2011).

In case of boll weight, mean performance of crosses showed that the cross GBhv- 283 x GAM- 165 (2.94 g) recorded the highest mean performance. The hybrid GShv- 273/07 x GBhv- 287 depicted the highest significant positive heterobeltiosis of 20.60 per cent. Fourteen hybrids noticed with positive significant standard heterosis, the highest value was observed for the cross GBhv- 283 x GAM- 165 (44.83 %). The same result assembled by other researchers Patil *et al.* (2009), Jyotiba *et al.* (2010), Patel *et al.* (2010), Sekhar babu *et al.* (2011) and Tyagi *et al.* (2014).

The range of mean value among cross combination for seed cotton yield/ plant varied from 51.16 g (947.40 kg/ ha) to 223.15 g (4132.40 kg/ ha). The extent of heterosis for seed cotton yield/ plant ranged from -43.77 to 155.60 per cent and -61.63 to 67.36 per cent over BP and SC, respectively. Among 45 hybrids, 17 showed significant positive heterosis over better parent while five hybrids indicated significant positive standard heterosis. Cross combinations, GBhv- 282 x G 27, GBhv- 287 x 824, GBhv- 282 x GAM- 173, GBhv- 286 x G 27 and GBhv- 283 x 824 were the top ranking heterotic crosses showed positive significant economic heterosis for seed cotton yield/ plant. The results reported in the present investigation are in agreement with earlier workers Patil *et al.* (2009), Jyotiba *et al.* (2010), Patel *et al.* (2010), Saravanan and Koodalingam *et al.* (2011) and Sekhar babu *et al.* (2011).

Economic traits

The economic traits included in the present study are seed index, lint index and ginning outturn. Among these three economic traits, ginning outturn per cent primarily depends upon seed weight and lint weight. Lint index represent the absolute weight of lint produced per seed and this trait is more important in breeding work than ginning outturn as it is highly correlated with the lint yield.

For ginning percentage highly significant heterosis over better parent and standard check was observed in GBhv- 282 x GAM- 141 (14.86 and 11.21 %). Patil *et al.* (2009), Jyotiba *et al.* (2010) and Sekhar babu *et al.* (2011) also reported varying magnitude of heterosis for ginning out turn. Among the crosses studied, the cross combination GBHV- 286 x 824 was superior over standard check for seed index as well as lint index.

Summary

In the present experiment crosses GBhv- 282 x G 27, GBhv- 287 x 824, GBhv- 282 x GAM- 173, GBhv- 286 x G 27 and GBhv- 283 x 824 appeared to more promising for seed cotton yield/ plant. In these crosses increased in no. of bolls was significantly associated with increase in seed cotton yield. Above crosses could be tested for stability performance before exploitation of hybrid vigour for commercial cultivation.

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