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HETEROSIS FOR SEED COTTON YIELD, YIELD CONTRIBUTING CHARACTERS AND FIBRE QUALITY PARAMETERS INTETRAPLOID COTTON (*GOSSYPIUM HIRSUTUM* L.) AND (*GOSSYPIUM BARBADENSE* L.)

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ABSTRACT

A line × tester crossing programme was taken up with seven lines and three testers with a view to identify the best heterotic crosses for seed cotton yield, yield attributing traits and fibre quality in cotton. A set of 21 (H × B) hybrids and one check hybrid DCH 32 were grown at Rasi seeds Research and Development Farm Attur. Analysis of variance showed significant differences amongst parents and hybrids for all the characters indicating presence of genetic variability. Heterosis was worked out over better parent and standard hybrid, DCH 32.Based on study of heterobeltiosis; it was found that number bolls per plant, boll weight were main contributors towards increase in heterotic effects for seed cotton yield per plant. The hybrid combination CG64× CG45SB (52.53 per cent), CG67 × CG45SB (45.57 per cent), CG62 × CG45SB (39.87 per cent), CG64 × CG45E (37.34 per cent) and CG67 × CG45E (35.44 per cent) were best heterotic crosses over standard check for seed cotton yield per plant. The crosses CG62 × CG45SB, CG 67 × CG45SB, CG64 × CG45SB, CG62 × CG45E and CG67 × CG45 Erecorded highest standard heterosis for 2.5 per cent staple length and the crosses CG62 × CG45SB, CG92 × CG45SB, CG67 × G45SB, CG67 × CG45E and CG62 × CG45E were best for fibre strength. The crosses CG64 × CG45SB, CG67 × CG45SB, CG62 × CG45SB were best heterotic for the yield and fibre quality parameters and could be exploited.

INTRODUCTION

Cotton, the king of fibre is one of the most momentous and important cash crops of the country. It is the most important commercial crop contributing nearly 65 per cent of the total raw material needs of the textile industry in our country. Cotton is cultivated in area of 115.53 lakh hectares with the production of 375 lakh bales (AICCIP, Report, 2014). Among the four cultivated species of cottonthe varieties and hybrids of two species *G. hirsutum,G. barbadense, G. hirsutumx G. hirsutum* and *G. hirsutum* × *G. barbadense* hybrids were widely cultivated in India. In India around 7 – 9 lakh bales of ELS cotton is needed for the textile mills but the production is only around 5.0 lakh bales. The inter specific hybrids (*G. hirsutum* × *G. barbadense)* which are the one of the source for ELS cotton production is too exploited to meet the demand. Several workers reported higher heterosis in case of inter-specifichybrids. Exploitation of heterosis (*G. hirsutum*× *G. barbadense*) on commercial scale and systemic varietal improvement through hybridization are the main tools to increase ELS cotton production. India is pioneer in commercialization of heterosis in cotton and noticeable heterosis is also reported in cotton by many workers (Khadi *et al.*, 1993; Wu *et al.*, 2004; Tuteja *et al.,* 2005). India is pioneer in commercialization of heterosis in cotton and noticeable heterosis is also reported in cotton by many workers (Khadi *et al.*, 1993; Wu *et al.*, 2004; Tuteja *et al.,* 2005). Heterosis breeding is useful to identify the cross combinations which are promising in conventional breeding programme. Therefore, the present investigation was undertaken to find out the extent of heterobeltiosis and standard heterosis for seed cotton yield and its contributing traits in interspecific hybrids of cotton.

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MATERIALS AND METHODS

The present investigation was carried out at Research and Development Farm of Rasi Seeds, Attur, during 2009 Winter.

Table 1. Analysis of variance for combining ability for twelve characters in cotton

Source of variation	DF	Number of bolls per plant	Boll Weight (g)	Seed cotton yield per plant (g)	Ginning outturn (per cent)	Lint Index (g)	Seed Index (g)	2.5 Span Length (mm)	Uniformity Ratio (per cent)	Fibre Strength (g/tex)	Micronaire	Elongation
Cross	20	1542.18**	0.12**	3037.92**	7.23**	1.01**	1.29**	3.53**	3.04**	17.27**	0.22**	0.62**
Line	6	2222.21**	0.14**	3701.64**	17.83**	2.52**	1.91**	4.96**	3.73**	39.92**	0.27**	1.02**
Tester	2	7249.45**	0.18**	16411.07**	0.77**	1.27**	2.24**	13.94**	10.47**	33.85**	0.52**	0.81**
LXT	12	250.95**	0.11**	477.20**	3.01**	0.21**	0.83**	1.08**	1.46**	3.18**	0.15**	0.39**
Cross VS parents	1	21672.26**	5.17**	146733.33**	116.65**	0.00	28.73**	97.00**	4.12**	72.40**	4.73**	0.08**
Error	30	13.74	0.01	5.69	0.05	0.01	0.02**	0.03	0.03	0.02	0.01	0.02

* Significant at 5 per cent level, ** Significant at 1 per cent level.

Table 2. Range of *per se* performance, Heterobeltiosis (H) and Standard heterosis (SH), best five crosses and number of significant crosses in desirable direction for different characters in cotton

Character	*per se*	Heterobeltiosis (H)	Standard heterosis (SH)	Best five crosses				No.of significant crosses in desirable direction	
				Heterobeltiosis (H)	Value (%)	Standard heterosis (SH)	Value (%)	H(%)	SH (%)
Number of bolls per plant	68.00 to 166.50	-21.1 to 129.5	6.5 to 159.4	CG67 ×CG45SB	129.50	CG67 × CG45SB	159.35	18	19
				CG62 × CG45SB	87.77	CG 64 × G45SBCG62 ×	141.46		
				CG67 × CG45E	78.20	CG45SB	112.20		
				CG62 × CG45E	72.95	CG 64 × CG45ECG67 ×	109.76		
				CG62 × CG305	68.85	CG45E	92.68		
Boll Weight (g)	3.45 to 4.40	-31.5 to -2.3	-20.2 to 9.3			CG150 × CG45ECG150	9.29	-	4
						× G45SB	3.57		
						CG64 × CG45SB	2.38		
						CG62 × CG45E	2.38		
Seed cotton yield per plant (g)	204.05 to 353.40	15.4 to 58.6	-2.5 to 52.5	CG64 × CG45SB	58.55	CG64 × CG45SB	52.53	12	19
				CG67 × CG45SB	47.44	CG67 × CG45SBCG62 ×	45.57		
				CG62 × CG45SBCG64 ×	43.51	CG45SB	39.87		
				CG45E	40.13	CG67 × CG45E	37.34		
				CG67 × CG45E	39.10	CG67 × CG305	35.44		
Ginning outturn (per cent)	26.65 to 33.55	-29.3 to -5.3	-15.5 to 3.1			CG150 × CG305	13.14	-	3
						CG150 × CG45E	4.97		
						CG91 × CG45E	2.72		
						CG163 × CG45SB	-0.16		
						CG91 × CG305	-0.48		
Lint Index (g)	4.35 to 6.90	-42.0 to 15.2	-24.3 to 23.4	CG163 × CG45SBCG62 ×	15.15	CG150 × CG305	23.42	3	2
				CG305	13.00	CG91 × CG305	15.32		
				CG92 × CG305	9.00	CG150 × G45SB	5.41		
				CG62 × CG45SB	5.00	CG91 × CG45SB	2.70		
				CG64 × CG305	4.63	CG91 × CG45E	2.70		
Seed Index (g)	10.95 to 14.25	-27.5 to 16.9	-27.1 to 13.2	CG91 × CG305	16.87	CG91 × CG305	13.15	1	1
				CG64 × CG305	11.52	CG91 × CG45SB	9.56		
				CG91 × CG45SB	7.84	CG64 × CG305	7.97		
				CG62 × CG305	7.82	CG150 × CG45SB	7.97		
				CG150 × CG45SB	6.27	CG62 × CG45SB	4.78		

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2.5 Span Length (mm)	35.25 to 39.80	-15.9 to 1.7	-5.7 to 6.8	CG62 × CG45E	1.73	CG64 × CG45SB	6.76	2	11
				CG67 × CG45E	1.73	CG67 × CG45SB	6.21		
				CG64 × CG45SB	0.65	CG62 × CG45SB	5.79		
				CG67 × CG45SBCG62 ×	0.13	CG62 × CG45E	5.66		
				CG45SB	-0.26	CG67 × CG45E	5.66		
UniformityRatio (per cent)	42.20 to 47.15	-9.3 to 5.6	-2.3 to 9.3	CG163 × CG45SB	5.62	CG163 × G45SB	9.30	4	18
				CG67 × CG45SB	2.56	CG64 × CG45SB	8.14		
				CG163 × CG305	1.15	CG67 × CG45SB	6.98		
				CG163 × CG45E	1.12	CG64 × CG45E	4.65		
				CG64 × CG45SB	0.5	CG91 × CG45SB	4.65		
Fibre Strength (g/tex)	26.25 to 35.70	-32.7 to 0.1	-5.9 to 34.7	-	-	CG62 × CG45SB	34.72	-	15
						CG92 × CG45SB	34.72		
						CG67 × CG45SB	33.40		
						CG67 × CG45E	30.75		
						CG62 × CG45E	25.09		
Micronaire	2.60 to 3.85	-38.4 to 5.9	-22.1 to 19.1	CG163 × CG45E	5.88	CG150 × CG305	19.12	3	7
				CG163 × CG305	2.94	CG91 × CG45SB CG64	13.24		
				CG92 × CG305	2.86	× CG45E	7.35		
						CG92 × CG305 CG163 ×	5.88		
						CG45E	5.88		
Elongation	4.25-6.35	-17.3 to 25.5	-29.8 to 13.5	CG92 × CG305	25.53	CG92 × CG305	13.46	9	9
				CG62 × CG45SB CG92 ×	20	CG64 × CG45SB	11.54		
				CG45SB CG91	14.29	CG91 × CG305	6.73		
				× CG305	9.9	CG150 × CG45E	6.73		
				CG64 × CG45SB	8.41	CG150 × CG305	4.81		

The experimental materials consisted of 21 hybrids (*G. hirsutum* × *G. barbadense*) obtained by crossing of seven lines (*G. hirsutum*) *viz.,* CG62, CG64, CG67, CG91, CG92, CG150 and CG163 and three testers (*G. barbadense*) *viz.,* CG45SB, CG45E and CG305. The hybrids and parents were evaluated in randomized block design with two replications. Each treatment was raised furrows of 20feet length spaced at 1.2m apart with plant to plant distance of 60cm. All the recommended agronomical practices and plant protection measures were followed as and when required to raise a good crop of cotton. Observations were recorded for number of bolls per pant, boll weight (g), seed cotton yield per plant (g), ginning outturn (per cent), Lint Index (g), Seed Index (g), 2.5 per cent Span Length (mm), Uniformity Ratio (per cent), Fibre Strength (3.2 g/tex), Micronaire (10^{-6}g/inch) and Elongation. Data were recorded on five random competitive plants from each entry from both replications and mean of five plants was taken for further analysis. Combining ability analysis were estimated as per Kempthorene (1957). Standard heterosis were estimated as per the procedure suggested by Shull (1948) and Liang *et al*. (1971).

RESULTS AND DISCUSSION

The analysis of variance for parents and their hybrids (Table 1) revealed significant differences among genotypes, parents and hybrids for all the eleven traits suggesting the presence of considerable genetic variation with respect to various traits studied. Variance due to parents v_s hybrids as a group was significant for all the characters under study. Heterosis over better parent and standard check for eleven characters are presented in Table 2. In cotton number of bolls per plant and boll weight are two important yield attributing characters which are positively associated with the seed cotton yield. For the number of bolls per plant 18 and 19 crosses showed significant positive heterobeltiosis and the standard heterosis with a range of -21.1 to 129.5 and 6.5 per cent to 159.4 per cent respectively. The cross Combination CG67 × CG45SB recorded highest heterobeltiosis (129.5 per cent) and standard heterosis (159.4 per cent) along with high *per se* performance. Similar findings were reported by Laxman *et al.* (2003), Deosarkar *et al.* (2009) and Mehta *et al.* (2014).

Out of the 21 hybrids 4hybrids only recorded significant standard heterosis for boll weight with a range of -20.2 per cent to 9.3 per cent. Among the three hybrids the CG 150 × CG 45 E was best with the standard heterosis of 9.29 per cent followed by CG 150 × CG 45 E (3.57 per cent) and CG 64 × CG45SB (2.38 per cent) and CG62×CG45E (2.38 per cent). Similar kind of results were reported by Laxman *et al.* (2003), Deosarkar *et al.* (2009) and Mehta *et al.* (2014). For the seed cotton yield 12 hybrids recorded significant positive heterosis over better parent with a range of 15.4 per cent to 58.6 per cent and 19 hybrids exhibited significant standard heterosis over the standard check with a range of -2.5per cent to 52.5 per cent. The cross combination CG64× CG45 SB (52.53 per cent), CG67 × CG45SB (45.57 per cent), CG62 × CG45SB (39.87 per cent), CG64 × CG45E (37.34 per cent) and CG67 × CG45E (35.44 per cent) were best heterotic crosses over standard check for seed cotton yield per plant. The results are in accordance with Samuel Rajan *et al.* 2000, Laxman *et al.* (2003), Deosarkar *et al.* (2009) and Mehta *et al.* (2014).

For the character ginning outturn none of the hybrids recorded significant positive heterobeltiosis the standard heterosis ranged from -15.5 per cent to 13.1 per cent. The hybrid combination CG 150 × CG 305 recorded highest standard heterosis of 13.1 per cent for the character ginning outturn and 23.42 per cent for the lint index. The hybrid combination CG 91 × CG 305 is the only hybrid showing significant heterobeltiosis (16.87 per cent) and standard heterosis (13.15 per cent) for the character seed index. Fibre quality parameters are the foremost thing in the case of the interspecific hybrids in cotton. Two cross combination CG62 × CG45SB and CG67 × CG45E only showed significant positive heterobeltiosis for 2.5 per cent span length. Out of 11 crosses with a significant positive standard heterosis the cross combination CG62 × CG45SB recorded highest standard heterosis of 6.76 per cent for 2.5 per cent staple length. The crosses CG62 × CG45SB, CG92 × CG45SB, CG67 × G45SB, CG67 × CG45E and CG62 × CG45E for best for fibre strength. The crosses CG64 × CG 45 SB, CG67 × CG45SB, CG62 × CG45SB were best heterotic for the yield and fibre quality parameters. Based on the heterobeltiosis and standard heterosis for yield, yield contributing characters and fibre quality parameters. The hybrid combinations CG64 × CG45SB, CG67 × CG45SB, CG62 × CG45SB and CG67 × CG45E appeared to be good and it can be exploited for commercial purpose.

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