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Heterosis in Intra- and Interspecific Diallel Crosses Among Some Cotton Cultivars of Sudan

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ABSTRACT

Estimates of mid-parent heterosis for seed cotton yield and its components were studied in six intra-*hirsutum*, six intra-barbadense and sixteen interspecific (*Gossypium hirsutum x Gossypium barbadense)* hybrids. The material was grown in 2000 and 2001 seasons at the Gezira Research Station, Wad Medani, Sudan. Highly significant variability was detected for all the measured traits. Two interspecific hybrids, Acala(93)H x B-Pima and Acala(93)H x Barakat-S, outyielded the best parent by 127.6% and 111.6%, and 116.2% and 114.4% in both seasons, respectively. The magnitude of heterotic effect was greater in the interspecific hybrids than in the intraspecific hybrids. Maximum heterosis for seed cotton yield, number of sympodia and bolls per plant and fiber quality properties was obtained in six interspecific hybrids, viz. Acala (93)H x B-Pima, Acala (93) H x Barakat-90, Acala (93) H x Barakat- S, Shambat-B x B-Pima, Albar(57)12 x Barakat-90 and Scala(93)H x Huda. This suggested that these hybrids can be used as commercial hybrids, hybrid performing doubled haploids and as source populations for further selection to improve cotton yield.

INTRODUCTION

The task of identifying parents that will express maximum heterosis when crossed is a concern to plant breeders. In Sudan, cotton used to be the leading cash crop and the country was the world's second largest producer of extra long staple cotton after Egypt (Fadlalla, 1990). In the last ten years, Sudan witnessed a decline in cotton area and production amounting to more than 50% (Mursal, 2003). This made cotton recently to rank the third after petroleum and sesame in export earnings.

Therefore, breeding for high yielding varieties is critical to restore confidence in cotton production in Sudan. It is essential to evaluate a number of hybrids in order to identify those with good performance for hybrid cotton production and further selection in advanced bulk generations for development of new inbred lines.

It has been established that sufficient magnitude of heterosis is present in cotton to result in significant increase in yields of intraspecific as well as interspecific hybrids (Wells and Meredith, 1984; Katageri *et al.*, 1991؛ *et al.*, 1996; Galanopoulou-Sendouca and Roupakias,1999). Soomro hough heterosis occurs in cotton, it has not been widely used in hybrid production, with the exception of India, owing to difficulties in producing cheap commercial F_1 hybrid seed (Roupakias *et al.*, 1998). Hybrid seed in India is produced by hand emasculation techniques, which is feasible owing to cheap labour cost (Roupakias *et al.*, 1998), as well as male sterility. However, advance in the technology offers an alternative to fix heterosis in what is called hybrid performing doubled haploid.

This work was designed to evaluate heterosis for yield, yield components and fiber characteristics of intraspecific and interspecific hybrids in an attempt to provide guidelines for yield improvement in breeding program in Sudan.

MATERIALS AND METHODS

Eight parents and 28 F_1 hybrid combinations were planted in 2001 and at the Gezira Research Station (GRS), Wad Medani, Sudan. The parents comprised seven cultivars; namely, Albar (57)12, Barac(67)B, Acala(93)H, Shambat-B, Barakat-90, Huda and Barakat-S, and a prospective variety, B-Pima. The former four cultivars belong to G. *Hirsutum* L., while the later three and the prospective variety, B-Pima, Belong to G. *barbadense* L. Barakat-90, Barakat-S B-Pima are extra long, Huda and Shambat-B are long staple; Barac(67)B and Acala(93)H are medium staple, while Albar(57)12 is a short staple cotton.

The soil type at the experimental site is vertisol with 40%-70% clay content, 8.0-9.6 pH, less than 1% organic carbon and 0.03% total Nitrogen. The experimental design was a randomized complete block With three replications for each season. Each plot was three rows of 5 m length with 0.8 m and 0.5 m spacing between and within rows, respectively. The recommended cultural practices for cotton cultivation were followed. Date were collected on number of sympodia and number of bolls per plant (average of ten random plants in each plot), boll weight (average of 30 bolls), seed cotton yield in kg ha^{-1}, ginning out –turn, 100-seed weight, lint index, and fiber length, fineness and strength.

Data analysis

Analysis of variance was performed for each year separately, and then combined over the two years. Mid-parent heterosis was estimate as:

Average heterosis (h^-) = [(F_1-MP) /MP] x 100

where:

F_l is the mean of F_l hybrid; MP is the mean value of the two parents involved in the cross, calculated as (P_l + p_2) /2؛

Standard error (S.E.) for estimate of average heterosis (h^-) = (1.5xMe x1/r)½

where:

Me is the error mean square obtained from the analysis of variance

Test of significance of heterosis was done according to Singh and Narayanan (1993).

RESULTS AND DISCUSSION

Analysis of variance

The analysis of variance indicated the presence of significant differences among the 36 genotypes for all the measured traits (Table 1). Year effects were significant only for number of sympodia, bolls per plants and fiber length and highly significant for bolls per plant Genotype x year interactions were detected for seed cotton yield, bolls per plant, boll weight, ginning out-turn, lint index, 100-seed weight and fiber length. This could partially be attributed to water stress and higher boll shedding due to insect infestation in the second season. In contrast genotype x year interaction for sympodia per plant, fiber fineness and fiber strength were not significant suggesting that these trait were less affected by the stresses experienced in the second season.

Source	df	Seed cotton yield	Soymodia /plant	Bolls/ plant	Boll wt	100-seed weight	Lint index	Ginning Out-turn	Fiber length	Fiber Finenes	Fiber strength
Genotypes	35	15329677***	16.0***	207.8***	9.4***	12.4***	2.8***	26.0***	43.9***	1.7***	69.1* **
year	1	1832136	180.7*	205**	1.7	1.9	0.3	2.7	0.04*	1.2	60.4
Year Genotypes	35	1071318***	2.8	23.1***	0.2*	1.4**	0.4*	8.9***	2.1*	0.1	2.4

* ** *** Significant at 0.05, 0.01 and 0.001 levels of probability, respectively.

Averaged over the two seasons, seed cotton yield ranged between 3518 and 8713 kg/ha (Table 2). Yield of the intra-*hirsutum* and intra-*barbadense* hybrids were not significantly different from their parents. The intra-*hirsutum* hybrids, Albar(57)12 x Barac(67)B and Acala (93) Hx Shambat-B, outyielded the highest yielding parent in the experiment (Shambat-B) by 108.7% and 102.2%, respectively. Seed cotton yield of most of the interspecific hybrids was not significantly different from the *G. hirsutum* parents; however, the interspecific hybrid Shambat-B x Barakat-90 gave significantly lower yield than its *hirsutum* parent. The best performing interspecific hybrids were Acala(93)H x Barakat-90، Acala(93)H x Huda, Acala(93)H x Barakat-S, Acala(93)H x B-Pima and Shambat-B x B-Pima, which outyielded the highest yielding parent by 104.8 106.3% 115.6% 120.0% and 107.4%, respectively. The intra- *barbadense* hybrids were the lowest yielding.

Regarding yield components, the number of sympodia and bolls per plant, boll weight, 100 seed weight, lint index, ginning out-turn and the fiber quality traits, the intraspecific hybrids were within the range values of the parent of each species (Table 2). The interspecific hybrids were characterized by the *barbadense* phenotype, showing lower ginning out-turn and superior fiber quality, but scored the highest number of sympodia and bolls per plant. With the advance in the selection techniques, such as molecular marker-assisted selection, improvement of fiber quality of *hirsutum* could be possible through interspecific hybridization.

Heterosis

Seed cotton yield and its components: Averaged over the two years, significant estimates of mid-parent heterosis (F_I-MP %) were shown by the interspecific hybrids for almost all of the studied traits with few exceptions. Positive significant and highly significant heterosis for seed cotton yield was obtained for 14 of the 16 interspecific hybrids, ranging between 16.6% to 72.8%, whereas the intraspecific hybrids showed no significant heterosis except the intra-hirsutum hybrid, Albar(57)12 x Barac(67)B, which gave highly significant (18.5%) increase in heterosis (Table 2).

Table 2. Means and heterosis- [expressed as a percentage of mid-parent (MP)] in F_1 hybrids for seed cotton yield, yield components and fiber properties, combined for the two seasons (2000 and 2001).

	Seed cotton (kg/ha)		Sympodia/plant	
Genotype	Mean	F_1-Mp(%)	Mean	F_1-Mp(%)
Hybrids				
Albar(57)12 xBarakat(67)B	7889	18.5**	11.1	6.1
Albar(57)12 x Acala(93)H	6381	-4.2	9.6	-9.0
Albar(57)12 x Shambat-B	6802	-3.0	11.1	6.3
Albar(57)12 x xBarakat-90	71,40	38.5**	15.0	21.0*
Albar(57)12 x Huda	6893	24.3**	14.4	22.9*
Albar(57)12 x Barakat-s	6964	30.8**	14.2	30.2**
Albar(57)12 x B-Pima	6473	26.0**	13.6	23.0*
Barace(67)B x Acala(93)H	6610	0.7	10.2	-4.0
Barac(67)B x Shambat-B	6278	-9.1	10.4	-1.2
Barac(67)B x Barakat-90	6533	29.3**	14.5	26.1**
Barac(67)B x Huda	6645	22.1**	13.4	13.5
Barac(67)B x Barakat-s	6719	22.9**	13.7	25.1**
Barac(67)B x B-Pima	5870	16.6*	14.1	26.2**
Acala(93)H x Shambat-B	7419	7.3	11.5	8.9
Acala(93)H x Brakat-90	7609	50.4**	13.6	17.3
Acala(93)H x Huda	7713	41.4**	141.5	22.2**
Acala(93)H x Barakat-s	8393	60.5**	14.2	28.2**
Acala(93)H x B-Pima	8713	72.8**	14.2	25.8*
Shambat-B x Barakat-90	3887	-28.1**	12.7	11.2
Shambat-B x Huda	6358	9.7	14.7	25.6**
Shambat-B x Barakat-S	6597	18.3**	14.7	35.0**
Shambat-B x B-Pima	7797	44.7**	15.2	37.0**
Barakat-90 x Huda	4124	4.6	11.9	-7.3
Barakat-90 x Barakat-s	3655	-1.8	14.0	17.5
Barakat-90 x B-Pima	3644	3.1	11.8	-2.2
Huda x Barak-S	3920	-4.7	12.4	1.7
Huda x B-Pima	3687	-6.1	13.2	6.3
Barakat-S x B-Pima	3777	2.0	13.0	12.6
G. hirsutunl parents				
Albar(57)12	6568	-	10.4	-
Barac(67)B	6555	-	10.5	-
Acala(93)H	6759	-	10.7	-
Shambat-B	7258	-	10.5	-
G. barbadense parents				
Barakat-90	3552	-	12.4	-
Huda	4335	-	13.0	-
Barakat-S	3891	-	11.4	-
B-Pima	3518	-	11.8	-
S.E±		3.73		1.13
LSD(0.05)	603.0		1.8	

Table 2.(Continued)

	Bolls/plant		Bolls weight	
Genotype	Mean	F_1-Mp(%)	Mean	F_1-Mp(%)
Hybrids				
Albar(57)12 xBarakat(67)B	15.1	6.4	6.4	13.3**
Albar(57)12 x Acala(93)H	13.9	-7.2	5.7	11.0*
Albar(57)12 x Shambat-B	15.5	3.6	6.3	13.8**
Albar(57)12 x xBarakat-90	25.3	37.1**	3.7	-8.3
Albar(57)12 x Huda	28.1	51.3**	3.7	-5.2
Albar(57)12 x Barakat-s	30.4	64.8**	3.7	-4.4
Albar(57)12 x B-Pima	27.3	44.6**	3.7	-6.2
Barace(67)B x Acala(93)H	14.4	-5.1	6.4	10.3*
Barac(67)B x Shambat-B	13.3	-12.6	6.3	3.8
Barac(67)B x Barakat-90	24.7	32.3**	3.7	-19.6**
Barac(67)B x Huda	27.3	45.2**	3.7	-19.3**
Barac(67)B x Barakat-s	27.2	45.5**	3.5	-22.0**
Barac(67)B x B-Pima	25.2	33.3**	3.6	-19.8**
Acala(93)H x Shambat-B	15.2	-5.0	6.3	12.7**
Acala(93)H x Brakat-90	22.8	17.4**	3.9	-6.7
Acala(93)H x Huda	31.1	53.9**	3.9	-3.7
Acala(93)H x Barakat-s	32.0	62.3**	4.2	5.2
Acala(93)H x B-Pima	27.8	61.2**	4.1	1.2
Shambat-B x Barakat-90	30.5	46.0**	3.4	-24.9**
Shambat-B x Huda	30.2	41.8**	3.2	-27.7**
Shambat-B x Barakat-S	24.3	56.5**	3.3	-20.9**
Shambat-B x B-Pima	25.2	51.5**	3.4	9.5
Barakat-90 x Huda	23.3	5.5	3.2	8.2
Barakat-90 x Barakat-s	25.3	9.7	3.1	0.2
Barakat-90 x B-Pima	24.5	-0.2	2.9	10.1
Huda x Barak-S	25.2	9.9	3.0	15.1
Huda x B-Pima	24.5	4.2	3.3	15.3
Barakat-S x B-Pima	25.2	8.0	3.2	14.8
G. hirsutunl parents				
Albar(57)12	14.0	-	5.0	-
Barac(67)B	14.5	-	6.2	-
Acala(93)H	15.9	-	5.3	-
Shambat-B	16.0	-	6.0	-
G. barbadense parents				
Barakat-90	22.9	-	3.0	-
Huda	23.2	-	2.8	-
Barakat-S	22.9	-	2.7	-
B-Pima	23,8	-	2.8	-
S.E±		1.57		0.25
LSD(0.05)	2.5		0.4	

Table 2.(Continued)

Genotype	100-seed weight		Lint indes		Ginning out turn	
	Mean	F_1-Mp(%)	Mean	F_1-Mp(%)	Mean	F_1-Mp(%)
Hybrids						
Albar(57)12 xBarakat(67)B	13.9	9.9*	7.8	15.5**	36.4	1.8
Albar(57)12 x Acala(93)H	12.0	-0.8	6.7	3.0	36.4	4.6
Albar(57)12 x Shambat-B	13.6	11.2*	6.9	7.9	35.5	1.4
Albar(57)12 x xBarakat-90	12.5	6.0	5.7	-5.4	33.4	3.0
Albar(57)12 x Huda	12.2	1.9	6.2	2.1	34.8	1.0
Albar(57)12 x Barakat-s	11.4	2.6	5.5	-2.1	32.6	3.0
Albar(57)12 x B-Pima	12.6	10.0	5.8	-0.3	32.4	5.2
Barace(67)B x Acala(93)H	13.0	0.0	7.5	2.7	38.0	6.9
Barac(67)B x Shambat-B	13.2	0.7	6.9	-4.4	36.6	2.1
Barac(67)B x Barakat-90	14.9	17.9**	7.0	3.3	33.6	4.6
Barac(67)B x Huda	14.0	10.2*	6.8	-1.7	35.3	0.0
Barac(67)B x Barakat-s	14.8	18.1**	6.5	1.0	32.6	5.3
Barac(67)B x B-Pima	15.5	25.8**	6.6	-0.2	32.7	-6.4
Acala(93)H x Shambat-B	14.1	12.1*	7.4	7.5	35.2	0.8
Acala(93)H x Brakat-90	13.8	13.6**	6.0	-8.3	33.1	-3.3
Acala(93)H x Huda	14.0	14.0*	6.7	1.4	35.6	3.2
Acala(93)H x Barakat-s	15.0	24.5**	7.0	13.0*	32.8	-2.0
Acala(93)H x B-Pima	14.4	21.6**	6.6	3.5	34.4	1.2
Shambat-B x Barakat-90	16.2	32.3**	6.7	5.8	30.2	-12.5**
Shambat-B x Huda	15.6	25.8**	6.5	1.0	30.3	-12.7**
Shambat-B x Barakat-S	14.3	17.8**	5.7	-5.2	29.4	-12.9**
Shambat-B x B-Pima	16.7	32.1**	5.6	-9.4	29.8	-13.0**
Barakat-90 x Huda	11.3	-5.2	6.1	-0.1	34.9	2.4
Barakat-90 x Barakat-s	11.8	1.0	5.7	1.4	34.3	3.6
Barakat-90 x B-Pima	11.8	3.1	5.6	-4.6	34.0	1.0
Huda x Barak-S	11.6	2.0	5.6	-2.5	30.2	-9.3
Huda x B-Pima	11.8	1.7	5.9	-1.0	32.5	-4.0
Barakat-S x B-Pima	12.1	6.2	5.6	1.7	31.6	-3.6
G. hirsutunl parents						
Albar(57)12	11.8	-	6.0	-	34.9	-
Barac(67)B	13.5	-	7.6	-	36.5	-
Acala(93)H	12.5	-	7.1	-	34.6	-
Shambat-B	12.7	-	6.7	-	35.2	-
G. barbadense parents						
Barakat-90	11.8	-	6.0	-	33.9	-
Huda	12.1	-	6.2	-	34.3	-
Barakat-S	11.7	-	5.2	-	32.3	-
B-Pima	11.2	-	5.7	-	33.4	-
S.E±		0.6		0.3		1.3
LSD(0.05)	1.0				2.1	

Table 2. (Contiued)

Genotype	Fiber length		Fiber fineness		Fiber strength	
	Mean	F_1-Mp(%)	Mean	F_1-Mp(%)	Mean	F_1-Mp(%)
Hybrids						
Albar(57)12 xBarakat(67)B	30.3	4.6	4.6	0.3	22.1	-2.7
Albar(57)12 x Acala(93)H	31.0	5.8*	4.8	-4.1	22.3	-1.3
Albar(57)12 x Shambat-B	31.4	4.9	4.4	-3.9	22.9	-0.4
Albar(57)12 x xBarakat-90	34.8	11.1**	3.6	-19.6**	30.0	12.2**
Albar(57)12 x Huda	34.5	9.8**	3.7	-17.8**	29.6	11.7**
Albar(57)12 x Barakat-s	35.5	12.9**	3.3	-22.4**	29.4	9.8*
Albar(57)12 x B-Pima	36.7	16.7**	3.6	-15.8**	29.0	9.8*
Barace(67)B x Acala(93)H	29.7	0.9	4.3	-6.1	22.*1	-0.4
Barac(67)B x Shambat-B	29.9	-0.2	4.2	2.1	22.2	-1.7
Barac(67)B x Barakat-90	35.2	12.1**	3.1	-22.7**	29.7	13.0**
Barac(67)B x Huda	35.2	11.6**	3.3	-18.8**	30.1	15.3**
Barac(67)B x Barakat-s	35.3	12.1**	3.1	-20.3**	29.2	10.9*
Barac(67)B x B-Pima	35.6	12.9**	3.3	-11.5*	30.3	16.6**
Acala(93)H x Shambat-B	32.2	6.2*	4.4	-3.4	22.4	-0.4
Acala(93)H x Brakat-90	36.7	15.4**	3.4	-23.2**	29.4	12.1**
Acala(93)H x Huda	35.8	12.2**	3.6	-18.2**	29.7	14.0**
Acala(93)H x Barakat-s	36.6	15.4**	3.4	-21.5**	29.4	11.7**
Acala(93)H x B-Pima	37.2	16.6**	3.7	-12.9**	28.4	9.5*
Shambat-B x Barakat-90	36.8	13.6**	3.2	-21.5**	30.8	15.6**
Shambat-B x Huda	37.4	15.3**	3.4	-15.0**	30.5	15.5**
Shambat-B x Barakat-S	36.8	13.6	3.0	-22.1**	29.6	11.1**
Shambat-B x B-Pima	37.7	16.2**	3.2	-14.4**	29.6	12.6**
Barakat-90 x Huda	34.8	2.6	3.9	1.4	29.5	-2.0
Barakat-90 x Barakat-s	35.1	3.7	3.6	-1.6	29.2	-3.9
Barakat-90 x B-Pima	33.5	-1.3	3.5	-4.0	29.9	-0.4
Huda x Barak-S	8/34	2.6	3.6	-3.4	30.1	-0.3
Huda x B-Pima	35.0	3.0	3.6	-0.8	30.2	1.5
Barakat-S x B-Pima	35.5	1.7	3.4	-0.7	31.0	3.0
G. hirsutunl parents						
Albar(57)12	28.9	-	5.1	-	23.1	-
Barac(67)B	29.1	-	4.1	-	22.2	-
Acala(93)H	29.8	-	5.0	-	22.1	-
Shambat-B	30.9	-	4.2	-	22.8	-
G. barbadense parents						
Barakat-90	33.8	-		-	30.4	-
Huda	34.0	-		-	29.9	-
Barakat-S	33.9	-		-	30.5	-
B-Pima	34.0	-		-	29.7	-
S.E±		0.8		0.2		1.2
LSD(0.05)	1.3				1.9	

** *Significant at 0.05 and 0.01 level of probability, respectively.

The highest degree Heterosis (30.8%-72.8%) was manifested by the hybrids Acala(93)H x B-Pima (72.8%), Acala(93)H x Barakat S ،(%60.5) Acala(93)H x Barakat-90 (50.4%), Shambat-B x B-Pima, (%44.7) Acala(93)H x Huda (41.4%), and Albar (57)12 x Baraket -90 (38.8%) and Albar(57)12 x Barakat-S (30.8%). The great genetic differences between the two parents of the hybrids, i.e., *G. hirsutum* and *G. barbadense*, might be the reason for the higher heterotic values of the interspecific than the intraspecific hybrids.

The *hirsutum* parents were all Acala types except Albar(57)12, which was introduced from Uganda, while the *barbadense* parents had an Egyptian cotton genetic background. A high degree of heterosis would generally be expected when the parental cultivars have different alleles in a large number of loci, which is usually the case when cultivars are of a divergent origin. Similar conclusion was reached by Marani and Avieli (1973).

Like seed cotton yield, significant and highly significant positive heterosis for sympodia and bolls per plant was detected for the interspecific hybrids, ranging between 21% to 37% and 17.4% to 64.8%, respectively (Table 2). The highest degree of heterosis was given by 8 hybrids for sympodia per plant (above 25%) and by 12 hybrids for bolls per plant (above 40%). In contrast, the interspecific hybrids exhibited highly significant negative heterosis for boll weight, while intra-*hirsutum* gave highly significant positive heterosis and the intra-*barbadense* gave non-significant one (Table 2). Hussain *et al.* (1990), Patil *et al.* (1991) and Khan et al. (1993) obtained significant heterosis for boll weight in intra-*hirsutum*.

Seed cotton yield is the product of number of bolls per plant or per unit area and boll weight. In the present study, the number of sympodia and bolls per plant contributed directly to yield increase in the interspecific hybrids. This indicates that heterosis in production of number of sympodia and bolls are more important for increase in yield than boll weight. Ano *et al*. (1983) reported similar results and concluded that an increase in yield is more due to increase in the number of bolls than in their weights. Although the intraspecific hybrids showed positive heterosis for boll weight, they showed negative heterosis for seed cotton yield. This confirmed the negative correlation of boll weight with boll number. Sandhu et al. (1993) reported that such negative correlation make improvement in yield through improvement of both components a difficult task. Other researchers (Davis, 1977; Soomro *et al.*, 1996, Keerio *et al,* 1996) reported significant heterosis for yield and yield components.

Heterotic effects were small with regards to ginning out-turn and its components, lint index and 100-seed weight (Table 2). Heterosis for ginning out-turn was highly significant and negative for the interspcific hybrids having Shambat-B as a common parent, while it was significant and positive for lint index in two hybrids, Albar(57)12 x Barac(67)B (intra-*hirsutum*), and Acala(93)H x Barakat-S (interspecific) (Table 2). For -100seed weight, highly significant heterosis was shown by the interspecific hybrids, and significant for three intra-*hirsutum* hybrids(Albar(57)12 x Barac(67)B. Albar(5&)12x Shambat-B and x Shambat-B and Acala(93)H x Shambat-B ranging between 9.9% and 32.1%. The low heterotic values ginning out-turn and lint index might be due to absence of epistasis/dominance effect since heterosis in F_1 hybrids is a consequence of fluctuations in the dominance relationship among the parents, which depends on the cross and the trait. These results agree with Meredith (1984) who reported little heterosis for lint percentage, lint index and seed index.

Fiber characteristics: As observed in 'the yield and yield components, significant and highly significant increase in heterosis for fiber length, fineness and strength was exhibited by the interspecific hybrids, except for fiber length where two intra-*hirsutum* hybrids, Albar(57)12 x Acala(93)H and Acala(93)H x Shambat-B, showed increase in heterosis by 5.8% and 6.2%, respectively (Table 2). Heterosis in the interspecific hybrids ranged between 9.8 and 16.7% for fiber length, -11.5 and -23.2% for fiber fineness (negative means finer fihers) and 9.8 and 16.6% for fiber •strength. Kowsalya and

Raveendran (1997) reported significant values of heterosis for 2.5% span length, fiber fineness and bundle strength.

The interspecific hybrids exhibited the superior fiber quality of the *barbadens*e parents with longer, finer and stronger fibers. Thus, their relatively good productivity together with their good fiber quality، characters that do not coexist generally in *G. hirsutum* varieties, indicate that interspecific hybrids with acceptable performance under Sudan environmental conditions could be developed if hybrid seed production is economically The potential use of interspecific cotton hybrids, based on their combination of productivity and quality has been reported by Davis and Palomo (1980) and Galanopoulou-Sendouca and Roupaias.

In conclusion the magnitude of heterotic effect is greater in the interspecific hybrids than in the intraspecific hybrids, Maximum heterosis for seed cotton yield was revealed in six superior interspecific hybrids. viz: Acala(93)H x B-Pima, Acala(93)H x Barakat-90 Acala(93)H x Barakat-S, Shambat-BxB-Pima, Albar(57)12x Barakat-90 and Acala(93)H x Huda, These bybrids also showed maximum heterosis for number of sympodia and bolls per plant, and the fiber quality properties. Therefore these hybrids could be utilized as commercial hybrids and as a source population for further selection to improve yield, particularly if coupled with utilization for efficient marker-assisted breeding. A number of intra and interspecific hybrids showing heterosis for specific fiber characteristics and yield components were identified and could be used for targeted improvement of the prescribed traits. The study has also uncovered the narrow genetic base of the tested cultivars, which calls for germplasm enhancement and diversification of genetic resources.

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