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SCREENING ELITE HYBRIDS OF COTTON *GOSSYPIUM HIRSUTUM L.*

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Study on heterosis was carried out on 15 hybrid combinations involving eight *Gossypium hirsutum* L. varieties. Six hybrids showed significant differences in all types of heterosis for attributes like boll number and seed cotton yield per plant and one hybrid showed heterosis for boll weight. None of the hybrids showed significant increase over parents for sympodia per plant. The hybrid S-12 x CRIS-52 exhibited maximum heterosis over commercial cultivar (183.76%). The crosses S-12 x CRIS-52 and CRIS-7A NIAB-78 showed promising performance for the characters like boll number and seed cotton yield and are recommended to be included in breeding programmes to develop high yielding varieties/ hybrids.

Key words: *Gossypium hirsutum* L, Heterosis, Yield.

Introduction

Cotton is silver fibre of Pakistan and plays a vital role in the economy of the country. About 60% foreign exchange is earned from the export of raw cotton or cotton goods whereas 55% of the locally produced edible oil is obtained from the cotton seed. Hence, the situation necessitates the increase of the production of cotton per unit area which can be accomplished either by evolving high yielding varieties or by hybrid seed production. The former is a lengthy and time consuming process whereas the latter is short term and a shortcut and thus a desirable method for experimentation.

The occurrence of heterosis is common in plant species,but its level of expression is highly variable (Fehr 1987). Substantial increase in yield of various crops has been obtained through the exploitation of the phenomenon of heterosis. Ample evidence on the occurrence of the heterosis in cotton is available in the literature. Kolte and Thombre (1984) reported positive heterosis for sympodia, bolls and seed cotton yield per plant. Patil *et al* (1991), Katageri *et al* (1991) and Kumar *et al* (1992) reported positive heterosis for number of bolls, boll weight and seed cotton yield per plant. Similar findings have been reported by Bing *et al* (1993).

In view of the importance of heterosis, the research reported herein was conducted to obtain information relating to the potential of heterosis in 15 F_1 hybrids for yield and certain yield components for exploitation for development of better genotypes.

Materials and Methods

Fifteen intra-hirsutum crosses of 8 cultivars viz. S-12, CRIS-7A, BH-36, CIM-240 and NH-26 as lines (females) and CRIS-52, CYTO-129 and NIAB-78 as testers (males) were studied. F_1 hybrids were obtained through hybridization during 1992-93 season, following line x tester pattern of crossing, involving 5 lines and three testers. The hybrids along with parents were grown in randomized complete block design consisting of three replications. Four rows, each three meter long of each genotype/replication were grown. Sowing was done by dibbling with 30 and 75 centimeters within and between rows, respectively.All the field operations were carried out according to standard procedures.

Ten plants, at random, from each replication per genotype were tagged and treated as index plants for recording data. The characters investigated were number of sympodia, number of bolls, boll weight and seed cotton yield per plant. The standard method of analysis of variance according to Steel and Torrie (1980) was used to work out the statistical differences among the parents and F_1 hybrids for various characters. Heterosis over mid-parent, better parent and standard variety were calculated using the method suggested by Fehr (1987).

A "t" was used to evaluate difference of F_1 means from the respective midparent, better parent and standard variety, accordinng to the John Rawling's formula cited by Wyne *et al.* (1970).

Results and Discussion

The data in Table 1 reveal that maximum and minimum sympodia producing parents and hybrids were NH-26 (34.00) and S-12 (18.33), BH-36 x CRIS-52 (25.00) and CRIS-7A x CRIS-52 (17.00), respectively. In case of number of bolls, the highest and the lowest bolls setting parents and F_1s were CRIS-52 (43.33) and NH-26 (26.00) and CIM-

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240 x CYTO-129 and NH-26 x CRIS-52 (76.33 and 23.66, respectively). Regarding boll weight the maximum and minimum performance was given by S-12 (3.66 g) CRIS-52 (1.93 g), NH-26 x CRIS-52 (3.56 g) and BH-36 x NIAB-78 (1.98 g), respectively. Similarly for seed cotton yield, the highest and the lowest seed cotton yield producing parents and F_1s were CYTO-129 (134.23 g) and CRIS-7A (67.31 g), BH-36 x CYTO-129 (195.33 g) and NH-26 x CRIS-52 (86.62 g), respectively.

In respect of sympodia three crosses showed midparent and better parent heterosis and thirteen, economic heterosis. But none of these hybrids reached the significant level. The present results are supported by the findings of Kolte and Thombre (1984) who also reported similar results.

In respect of the number of bolls, all the crosses manifested positive midparent, heterobeltiosis and economic heterosis except one which exhibited only midparent heterosis. Further, it was noticed that 9,6 and 12 hybrids out of the 15 crosses exhibited significant positive midparent heterobeltiosis and economic heterosis, respectively. It was also noticed that the crosses in which S-12, BH-36, CIM-240 and

Table 1

Average performance and ANOVA (Mean squares) for genotype means of F_1 hybrids and their parents for various traits

Genotypes	Sympodia plant^{-1}		Boll No.		Boll Wt. (g)		Seed cotton yield per plant (g)	
P1 x P6	23.00	cd	75.00	a	2.60	de	182.86	ab
Pl x P7	22.66	cd	48.00	bc	2.60	de	127.33	cdefg
Pl x P8	20.00	cd	44.33	bcd	3.23	a	142.46	bcd
P2 x P6	17.00	d	43.66	bcd	2.80	de	123.16	cdefg
P2 x P7	20.00	cd	46.33	bc	2.90	de	133.70	cdef
P2 x P8	17.00	d	48.00	bc	3.36	a	163.43	abc
P3 x P6	25.00	bc	60.33	ab	2.13	cde	120.10	cdefgh
P3 x P7	24.00	cd	69.66	a	2.93	abcd	195.33	a
P3 x P8	21.66	cd	60.66	ab	1.90	e	115.96	defghi
P4 x P6	24.33	bcd	44.66	bc	1.93	e	89.93	fghij
P4 x P7	20.33	cd	76.33	a	2.13	cde	163.76	abc
P4 x P8	20.66	cd	59.00	ab	2.13	cde	118.00	defghi
P5 x P6	19.00	cd	23.66	e	3.56	a	86.26	ghij
P5 x P7	19.33	cd	38.66	cde	2.60	de	95.13	efghij
P5 x P8	23.33	cd	41.00	bcde	3.10	ab	127.66	cdefg
P1	18.33	cd	31.00	cde	3.66	a	113.76	defghi
P2	24.00	cd	29.96	cde	2.23	bcde	67.31	j
P3	31.66	ab	31.33	cde	3.03	ab	97.16	efghij
P4	20.33	cd	31.66	cde	2.20	de	72.90	ij
P5	34.00	a	26.00	de	3.00	abc	75.96	hij
P6	33.66	b	43.33	bcde	1.93	e	84.50	ghij
P7	22.00	cd	42.43	bcde	3.16	a	134.23	cde
P8	20.00	cd	26.43	de	2.86	abcd	75.33	hij
L.S.D at 5%	7.54		19.72		0.89		45.08	
Genotypes	66.54**		709.07**		0.87**		3787.69**	

Parents	Code/symbol	Parents	Code/symbol	Parents	Code/symbol	Parents	Code/symbol
S-12	P 1	BH-36	P 3	NH-26	P 5	CYTO-129	P 7
CRIS-7A	P 2	CIM-240	P 4	CRIS-52	P6	NIAB-78	P 8

** Significant at 1% level of probability.

CRIS-7A were used as lines, generally exhibited fruitful heterosis. It indicated that the character was controlled by the dominant genes. These results are advocated by the findings of Katageri *et al* (1991) and Bing *et al* (1993). As boll number is very important yield component, it is suggested that these cultivars should be used in the development of high yielding cultivars/hybrids.

Regarding boll weight, 5, 4 and 6 crosses displayed positive heterosis over midparent, better parent and commercial cultivar, respectively (Table 2). But hybrids NH-26 x CRIS-52 expressed midparent and economic and CRIS-7A x CRIS-52 and CRIS-7A x NIAB-78 midparent significant positive heterosis, while none of the F_1s revealed significant heterobeltiosis. These results are in accordance with the findings of Bing *et al* (1993).

All the crosses showed midparent (except one), heterobeltiosis (except three) and economic heterosis for seed cotton yield per plant. But the heterosis so far expressed by the hybrids

Table 2

Heterotic performance of 15 F_1 hybrids for various traits

	Percentage increase (+) or decrease (-) over					
CROSSES	Ht%	Hbt%	Eht%	Ht%	Hbt%	Eht%
	Sympodia			Number of Bolls		
P1 x P6	-11.50	-31.66	+25.74	+110.17**	+73.09**	+183.76**
P1 x P7	+12.40	+3.00	+23.62	+30.75	+13.12	+81.61**
P1 x P8	+4.38	+0.00	+9.11	+54.40*	+43.00	+67.72*
P2 x P6	-41.03	-49.49	-7.25	+19.15	+0.76	+65.19*
P2 x P7	-13.04	-16.66	+9.11	+28.01	+9.19	+75.40**
P2 x P8	-22.72	-29.16	-7.25	+70.27**	+60.21*	+81.61**
P3 x P6	-23.45	-25.72	+36.38	+61.61**	+39.23	+128.26**
P3 x P7	-10.54	-24.19	+30.93	+88.88**	+64.17**	+163.56**
P3 x P8	-16.14	-31.58	+18.16	+110.04**	+93.16**	+129.51**
P4 x P6	-9.85	-27.71	+32.73	+19.12	+3.06	+68.97*
P4 x P7	-3.92	-7.59	+10.91	+106.07**	+79.89**	+180.80**
P4 x P8	+2.48	+1.62	+12.71	+103.16**	+86.35**	+123.23**
P5 x P6	-43.83	-44.11	+3.65	-31.73	-45.93	-10.48
P5 x P7	-30.96	-43.14	+5.45	+13.00	-8.88	+46.27
P5 x P8	-13.59	-31.38	+27.27	+56.42*	+55.12	+55.12
	Boll Weight (g)			Seed Cotton Yield (g)		
P1 x P6	-6.81	-28.96	-9.09	+84.46**	+60.74**	+142.74**
P1 x P7	-23.75	-28.96	-9.09	+2.69	-5.14	+69.02**
P1 x P8	-0.92	-11.74	+12.93	+50.86**	+25.22	+89.11**
P2 x P6	+34.61*	+25.56	-2.09	+62.26**	+45.75*	+63.49**
P2 x P7	+7.80	-8.22	+1.39	+32.67	-0.39	+77.48**
P2 x P8	+32.28*	+17.84	+17.48	+129.15**	+116.95**	+116.95**
P3 x P6	-14.11	-29.70	-25.52	+32.22	+23.61	+59.43*
P3 x P7	-5.17	-7.27	+2.44	+68.83**	+45.51**	+159.29**
P3 x P8	-53.37	-37.29	-33.56	+34.46	+19.34	+53.93*
P4 x P6	-6.31	-12.27	-32.50	+14.26	+6.43	+19.38
P4 x P7	-20.52	-32.59	-25.52	+58.13**	+21.92	+117.39**
P4 x P8	-15.81	-25.52	-25.52	+59.32	+56.64*	+56.64*
P5 x P6	+44.71**	+18.66	+24.47*	+7.51*	+2.08	+14.50
P5 x P7	-15.58	-17.62	-0.09	-9.47	-2.19	+26.28
P5 x P8	+5.80	+3.39	+8.39	+68.77**	+68.06**	+69.46**

Parents	Code/Symbol	Parents	Code/Symbol
S-12	P1	NH-26	P5
CRIS-7A	P2	CRIS-52	P6
BH-36	P3	CYTO-129	P7
CIM-240	P4	NIAB-78	P8

Ht% = Heterosis (over mid parent)
Hbt% = Heterobeltiosis (over better parent)
Eht% = Economic heterosis (over standard/commercial cultivar)
* = Significant 5% level of probability.
** = Significant 1% level of probability.

was of different magnitude (Table 2). Twelve crosses exhibited significant positive midparent and economic heterosis and six heterobeltiosis. These results are is accordance with the findings of Katageri *et al* (1991), Kumar *et al* (1992)and Bing *et al* (1993). Furthermore, it is observed that seed cotton yield heterosis is dependent on the number of boll heterosis. Generally, the hybrids which showed heterosis for boll number, also displayed heterosis for seed cotton yield. This indicates that both the traits are controlled by common genes.

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