Indian J. Genet., 50 (4): 396–399 (1990)

INTRASPECIFIC HETEROSIS IN DIPLOID AND TETRAPLOID COTTONS

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(Received: November 30, 1987; accepted: November 18, 1989)

ABSTRACT

Studies on heterosis were made in diploid (*Gossypium arboreum* L.) and tetraploid (*G. hirsutum* L.) cottons for seed cotton yield over three years. Heterosis over better parent and commercial heterosis ranged from 10.9–98.7% and 40.2–162.2% in diploid and from 7.3–246.2% and 6.9–107% in tetraploid cotton, respectively. In the latter species, heterosis over the popular hybrid ranged from 11–134.4%. The important heterotic crosses were LD 135 x Spotless (162.2%), LD 135 x Naked Seeded (155.7%), and Lohit x Spotless (136.9%) in diploid; and DCI 118c x F 414 (107.7%), Tamcot Camde x MCU 10 (97.7%), and MCU 10 x H 777 (89.6%) in tetraploid cotton. A close relationship between the yield of parental lines and their hybrids was observed. The genetic base and geographical diversity of the parental lines were also associated with the manifestation of heterosis. Ample scope for evolving high yielding intra-hirsutum hybrids but limited scope for intra-arboreum hybrids was indicated.

Key words: Heterosis, *Gossypium* spp., cotton.

The magnitude of heterosis in cotton has been extensively studied [1–9]. In India, several hybrids, especially at tetraploid level, have been released for commercial cultivation, but most of them belong to the long and extralong staple group. There is surplus of cotton production in this staple group at present and shortage in the medium staple length group. Hence the present investigation has been undertaken to explore the possibilities of developing hybrids in medium staple group at intraspecific level in both diploid (*Gossypium arboreum* L.) and tetraploid (*G. hirsutum* L.) cottons using superior germplasm lines.

MATERIALS AND METHODS

The experimental material consisted of 21, 51 and 50 crosses of diploid cotton and 213, 212 and 161 crosses of tetraploid cotton. These crosses along with parents were grown in randomized block design with three replications during 1986, 1987 and 1988, respectively, at the Research Farm of the Central Institute for Cotton Research, Nagpur. In each

replication, parents and F_1 were grown in single rows of 4.5 m length, spaced 60 cm apart, and plants within row were 45 cm apart. Five competitive plants were randomly selected in each plot of every replication and observations recorded on seed cotton yield/plant, bolls/plant, boll weight, halo length, and ginning per cent. Heterosis over better parent and popular variety was estimated in respect of yield in both the species and also over the popular hybrid (H 4) in the tetraploid species.

RESULTS AND DISCUSSION

The differences among genotypes were significant for all the characters in both the species in all the three years, which revealed the presence of genetic variability for these characters in the material. The variation due to parents vs hybrids was highly significant for yield and bolls/plant, indicating presence of heterotic response.

In the diploid cotton, out of the 21, 51 and 50 crosses evaluated 15, 32 and 17 crosses exhibited positive heterosis ranging from 40.2–162.2%, 43.9–110.9% and 41.4–123.8% in 1986, 1987 and 1988, respectively (Table 1). Heterosis over better parent (BP) varied from 20.2–98.7%, 10.9–65.9% and 18.5–90.1% in the above years. Superior useful heterotic crosses were LD 135 x Spotless (162.2%), LD 135 x Naked Seeded (155.7%), and Lohit x Spotless (136.9%). Since diploid cottons have high degree of resistance to insects, diseases and drought, and also wider adaptability, hybrids at diploid level will be a valuable contribution if heterosis for yield is coupled with fibre quality. However, most of the useful heterotic crosses belonged to either short or lower medium staple category, indicating a limited scope for evolving hybrids with medium staple length at intraspecific diploid level.

Table 1. Range of heterosis for seed cotton yield in diploid and tetraploid cottons

Parameter	Diploid cotton			Tetraploid cotton		
	1986	1987	1988	1986	1987	1988
No. of crosses	21	51	50	213	212	161
Parental lines	13	24	23	45	50	54
No. of crosses with positive useful heterosis	15	32	17	26	22	15
Heterosis (%) over:						
Better parent	20.2–98.7	10.9–65.9	18.5–90.1	20–154	24.8–246.2	7.3–89.6
Popular variety	40.2–162.2	43.9–110.9	41.4–123.8	20–107	6.9–83.5	7.0–51.4
Popular hybrid	—	—	—	16.6–70.6	36.5–134.4	11.0–39.1

In the tetraploid species, out of 213, 212 and 161 crosses evaluated, 26, 22 and 15 showed positive useful heterosis ranging from 20–107%, 6.9–83.5% and 7–51.4% in 1986, 1987 and 1988, respectively. Heterosis over the popular hybrid H 4 ranged from 16.6–70.6%,

36.5–134.4% and 11–39.1% in the above three years. In cotton, heterosis more than 40% over the commercial variety and more than 20% over the commercial hybrid is considered significant. The superior heterotic crosses were DCI 118c x F 414 (107.7%), Tamcot Camde x MCU 10 (97.7%) and MCU 10 x H 777 (89.6%). These crosses also showed 70.6, 62.4 and 55.7% heterosis over the popular cotton hybrid, H 4 (Table 2). Most of the useful heterotic cross combinations belonged to either long or extra long staple groups indicating sufficient scope for evolving hybrids in these staple length groups.

Table 2. Five best heterotic crosses for seed cotton yield in diploid and tetraploid cottons

Diploid cotton			Tetraploid cotton			
cross	heterosis (%) over		cross	heterosis (%) over		
	BP	PV		BP	PV	PH
			1986			
LD 135 x Spotless	94.1	162.2	DCI 118c x F 414	53.8	107.7	70.6
LD 135 x Naked Seeded	89.3	155.7	Tamcot Camde x MCU 10	97.4	97.7	62.4
Lohit x Spotless	78.9	136.9	MCU 10 x H 777	89.3	89.6	55.7
Desi 6 x Spotless	65.22	118.7	DCI 118c x G 67	103.4	86.3	53.0
GLSI x Naked Seeded	90.6	110.6	LRA 5166 x H 777	86.5	86.5	53.2
			1987			
AC 3284 x K 9	27.0	110.1	EC 137592 x SRT 1	177.8	83.5	134.3
AKH 4 x K 9	42.1	97.6	EC 154208 x 1412	246.2	72.0	119.7
LD 135 x K 9	33.7	85.9	EC 141667 x LRA 5166	62.6	62.6	107.7
AC 3284 x LS 3	10.9	85.8	EC 132025 x MCU 5	48.7	62.4	107.4
LD 135 x LS 3	38.4	79.7	EC 132025 x LRA 5166	57.9	57.9	101.8
			1988			
G 27 x Chinese NL	87.5	123.8	DCI 118c x Sharada	63.6	19.1	30.4
NAS 4 x K 9	68.7	101.3	DCI 116 x Sharada	89.6	27.0	39.1
G 27 x AKH 4	71.9	79.7	EC 158572 x Sharada	46.6	13.5	24.3
NAS 5 x K 9	48.7	77.5	DCI 118c x SIMA-1	40.0	10.8	21.3
NAS 2 x AKH 4	90.1	90.1	EC 132031 x Sharada	44.8	14.7	25.6

BP—better parent, PV—popular variety and PH—popular hybrid.

Heterosis for yield in both the species resulted mainly due to increase in number of bolls/plant in all the three years. Similar results were reported earlier [1–6]. A close relationship between the yield of parent varieties and performance of their hybrids was observed and the genetic base and geographical diversity of the parent lines were found to

play important role in the manifestation of heterosis for seed cotton yield in both species in all the three years. This is in general conformity with the results of other workers [6–9].

The magnitude of heterosis was slightly higher in diploid species than in tetraploid over the commercial cultivars of the respective species, but the per se performance of intra-arboreum hybrids was much poorer than those of intra-hirsutum hybrids, indicating limited scope for developing high yielding intra-arboreum hybrids.

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