Indian J. Genet., **63**(4): 325-327 (2003)

Heterosis for fibre properties in intra-*hirsutum* crosses (*Gossypium hirsutum* L.)

Phundan Singh, T. R. Loknathan and Dinesh K. Agarwal

Central Institute for Cotton Research, Nagpur 440 010

(Received: July 2002; Revised: September 2002; Accepted: October 2003)

Abstract

The magnitude of useful heterosis was studied in 1807 crosses in instalments annually over a period of ten years for three fibre traits *viz.*, halo length, ginning percentage and lint index. In ten years for the entire material, the useful heterosis ranged from 27.5 to 31.5 for halo length, 4.3 to 16.9 for ginning outturn and 28.9 to 58.3 for lint index. For lint index, the superior crosses included F 505 × Nandyal Brown, Sharada × 2609, Suman × Khandwa 3, Suman × GP 14, Suman × R 50 and Suman × LH 900. For halo length, the superior crosses identified were LRA 5166 × 1589, LRA 5166 × Naked Seed, Suman × Naked Seed, Sharada × 2527 and MCU 5 × 2527. For ginning outturn, the superior crosses identified were F 505 × Bobdel, LRK 516 × JBWR 19, LRA 5166 × EK 157-131 and Jurhad × BGP 911. Present study indicated possibility of evolving productive intra-*hirsutum* hybrids with desirable fibre properties *viz.*, halo length, ginning outturn and lint index.

Key words: Upland cotton, useful heterosis, halo length, ginning percentage, lint index

Introduction

Cotton is an important commercial crop which provides raw material in the form of lint to the textile industry. India is the pioneer country for cultivation of hybrids on commercial scale. The work on heterosis has been reviewed from time to time by various workers [1-5]. In cotton, the earlier studies on heterosis have been mostly confined to yield and yield components and relatively very little work has been done on heterosis of fibre characters. Since cotton is a fibre yielding crop, knowledge of fibre properties is very important for breeders. Hence, the present study was undertaken to find out the level of useful heterosis for three fibre characters *viz.*, halo length, ginning outturn and lint index in upland cotton (*Gossypium hirsutum* L.) which is the predominant cultivated species all over the world.

Material and methods

Intra-hirsutum crosses made every year were evaluated from 1990-91 to 1999-2000. The number of crosses varied from year to year. These crosses alongwith their parents were grown in randomized block design with 3 replications. In each replication, parents and F_1s were grown in single row of 10 dibbles. The row to row spacing was 60 cm and plant to plant 45 cm. Five competitive plants were randomly selected in each plot of every replication and observations recorded on halo length, ginning outturn and lint index. The useful heterosis was estimated over the check variety LRA 5166 for above three traits.

Results and discussion

The results are based on a ten year evaluation of a total number of 1807 intra-*hirsutum* crosses in ten sets, each set for one year. The genetic differences among crosses were found significant in all the years. A wide range of useful heterosis was observed for halo length, ginning outturn and lint index. For halo length, the useful heterosis ranged from 2.6 in 1996-97 (PKV 081 × Brymen Light Brown) to 32.4 in 1997-98 (LRA 5166 × 1489). The heterosis was moderate to low for halo length. For this character, the superior crosses identified were LRA 5166 × 1589, LRA 5166 × Naked Seed, Suman × Naked Seed, Sharada × 2527 and MCU 5 × 2527. (Table 1). For this character, MCU 5 and PKV 081 as male parents contributed to relatively high heterotic values in most of the crosses. These results are in agreement with those of previous workers [2, 3, 4, 5].

Relatively moderate level of heterosis was observed for ginning outturn with high mean values in 1995-96. The mean values for ginning outturn were the highest in 1997-98, but heterotic values were low. This was due to higher value of LRA 5166. Thus, ginning outturn showed highest values during that year for all the best identified crosses. For ginning outturn, the range was from 4.3 for PKV 081 × Brymen Brown in 1996-97 to 16.9 for F505 × Bobdel in 1992-93. For this trait, LRA 5166 contributed to a high level exceeding 40% as mean values. For this character, the best crosses included F 505 × Bobdel, LRK 516 × JBWR

Table 1. Extent of heterosis for halo length in intra-*hirsutum* crosses

Year	No. of crosses evaluated	Extent of heterosis upto (%)	Superior crosses	Heterosis (%)	Halo length
1990-91	241	8.7	MCU 5 VT × LRA 5166	8.7	30.3
			MCU 5 VT × Kanchana	8.7	30.3
			LR-A 5166 (Check)	-	29.6
1991-92	202	15.6	Kanchana × MCU 5	15.6	29.6
			MCU 5 × LH 900	12.1	28.7
			LRA 5166 (Check)	-	25.7
1992-93	215	19.3	Juhard × CNHPT 7	19.3	27.9
			MCU 5 × PKV 081	18.1	-
			LRA 5166 (Check)	-	24.3
1993-94	479	14.4	MCU 5 × VAR. 32	14.4	30.9
			MCU 5 × BW-7	11.1	30.0
			LRA 5166 (Check)	-	27.0
1994-95	150	16.7	PKV 081 × YG 16	16.7	31.5
			PKV 081 × JBWR 16	11.1	30.0
			LRA 5166 (Check)	-	27.0
1995-96	180	21.4	PKV 081 × Nigerian brown	21.4	29. 5
			MCU 5 × Brymen brown	17.3	28.5
			LRA 5166 (Check)	-	24.6
1996-97	120	2.6	PKV 081 × Brymen light brown	2.6	27.5
			LRA 5166 (Check)	-	26.8
1997-98	122	32.4	LRA 5166 × 1489	32.4	28.0
			LRA 5166 × Naked seed	31.3	27.7
			LRA 5166 (Check)	-	21.1
1998-99	63	19.6	LRA 5166 × Naked seed	19.6	31.1
			Khandwa 2 × 1489	11.5	29.0
			LRA 5166 (Check)	-	26.0
1999-2000	35	7.7	Khandwa 3 × G.COT 10	7.7	28.0
			Khandwa 2 × ACP 71	7.7	28.0
			LRA 5166 (Check)	-	26.0

19, LRA 5166 × EK 157-131 and Juhrad × BGP 911 (Table 2).

Lint index, an important component of lint yield per boll and per plant, relatively expressed higher value of heterosis as compared to other two traits (Table 3). For lint index, the heterosis ranged from 28.6 for ACP 71 × 2756 in 1998-99 to 58.3 for Suman × Khandwa in 1990-91. High level of heterosis was observed during 1990-91. For this trait the superior crosses identified were F 505 × Nandyal Brown, Sharda × 2609, Suman × Khandwa 3, Suman × GP 14, Suman × R 50 and Suman × LH 900.

The present study indicates that there is ample scope for developing productive intra- hirsutum hybrids with desirable combinations of halo length, ginning outturn and lint index. Some brown linted hybrids with high yield and superior fibre quality were also identified.

References

1. **Loden H. D. and Richmond T. R.** 1951. Hybrid vigour in cotton cytological aspects and practical applications. Econ. Bot., **5**: 387-408.
2. **Dorairaj M. S.** 1968. Hybrid vigour in cotton improvement. Madras Agric. J., **55**: 24-31.
3. **Davis D. D.** 1978. Hybrid Cotton : Specific problems and potentials. Adun. Agron., **30**: 129-157.
4. **Singh T. H., Chahal G. S., Bharadwaj H. L. and Tikku P. L.** 1980. Exploitation of heterosis in cotton - A Review. ISCI Journal, **3**: 46-56.
5. **Singh S. K.** 1987. Exploitation of heterosis in cotton. A Review. M.Sc. Disseration of heterosis (unpublished), Nagpur University, 1987.
6. **Narayanan S. S., Singh P. and Bhat M. G.** 1988. Heterosis breeding in cotton. *In*: Heterosis Breeding. R.C. Rakshit (ed) : Bidhan Chandra Agri. Uni., Kalyani, West Bengal, India, pp. 37-44.
7. **Singh P. and Singh S.** 1999. Heterosis Breeding in Cotton, Kalyani Publishers, New Delhi.

Table 2. Extent of heterosis for ginning outturn in intra-*hirsutum* crosses

Year	No. of crosses evaluated	Extent of heterosis upto (%)	Superior crosses	Heterosis (%)	Ginning outturn (%)
1990-91	241	13.9	PKV 081 × Kanchana	13.9	40.6
			LH 900 × KDCH 10	11.7	39.8
			LRA 5166 (Check)	-	35.6
1991-92	202	12.2	Kanchana × F 505	12.2	37.3
			F 286 × LRA 5166	10.2	36.7
			LRA 5166 (Check)	-	33.3
1992-93	215	16.9	F 505 × Bobdel	16.9	40.9
			LRA 5166 × EK 157-131	16.6	40.8
			LRA 5166 (Check)	-	35.0
1993-94	479	16.8	LRK 516 × JBWR 19	16.8	38.2
			LRK 516 × Mar. 22	15.3	37.7
			LRA 5166 (Check)	-	32.7
1994-95	150	13.8	LH 900 × EG 3	13.8	38.7
			PKV 081 × Variety-25	13.2	38.5
			LRA 5166 (Check)	-	34.0
1995-96	180	16.4	Juhrad × BGP 911	16.4	40.5
			F 505 × BGP 949	15.5	40.2
			LRA 5166 (Check)	-	36.1
1996-97	120	4.3	PKV 081 × Brymen brown	4.3	38.6
			LRA 5166 × BGO 928	2.2	37.6
			LRA 5166 (Check)	-	34.4
1997-98	122	6.1	LRA 5166 × Naked seed	6.1	41.6
			LRA 5166 × Buri nectariless	5.6	41.4
			LRA 5166 (Check)	-	39.2
1998-99	63	14.3	PKV 081 × Naked seed	14.3	40.0
			LRA 5166 × Naked seed	11.7	39.1
			LRA 5166 (Check)	-	35.0
1999-2000	35	10.6	G.Cot. 10 × SIMA 1	10.6	39.8
			Khandwa 3 × G.Cot. 10	10.0	39.6
			LRA 5166 (Check)	-	36.0

Table 3. Extent of heterosis for lint index in intra-*hirsutum* crosses

Year	No. of crosses evaluated	Extent of heterosis upto (%)	Superior crosses	Heterosis (%)	Lint index
1990-91	241	58.3	Suman × Khandwa 3	58.3	6.3
			PKV 081 × KDCAKD	55.3	6.2
			LRA 5166 (Check)	-	4.0
1991-92	202	40.7	Suman × LH 900	40.7	5.1
			A.N. × MCU 5 VT	38.9	5.0
			LRA 5166 (Check)	-	3.6
1992-93	215	44.4	Suman × R 50	44.4	6.5
			Suman × Khandwa-3	44.4	6.5
			LRA 5166 (Check)	-	4.5
1993-94	479	46.8	Suman × GP 14	46.8	6.9
			Suman × MAC 27	40.4	6.6
			LRA 5166 (Check)	-	4.7
1994-95*	150	-	-	-	-
1995-96	180	51.4	F 505 × Nandyal brown	51.4	5.3
			LRK 516 × BGP 911	42.9	5.0
			LRA 5166 (Check)	-	3.1
1996-97	120	34.2	LRA 5166 × KCM colour 92	34.2	5.5
			F 505 × BGP 928	26.8	5.2
			LRA 5166 (Check)	-	4.1
1997-98	122	52.6	Sharda × 2609	52.6	5.8
			Sharda × 2527	44.7	5.5
			LRA 5166 (Check)	-	3.8
1998-99	63	28.6	ACP 71 × 2756	28.6	5.2
			ACP 71 × 1489	17.5	4.7
			LRA 5166 (Check)	-	4.0
1999-2000	35	28.9	G.COT 10 × SIMA 1	28.9	4.9
			Khandwa 2 × G.COT 14	28.9	4.9
			LRA 5166 (Check)	-	3.8

*Not reported