



Research Note

Exploitation of Hybrid vigour among interspecific crosses of *Gossypium arboreum* L. and *Gossypium herbaceum* L.

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Abstract:

Twenty four inter specific *desi* cotton hybrids developed in a line x tester were studied to find out the extent of heterosis for 14 different characters *viz.*, yield, days to flowering, plant height, sympodia per plant, bolls per plant, boll weight, seed index, lint index, ginning per cent, micronaire value, uniformity ratio, bundle strength, 2.5 per cent span length and elongation ratio. There was appreciable heterosis for all the traits studied. The best performing F₁ hybrid, AH 60 x RAHS 129 showed the highest mid parent heterosis and heterobeltiosis. For seed cotton yield per plant, heterosis ranged from 33.61 to 431.32 and -48.08 to 426.36 per cent over mid parent and better parents respectively. The hybrid, AH 60 x RAHS 129 found to be superior for seven traits while the crosses AH 56 x G. Cot. 17 and AH 56 x RAHS 129 registered superiority for six and five different traits, respectively.

Key words: *Desi Cotton, Gossypium arboreum, Gossypium herbaceum, Heterosis*

Cotton is an important industrial crop of India with a current global textile fibre market share of nearly 66 per cent. The contribution of cotton to export income is to the tune of Rs. 36 crores (Kairon *et al.*, 2000). Exploitation of hybrid vigor or heterosis presents an opportunity to increase the yield potential of any crop. It is also essential to have detailed information about the desirable parental combination in any breeding programme which ultimately produces better heterotic hybrids. Studies have been conducted to explore the effects of heterosis using both F₁ and F₂ hybrids for yield and its components as summarized for cotton by Meredith (1984). Heterosis has raised the productivity of upland cotton and hence efforts are now being made to explore hybrid vigour in asiatic cotton for further increase in productivity.

The material for the present investigation consisted of a set of 24 cross combinations involving six female *Gossypium arboreum* parents (AH 56, AH 59, AH 60, AH 67, AH 262 and PA 375) and four male *Gossypium herbaceum* parents (RAHS 129, Jayadhar, Digvijay and G cot 17) in a Line x Tester fashion. All hybrids along with parents were raised in a RBD with two replications at CBS, TNAU, during Kharif 2003. The row to row and plant to plant distance was

maintained at 60 and 30 cm respectively. Data on ten competitive plants selected randomly were recorded for days to flowering, plant height, monopodia per plant, sympodia per plant, bolls per plant, single plant yield, lint index, seed index, ginning per cent, 2.5 per cent span length, elongation per cent, uniformity ratio, micronaire value and bundle strength. Combining ability analysis was done following standard procedure of Kempthorne (1957). Relative heterosis, heterobeltiosis and standard heterosis were estimated following the methods suggested by Hallauer and Miranda (1981).

Heterosis was estimated for the 24 hybrids for fourteen different traits and was expressed as increase or decrease over mid-parental value, and heterobeltiosis over better parent value. The most important criteria used for evaluation of hybrids is the degree of mean expression of hybrids for different characters. In the present study, the hybrids, AH 56 x RAHS 129 and AH 60 x RAHS 129 exhibited significantly higher mean values for seven traits including seed cotton yield. The crosses, AH 262 x G.Cot.17 and PA 375 x RAHS 129 exhibited significantly higher mean values for four and three yield and quality attributing traits respectively.

Specific combining ability is defined as the average performance of a specific cross combination expressed as deviation from the population mean and corrected for parental *gca* effects and *sca* is due to nonadditive genetic interaction (Sprague and Tatum, 1942). The crosses, AH 60 x RAHS 129, AH 56 x G.Cot. 17 and AH 67 x Jayadhar exhibited significantly higher *sca* effect for six traits including seed cotton yield. The *sca* is considered to be the best criteria for superior hybrids. The crosses, AH 262 x G.Cot.17, AH 59 x Jayadhar, and AH 56 x RAHS 129 showed desirable *sca* effects for five and three traits respectively along with seed cotton yield. None of the hybrids exhibited superior *sca* effects for all the characters. On the whole, the hybrids, AH 262 x G.Cot.17, AH 60 x RAHS 129, AH 56 x G.Cot. 17, AH 67 x Jayadhar, AH 56 x RAHS 129, AH 262 x G.Cot.17 and AH 59 x Jayadhar can be selected as best specific combiners since they exhibit higher *sca* effect for more traits (Table 1).

Heterosis was calculated as per cent increase or decrease over mid parent, better parent and standard. Nineteen crosses showed early flowering than the better parent. The hybrid, AH 59 x RAHS 129 showed very early flowering of 58 days. Twenty two hybrids showed superiority for plant height than the better parent and the cross PA 375 x Digvijay was the tallest. The cross, PA 375 x Digvijay recorded the minimum number of monopodia per plant while AH 67 x Jayadhar registered the maximum number of sympodia per plant. The cross AH 262 x G.Cot.17 exhibited superior performance for both single plant yield and bolls per plant. Eighteen crosses exceeded the value of better parent for seed index. The maximum seed index was recorded by hybrid AH 56 x RAHS 129. The hybrid, AH 56 x G.Cot. 17 had better value of heterosis for lint index while AH 67 x RAHS 129 registered maximum ginning per cent. The result is in accordance with the report of Ganapathy *et al.* (2005) and Rauf *et al.* (2005). The crosses, AH 56 x RAHS 129 and AH 67 x G.Cot. 17 expressed higher values of 2.5 per cent span length and uniformity ratio respectively. Seventeen crosses registered lower value for micronaire value. The cross, AH 56 x Jayadhar had higher micronaire value

among crosses. The hybrids, AH 56 x G.Cot. 17 and AH 60 x RAHS 129 registered higher values for bundle strength and elongation per cent, respectively. Dheva *et al.* (2002) and Muthu (2002) and Karademir and Gencer,(2010) also reported similar results (Table 2).

Based on high *per se*, high *sca* and high better parent heterosis (Table 3), AH 262 x G.Cot.17, AH 60 x RAHS 129, AH 56 x Digvijay, AH 56 x RAHS 129, and AH 56 x G.COT.17 were adjudged as best performers and these crosses can be utilized for heterosis breeding.

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Table 1 Range of *per se* and *sca* for yield and quality traits in interspecific crosses of cotton

Characters	<i>Per se</i>			<i>sca</i>		
	Range	Total Crosses	Best cross	Range	Total crosses	Best cross
Days to flower initiation	58.5 to 74.00	5	L ₂ x T ₁	0.17 to 5.00	8	L ₄ x T ₃
Plant height	118.00 to 238.50	3	L ₆ x T ₃	-40.55 to 58.47	13	L ₆ x T ₃
Monopodia per plant	0.50 to 3.50	4	L ₆ x T ₃	-1.36 to 1.10	6	L ₆ x T ₃
Sympodia per plant	27.20 to 68.40	5	L ₄ x T ₂	-14.58 to 10.44	7	L ₂ x T ₃
Bolls per plant	53.50 to 128.00	4	L ₅ x T ₄	-38.62 to 39.36	6	L ₃ x T ₁
Yield per plant	48.32 to 281.60	4	L ₅ x T ₄	-110.07 to 108.73	6	L ₅ x T ₄
Seed index	2.76 to 7.90	4	L ₂ x T ₄	-1.83 to 2.30	1	L ₁ x T ₁
Ginning per cent	44.18 to 72.47	4	L ₄ x T ₄	-10.42 to 8.53	-	L ₄ x T ₄
Lint index	4.97 to 7.45	5	L ₃ x T ₁	-1.26 to 0.99	1	L ₁ x T ₄
2.5 per cent span length	24.40 to 27.15	5	L ₅ x T ₁	-0.052 to 0.84	-	L ₃ x T ₄
Micronaire	47.00 to 51.00	8	L ₁ x T ₂	-1.60 to 1.60	-	L ₁ x T ₃
Uniformity ratio	4.40 to 5.85	4	L ₄ x T ₄	-0.044 to 1.60	-	L ₄ x T ₄
Bundle strength	19.75 to 25.35	4	L ₁ x T ₄	-0.273 to 1.202	-	L ₁ x T ₄
Elongation per cent	3.90 to 4.95	5	L ₄ x T ₄	-0.044 to 0.373	-	L ₄ x T ₄

Lines : L1- AH 56; L2-AH 59; L3-AH 60; L4-AH 67; L5-AH 262; L6- PA 375

Testers: T1- RAHS 129; T2- Jayadhar; T3- Digvijay and T4- G.Cot.17

Table 2 Range of Heterosis for yield and quality traits in interspecific crosses of cotton

Characters	Relative Heterosis			Heterobeltiosis		
	Range	Total Crosses	Best cross	Range	Total crosses	Best cross
Days to flower initiation	16.43 to 7.81	15	L ₂ x T ₁	3.50 to -19.31	19	L ₂ x T ₁
Plant height	12.97 to 175.09	24	L ₆ x T ₃	-5.22 to 169.66	22	L ₆ x T ₃
Monopodia per plant	-78.26 to 66.67	11	L ₁ x T ₃	-79.31 to 52.19	15	L ₁ x T ₃
Sympodia per plant	-11.40 to 95.15	22	L ₄ x T ₂	-15.53 to 70.50	19	L ₄ x T ₃
Bolls per plant	-26.03 to 234.95	23	L ₂ x T ₂	-1.83 to 187.64	23	L ₅ x T ₄
Yield per plant	33.61 to 431.32	22	L ₅ x T ₄	-48.08 to 426.36	19	L ₅ x T ₄
Seed index	-44.79 to 100.14	18	L ₁ x T ₁	-48.26 to 77.75	18	L ₁ x T ₁
Ginning per cent	-19.18 to 44.72	4	L ₁ x T ₁	-21.61 to 37.42	3	L ₄ x T ₁
Lint index	-4.01 to 45.89	23	L ₄ x T ₄	-0.37 to 43.50	22	L ₁ x T ₄
2.5 per cent span length	-7.28 to 7.58	8	L ₁ x T ₁	-8.92 to 6.10	7	L ₁ x T ₁
Micronaire	-3.59 to 13.97	13	L ₂ x T ₂	-4.08 to 6.25	7	L ₁ x T ₂
Uniformity ratio	-19.63 to 16.42	17	L ₄ x T ₄	-20.72 to 8.33	19	L ₄ x T ₄
Bundle strength	-6.84 to 31.18	13	L ₁ x T ₄	-7.71 to 30.00	11	L ₁ x T ₄
Elongation per cent	-14.29 to 14.79	9	L ₃ x T ₁	-16.16 to 14.12	9	L ₃ x T ₁

Lines : L1- AH 56; L2-AH 59; L3-AH 60; L4-AH 67; L5-AH 262; L6- PA 375

Testers: T1- RAHS 129; T2- Jayadhar; T3- Digvijay and T4- G.Cot.17





Table 3. Hybrids with superior mean, *sca* and Heterobeltiosis

Character	Superior hybrids with superior mean, <i>sca</i> and Heterobeltiosis
Days to flower initiation	L ₁ x T ₃ , L ₁ x T ₄ , L ₂ x T ₁ , L ₃ x T ₁ , L ₃ x T ₂ , L ₄ x T ₂ , L ₄ x T ₃ , L ₅ x T ₄
Plant height	L ₆ x T ₃ , L ₁ x T ₄ , L ₄ x T ₂
Sympodia per plant	L ₄ x T ₂ , L ₅ x T ₄ , L ₂ x T ₂
Bolls per plant	L ₅ x T ₄ , L ₃ x T ₁ , L ₁ x T ₁ , L ₂ x T ₂ , L ₄ x T ₂
Single plant yield	L ₅ x T ₄ , L ₃ x T ₁ , L ₁ x T ₁
Seed index	L ₂ x T ₄ , L ₆ x T ₂ , L ₆ x T ₁ , L ₁ x T ₁
Lint index	L ₁ x T ₄ , L ₃ x T ₁ , L ₄ x T ₂ , L ₄ x T ₄ , L ₂ x T ₁
Ginning per cent	L ₄ x T ₄ , L ₄ x T ₃ , L ₁ x T ₁ , L ₅ x T ₁
2.5 per cent span length	L ₁ x T ₁ , L ₃ x T ₁ , L ₅ x T ₁ , L ₅ x T ₂
Uniformity ratio	L ₁ x T ₁ , L ₁ x T ₂ , L ₄ x T ₄ , L ₂ x T ₂ , L ₃ x T ₃ , L ₃ x T ₄ , L ₆ x T ₄
Micronaire value	L ₄ x T ₄ , L ₆ x T ₂ , L ₃ x T ₄ , L ₅ x T ₂
Bundle strength	L ₁ x T ₄ , L ₁ x T ₁ , L ₂ x T ₁ , L ₃ x T ₄
Elongation per cent	L ₄ x T ₄ , L ₄ x T ₃ , L ₃ x T ₁ , L ₁ x T ₃ , L ₃ x T ₃ ,
Overall performance	L ₃ x T ₁ , L ₁ x T ₃ , L ₁ x T ₄ , L ₅ x T ₄

Lines : L1- AH 56; L2-AH 59; L3-AH 60; L4-AH 67; L5-AH 262; L6- PA 375

Testers: T1- RAHS 129; T2- Jayadhar; T3- Digvijay and T4- G.Cot.17