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# Heterosis and Inbreeding Depression for Seed Cotton Yield in Upland Cotton *G. hirsutum* L.

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**ABSTRACT**

**Eight parents of *G. hirsutum* L. and their 28 crosses were studied for heterosis and inbreeding depression. The cross, LH 299 x 13426 showed maximum heterobeltiosis followed by LH 299 x G. Cot.10 and DS-4 x B. N. The relative ranking on the basis of *per se* performance and heterosis differed, which depicted poor yielding ability of the parents. The hybrids which showed maximum heterosis in $F_1$ also showed maximum inbreeding depression in $F_2$ generation.**

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## INTRODUCTION

Among the four cultivated species of cotton, *G. hirsutum* L. is the predominantly cultivated species, grown in all the cotton growing tracts. Though, genetic variability is fairly wide in this species, there is further scope for broadening the genetic base to obtain suitable hybrids/varieties with high yield for the various agroclimatic conditions. Study of heterosis and inbreeding depression will have a direct bearing on the breeding methodology to be employed for varietal improvement. Hence, the present investigation was undertaken to study the magnitude of heterosis and inbreeding depression for seed cotton yield.

## MATERIALS AND METHODS

Eight parents viz., LH-299, DS-4, DS-56, 13426, B.N. 1412, H-655-C and G.Cot.10 were crossed in all possible combinations using diallel mating design (excluding reciprocals). Eight parents and their 28 $F_1$ and 28 $F_2$'s were grown in R.B.D. with three replications at Regional Cotton Research Station, GAU, Maktampur (Bharuch) during 1987-88. A single replication had one row each of parents and $F_1$'s and $F_2$'s had four rows. There were 15 dibbles in a row spaced at 120 cm between rows and 45 cm between plants. Observation on seed cotton yield per plant were recorded on 10 randomly selected plants from parents and $F_1$ and 20 plants from $F_2$ generation. The magnitude of heterosis and inbreeding depression from $F_1$ to $F_2$ were calculated using standard procedures.

## RESULTS AND DISCUSSION

Heterosis and inbreeding depression are two different facets of expression of the same phenomenon (Kheradnam *et al.* 1975).

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Performance of parents, $F_1$ hybrids as compared to the midparent and better parent and depression from $F_1$ to $F_2$ for seed cotton yield are presented in Table-1.

*TABLE 1*

**Heterosis over better parent (BP), mid parent (MP) and inbreeding depression (ID) for the promising combination.**

| Cross | Mean performance of | | | | Heterosis over | | Inbreeding depression (ID) |
|---|---|---|---|---|---|---|---|
| | Male | Female | $F_1$ | $F_2$ | MP | BP | |
| LH-299 x DS 4 | 36.0 | 53.6 | 67.3 | 37.7 | 50.1* | 25.4 | 20.2 |
| LH-299 x 13426 | 36.0 | 46.0 | 75.3 | 33.3 | 87.7** | 67.3* | 60.1* |
| LH-299 x G.Cot.10 | 36.0 | 35.0 | 57.3 | 53.7 | 61.5* | 59.2* | 41.8* |
| DS-4 x DS-56 | 53.6 | 45.0 | 53.0 | 31.3 | 07.4 | –1.2 | 59.7** |
| DS-4 x 13426 | 53.6 | 46.0 | 67.7 | 26.3 | 35.7 | 27.0 | 51.7** |
| DS-4 x B.N. | 53.6 | 49.3 | 78.0 | 38.3 | 51.4* | 45.3* | 52.9** |
| DS-4 x 1412 | 53.6 | 32.0 | 55.7 | 36.7 | 29.9 | 03.7 | 52.6** |
| DS-56 x 1412 | 45.0 | 32.0 | 63.0 | 78.7 | 63.6* | 40.0 | -24.8 |
| B.N. x 1412 | 49.3 | 32.0 | 68.7 | 36.0 | 68.8** | 39.1 | 58.7** |

*and** Significant at 0.05 and 0.01 level respectively.

Six crosses showed significant and positive heterosis over mid parental value for seed cotton yield, though only three crosses viz. LH-299 x 13426, LH 299 x G. Cot.10 and DS-4 x B.N exhibited significant and positive heterosis over better parent. Meredith and Bridge (1972) and Kumar *et al.* (1974) also observed high degree of heterosis in intra hirsutum crosses. Interestingly, the cross, LH 299 x 13426 though recorded highest mid-parent and better parent heterosis, ranked second in *per se* performance for seed cotton yield. Conversely, the cross DS-4 x B.N. showed highest mean performance but ranked fifth on the basis of average heterosis. Thus, relative ranking on the basis of *per se* performance and heterosis differed. This is attributed to the poor yielding ability of the parents. In such cases, average and better parent heterosis do not offer any economic promise.

It was pertinent to note that the crosses of low x low yielding parents showed maximum value of seed cotton yield and better parent heterosis, though their mean yields were lower as compared to high x high and high x low crosses. On the contrary, the crosses involving high x high yielding parents exhibited lower heterosis but their *per se* values were high. It would therefore, be desirable to select the hybrid based on mean values rather than extent of heterosis.

The loss in yield in advance generation was due to inbreeding depression. Inbreeding depression is caused by a decrease in heterozygosity which conditions strong dominance or over dominance (William and Meredith, 1979). The prevalence of dominant gene action in cotton suggest that inbreeding depression is a major complicating factor in early generation yield evaluation. In the present investigation, of the six heterotic crosses, four crosses showed significant inbreeding depression. Thus, high inbreeding depression was associated with high heterotic effect. This suggest the importance of non-additive gene action in cotton. Presence of such non-additive gene action which enhance the vigour for seed cotton yield in $F_1$ can be attributed to epistatic geneaction. However, two crosses LH 299 x DS4 and DS5 x 1412 were exceptions where high heterosis was associated with low inbreeding depression, suggesting that the transgressive segregation might have occured in $F_2$ generation. However, an examination of data on inbreeding depression for seed cotton yield/plant indicated that, in general, the mean expression of $F_2$ was lower than that of $F_1$, but in some cases comparable or even higher expression of $F_2$ than that of $F_1$ were also found as in case of DS 56 x 1412. This is in agreement with some of the earlier reports indicating superiority of $F_2$ over $F_1$. Yadav and Murthy (1976) and Gunasselan and Krisnaswami (1988).

Thus, it is quite clear that the biparental matings be made from such crosses and evaluated subsequently in systematic manner to get segregates superior to the better parent/standard variety which may be handled through pedigree method of breeding.

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