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HETEROSIS AND INBREEDING DEPRESSION STUDIES FOR SEED COTTON YIELD AND ITS COMPONENTS IN UPLAND COTTON (*GOSSYPIUM HIRSUTUM* L.)

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ABSTRACT

Cotton hybrids has its own advantage than varieties in yield and fibre properties. Heterosis breeding helps in identifying F_1 hybrids and in creating variability. The chief intention of any hybridization programme is to combine all the desirable genes present in two or more parents into a single genetic background. This investigation helped in identifying the extent of heterosis in crosses among four families in upland cotton (*Gossypium hirsutum* L.) which was conducted at college Farm during *kharif* 2021-23. The all 4 hybrids were derived by generation mean analysis study which were analysed for productivity traits in a Compact Family Block Design. All the four crosses showed significant relative heterosis in desired direction for days to flowering, bolls per plant, boll weight, sympodia per plant, seed cotton yield per plant and ginning percentage. While, only for ginning percentage, all the four crosses showed significant and desirable heterobeltiosis. For traits like bolls per plant, boll weight and sympodia per plant all the crosses recorded positive heterobeltiosis some had significant positive while others have positive but non-significant heterobeltiosis. These crosses can be exploited for crop improvement programme as they registered high *per se* performance combined with significant heterosis for most of the yield and yield attributing traits. This study reveals good scope for commercial exploitation of heterosis as well as isolation of potential progenies from the heterotic F_1 hybrids.

Key words : *Gossypium hirsutum* L., Heterosis, Inbreeding depression, Ginning percentage.

Introduction

Cotton has been used as a fabric in India from time immemorial and India is perhaps the first country to make use of cotton. Due to its importance in agricultural as well as industrial economy, it is also called as “White gold” and “King of apparel fibres”. Cotton was among the first species to which Mendelian principles were applied (Balls, 1906) and has a long history of improvement through breeding with sustained long-term yield gains of 7 to 10 kg of lint per ha per year (Meredth and Bridge, 1954).

Cotton is grown in 75 countries across the world out of which United States, China and India contribute 80% of the total yield in the world. Gujarat, Maharashtra, Haryana, Punjab, Rajasthan, Madhya Pradesh, Andhra Pradesh, Karnataka and Tamil Nadu are the major cotton growing states in India. Unlike other countries, India has a wide range of cotton species under cultivation and because of vast climatic variations between the northern and southern parts of the country, this crop is particularly grown throughout the year.

Currently, Gossypium includes 50 species, four of which are cultivated, 43 are wild diploids and three are wild tetraploids (Percival and Kohel, 1990). Out of the four cultivated species, *Gossypium hirsutum* L. and *Gossypium barbadense* L., commonly called as new world cottons are tetraploids (2n = 4x = 52), whereas, *Gossypium herbaceum* L. and *Gossypium arboreum* L. are diploids (2n = 2x = 26) and are commonly called as old world cottons.

Cotton production in India got momentum with the release of world's first cotton hybrid Hybrid-4 by Late Dr. C. T. Patel (1971) at Main Cotton Research station, Gujarat Agricultural University, Surat followed by the release of various high yielding hybrid varalaxmi which was released in 1972 from University of Agricultural Sciences, Dharwad (Karnataka) and subsequent hybrids has paved the way for large scale cultivation in the southern cotton growing states of India during early and late seventies to end of 20th century.

Heterosis refers to increase of F_1 in fitness and vigour over the parental values. In current usage heterosis and hybrid vigour are used as synonyms and interchangeable. The expression of heterosis is governed by nuclear genes. In some cases, heterosis results due to interaction between nuclear genes and cytoplasm. The magnitude of heterosis is associated with heterozygosity, because the dominance variance is associated with heterozygosity. For a plant breeder, the important issue is whether the best genotypes are homozygotes or heterozygotes. The manifestation of heterosis is affected by the genetic base of the parents. For example, in cotton higher heterosis is associated with broad genetic base of the parents.

Materials and Methods

The current experiment on upland cotton which involve six different generations *viz*., P_1, P_2, F_1, F_2, BC_1 and BC_2 of four different crosses (**1.** Cross- I: GN Cot 22 x GBHV 200; **2.** Cross- II: GN Cot 26 x GBHV 253; **3.** Cross- III: G Cot 16 x GISV 361; **4.** Cross- IV: G Cot 10 x Surat Dwarf) representing six diverse parental genotypes procured from Regional Cotton Research Station, Navsari Agricultural University, Bharuch andMain Cotton Research Station, Navsari Agricultural University, Surat was carried out to study the various genetic parameters of different traits. The crossing programme was carried out during Late *Kharif* 2021-22 while evaluation programme was carried out in *Kharif* 2022-23. Both crossing programme as well as evaluation programmes were conducted at the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari.

Randomly selected tencompetitive plants from each P_1, P_2, F_1 generations, twenty plants from each of the BC_1 and BC_2 generations and fortyplants from each F_2 generation were utilized per replication for recording observations. A total of eleven traits were recorded and the mean values were subjected to statistical analysis.

Heterosis was estimated as per cent increase or decrease in the mean value of F_1 hybrid over the mid-parent, *i.e.*, relative heterosis (Briggle, 1963) and over the better parent, *i.e.*, heterobeltiosis (Fonseca and Patterson, 1968) for each character.

$$\text{Relative heterosis}\,(\%) = \frac{\overline{F_1} - \overline{MP}}{\overline{MP}} \times 100$$

$$\text{Heterobeltiosis}\,(\%) = \frac{\overline{F_1} - \overline{BP}}{\overline{BP}} \times 100$$

Where,

$\overline{F_1}$ = Mean performance of the F_1 hybrid

$\overline{MP}$ = Mean value of the parents (P_1 and P_2) of a hybrid

$\overline{BP}$ = Mean value of better parent

Standard errors

$$\text{S. E.}\left(\overline{F_1} - \overline{MP}\right) \text{ (Standard error for relative heterosis)} = \sqrt{\frac{3Me}{2r}}$$

$$\text{S. E.}\left(\overline{F_1} - \overline{BP}\right) \text{ (Standard error for heterobeltiosis)} = \sqrt{\frac{2Me}{r}}$$

Where,

Me = Error mean square

r = Number of replications

t-test

The test of significance of the heterosis and heterobeltiosis was carried out by comparing the calculated values of 't' with the tabulated values 't' at 5% (1.96) and 1% (2.58) levels of significance, respectively.

$$t = \frac{\overline{F_1} - \overline{MP}}{\text{S. E.}\left(\overline{F_1} - \overline{MP}\right)} \text{ (For relative heterosis)}$$

$$t = \frac{\overline{F_1} - \overline{BP}}{\text{S. E.}\left(\overline{F_1} - \overline{BP}\right)} \text{ (For heterobeltiosis)}$$

Inbreeding depression refers to a decrease in fitness and vigour due to continuous inbreeding and decreased heterozygosity. It results due to fixation of unfavourable recessive genes in F_2 mostly because of homozygous condition, while in case of heterosis; undesirable effect of recessive genes of one parent are suppressed by favourable dominant genes of another parent.

Inbreeding depression was computed by using the following formulae:

$$\text{Inbreeding depression}\ (\%) = \frac{\overline{F}_1 - \overline{F}_2}{\overline{F}_1} \times 100$$

The standard error and 't' value for the test of significance for inbreeding depression were estimated as under:

$$\text{S. E.}\left(\overline{F}_1 - \overline{F}_2\right) = \sqrt{\frac{[V(F_1)(n_1 - 1)] + [V(F_2)(n_2 - 1)]}{n_1 + n_2 - 2}}$$

$$t = \frac{\overline{F}_1 - \overline{F}_2}{\text{S. E.}\left(\overline{F}_1 - \overline{F}_2\right)}$$

Where,

$\overline{F}_1$ = Mean value of the F_1 hybrid

$\overline{F}_2$ = Mean value of the F_2 generation

$V(F_1)$ = Variance of the F_1 generation

$V(F_2)$ = Variance of the F_2 generation

n_1 = Number of observations in the F_1 generation

n_2 = Number of observations in the F_2 generation

The significance of the inbreeding depression was tested by comparing the calculated 't' value with the table 't' value at 5% (1.96) and 1% (2.58) levels of significance, respectively.

Results and Discussion

The estimates of heterosis and inbreeding depression together provide information about the type of gene action involved in the expression of various quantitative traits. If high heterosis is followed by inbreeding depression, it indicates the presence of non-additive gene action (dominance and epistasis). If the performance is same in F_1 and F_2, it reveals presence of additive genes. If the heterosis is negative in F_1 and there is increase in F_2, it again indicates presence of additive genes. In practical plant breeding, heterosis can be fully exploited in the form of hybrids and partially in the form of synthetic and composite varieties.

For days to flowering,the magnitude of heterobeltiosis ranged from -8.82%(G Cot 16 x GISV 361) to 10.26% (G Cot 10 x Surat dwarf). G Cot 16 x GISV 361(-8.82%) recorded highest significant and desirable (negative) heterobeltiosis followed by GN Cot 26 x GBHV 253 (-3.63%) and GN Cot 22 x GBHV 200 (-1.96%), thus signifying worthy hybrids for early flowering. All the four crosses registered significant and undesirable (negative) inbreeding depression. Lowest inbreeding depression was observed in GN Cot 22 x GBHV 200(-4.82%) followed by G Cot 10 x Surat dwarf (-6.55%) and G Cot 16 x GISV 361 (-13.22%) as shown in Table 1. The significant and undesirable (negative) inbreeding depression for days to flowering was earlier manifested by El-Adly and Arafa (2009) and Komal *et al.* (2014b).

In case of days to boll opening, significant and desirable (negative) relative heterosis recorded by G Cot 16 x GISV 361 (-4.26%) followed by GN Cot 26 x GBHV 253 (-3.83%) and G Cot 10 x Surat dwarf (-3.53%). The value of heterobeltiosis was found to be significant and desirable (negative) for GN Cot 26 x GBHV 253 (-2.56%), G Cot 10 x Surat dwarf (-1.98%) and G Cot 16 x GISV 361 (-1.95%). All the four crosses manifested significant and undesirable (negative) inbreeding depression. Similar result of negative inbreeding depression was earlier observed by Komal *et al.* (2014b) and Haq *et al.* (2019).

As plant height (cm) is an important parameter considering plant growth, biomass and yield. It is an important indicator of yield estimation as it is related to growth and health of crops (Feng *et al.,* 2018). Reduced height *i.e.* dwarfing was taken as desirable trait. Magnitude of relative heterosis was positive (undesirable) and significant in all the four crosses evaluated. All the four crosses manifested significant and positive (desirable) values for inbreeding depression which revealed that F_2 population was in general dwarfed than its F_1. The inbreeding depression ranged from 4.62% (G Cot 10 x Surat dwarf) to 8.79% (G Cot 16 x GISV 361).

As number of bolls per plant is directly related to seed cotton yield, it is one of the most important traits under study. So, higher number of bolls per plant is desirable. In this study, all the four crosses evaluated showed positive (desirable) and significant relative heterosis. Relative heterosis ranged from 14.86% (GN Cot 26 x GBHV 253) to 26.46% (G Cot 16 x GBHV 253). The results of heterobeltiosis ranged from 5.82 % (GN Cot 22 x GBHV 200) to 20.36% (GN Cot 26 x GBHV 253). The estimates of hetero beltiosis were significant and positive (desirable) heterobeltiosis for three crosses under study *viz.*, G Cot 10 x Surat dwarf (9.94%), G Cot 16 x GISV 361 (14.41%) and GN Cot 26 x GBHV 253 (20.36%). The results of inbreeding depression showed significant and positive (undesirable) results for three crosses with lowest positive inbreeding depression in G Cot 10 x Surat dwarf (5.45%) followed by GN Cot 22 x GBHV 200 (14.29 %) and G Cot 16 x GISV 361 (15.50%). The similar results were observed by Hussain *et al.* (2009), Panni *et al.* (2012), Komal *et al.* (2014), Islam *et al.* (2015) and Tigga *et al.* (2017).

The single boll weight (g) is one of the most important contributing trait of cotton lint yield (Niu *et al.*, 2023). Predicting the single boll weight in a large area is important for variety selection and yield improvement (Xu *et al.*, 2020). Significant and positive (desirable) relative heterosis for the boll weight was recorded in all four crosses which ranged from 7.55% (GN Cot 26 x GBHV 253) to 12.71% (GN Cot 22 x GBHV 200). The cross GN Cot 22 x GBHV 200 (12.75 %) has highest positive significant heterosis for boll weight followed by cross G Cot 16 x GISV 361 (12.12%), G Cot 10 x Surat dwarf (7.75%) and GN Cot 26 x GBHV 253 (7.55%). All the four crosses under evaluation recorded significant and positive (desirable) heterobeltiosis. The estimates of heterobeltiosis ranged from 3.13% (G Cot 16 x GISV 361) to 6.31% (G Cot 10 x Surat dwarf). Magnitude of inbreeding depression vary from positive (undesirable) to negative (desirable). Similar results were obtained by Patel *et al.* (2014), Islam *et al.* (2015), Tigga *et al.* (2017) and Al- Hibbiny *et al.* (2020).

Number of monopodial branches per plant is a trait of prime significance in cotton because development of sympodia is mainly associated with this trait (Sahito *et al.*, 2015). For monopodia per plant, the data presented in Table indicated both negative (desirable) and positive (undesirable) values. Two crosses *viz*; GN Cot 22 x GBHV 200 (-20.28%) and GN Cot 26 x GBHV 253 (-4.35%) showed significant and negative (desirable) relative heterosis. Desirable (negative) and significant heterobeltiosis shown by two crosses *viz*; GN Cot 26 x GBHV 253 (-25.71%) and cross G Cot 16 x GISV 361 (-21.22%). The highest significant and positive (undesirable) heterobeltiosis was observed in cross G Cot 10 x Surat dwarf (43.34 %). Cot 22 x GBHV 200 (2.04%) had positive (undesirable) but non-significant heterobeltiosis. Significant desirable (positive) as well as undesirable (negative) inbreeding depression for monopodia per plant was observed among four crosses. Similar results were also reported earlier by Kencharaddi *et al.* (2013), Komal *et al.* (2014b) and Haq *et al.* (2019).

The fruiting bodies in cotton plant are produced on sympodial branches. It is one of the most important parameters contributing yield of cotton. Once sympodial branches formed on main stem, no monopodial branches are formed. All the four crosses depicted significant and positive (desirable) relative heterosis, which ranged from 13.63 % (cross GN Cot 26 x GBHV 253) to 32.66 % (cross G Cot 16 x GISV 361). Highest significant and positive relative heterosis was observed in cross G Cot 16 x GISV 361 (32.66%) followed by cross G Cot 10 x Surat dwarf (21.57%) and GN Cot 22 x GBHV 200 (15.29 %). Similar results of positive and significant heterosis were also reported by Abro *et al.* (2009), Kumar *et al.* (2015), Srinivas and Bhadru (2015c), Tigga *et al.* (2017), Khokar *et al.* (2018) and Udaya *et al.* (2023).

Seed cotton yield is one of the most important and economic traits of the cotton (Wang *et al.*, 2019). It is dependable variable so it is influenced by various other traits in cotton plant and that is why it is necessary to know the relationship between yield and its attributing traits. This will help in understanding of heterosis for seed cotton yield. Significant positive (desirable) relative heterosis was observed in all the four crosses ranging from 16.43 % (GN Cot 26 x GBHV 253) to 26.46 % (G Cot 16 x GISV 361). The significant and positive (desirable) heterobeltiosis was found only in cross G Cot 16 x GISV 361(15.84%). Positive (undesirable) and significant inbreeding depression was observed in all the four crosses, which ranged from 14.15 % (GN Cot 22 x GBHV 200) to 22.65% (G Cot 16 x GISV 361). Lowest inbreeding depression was found in cross GN cot 22 x GBHV 200 (14.15%) followed by GN Cot 26 x GBHV 253 (16.04%) and G Cot 10 x Surat dwarf (17.77%) as shown in Fig. 1. Significant and desirable (positive) heterosis for seed cotton yield per plant followed by considerable inbreeding depression indicated major role of non-additive gene actions in the inheritance of seed cotton yield per plant.Similar results were observed by Karademir *et al.* (2011), Komal *et al.* (2014b), Islam *et al.* (2015), Khan *et al.* (2017), Tigga *et al.* (2017), Haq *et al.* (2019) and AL-Hibbiny *et al.* (2020).

For ginning percentage, all the four crosses under evaluation obtained significant and positive values for relative heterosis. Significant and positive (desirable) relative heterosis ranged from 1.42% (GN Cot 26 x GBHV 253) to 4.31% (GN Cot 22 x GBHV 200). Heterosis over better parent was found positive (desirable) significant for all the four crosses *viz.*, cross GN Cot 26 x GBHV 253(4.19%), cross GN Cot 22 x GBHV 200 (3.46%), cross G Cot 10 x Surat dwarf (3.40%) and cross G Cot 16 x GISV 361 (2.29%). The

Table 1 : Estimates of relative heterosis (RH %), heterobeltiosis (HB %) and inbreeding depression (ID %) for days to flowering, days to boll opening, plant height (cm), bolls per plant, boll weight (g) and monopodia per plant in four crosses of cotton.

Particulars	Days to flowering	Days to boll opening	Plant height (cm)	Bolls per plant	Boll weight (g)	Monopodia per plant
Cross I (GN Cot 22 x GBHV 200)						
RH%	-2.27**	0.85	6.28*	21.58**	12.71**	-20.28*
HB%	-1.96**	4.12	-0.38	5.82	3.67	2.04
ID%	-4.82**	-2.46**	8.05*	14.29**	-2.45	-5.06**
Cross II (GN Cot 26 × GBHV 253)						
RH%	-6.32**	-3.83*	6.98**	14.86**	7.55**	-4.35*
HB%	-3.63**	-2.56*	-5.47**	20.36**	4.41	-25.71*
ID%	-14.89**	-1.73**	5.23**	4.40	3.30**	-12.50**
Cross III (G Cot 16 × GISV 361)						
RH%	-13.97*	-4.26**	8.70**	26.46*	12.12**	8.44*
HB%	-8.87*	-1.95**	2.18	14.41*	3.13	-21.22*
ID%	-13.22**	-1.76*	8.79**	15.50**	7.20*	10.17*
Cross IV (G Cot 10 × Surat dwarf)						
RH%	-1.65**	-3.53**	6.16**	17.30**	7.75**	49.50*
HB%	10.26**	-1.98**	3.25	9.94**	6.31*	43.34*
ID%	-6.55**	-3.67*	4.62**	5.45**	2.71**	29.80**

Table 2 : Estimates of relative heterosis (RH %), heterobeltiosis (HB %) and inbreeding depression (ID %) for days to flowering, days to boll opening, plant height (cm), bolls per plant, boll weight (g) and monopodia per plant in four crosses of cotton.

Particulars	Sympodia per plant	Seed cotton yield per plant (g)	Seed index (g)	Lint index (%)	Ginning percentage (%)
Cross I (GN Cot 22 x GBHV 200)					
RH%	15.29**	17.18**	3.26*	7.21**	4.31*
HB%	9.27	10.09	1.02	3.08	3.46**
ID%	10.91*	14.15**	3.60*	9.58**	-0.32
Cross II (GN Cot 26 × GBHV 253)					
RH%	13.63**	16.43*	2.53*	2.06	1.42*
HB%	9.32	7.44	0.09	-3.16	4.19*
ID%	20.14*	16.04**	0.07	-5.72**	3.19**
Cross III (G Cot 16 × GISV 361)					
RH%	32.66**	26.46**	1.55*	13.09**	4.02**
HB%	21.33**	15.84**	-4.27*	4.83*	2.29**
ID%	9.48*	22.65**	8.53**	5.35*	-0.61
Cross IV (G Cot 10 × Surat dwarf)					
RH%	21.57**	18.51**	0.17	4.06	1.55**
HB%	26.88**	-10.14	-7.96**	3.05	3.40**
ID%	1.99	17.77**	7.47**	1.38	0.13

magnitude of inbreeding depression varies from positive (undesirable) to negative (desirable). The estimates of inbreeding depression ranged from -0.61% (cross G Cot 16 x GISV 361) to 3.19% (cross GN Cot 26 x GBHV 253). Non-significant but negative (desirable) non-significant inbreeding depression was observed in cross G Cot 16 x GISV 361 (-0.61%) and cross GN Cot 22 x GBHV 200 (-0.32%). While, cross GN Cot 26 x GBHV 253 (3.19%) exhibited positive (undesirable) inbreeding depression. The positive and negative values of inbreeding

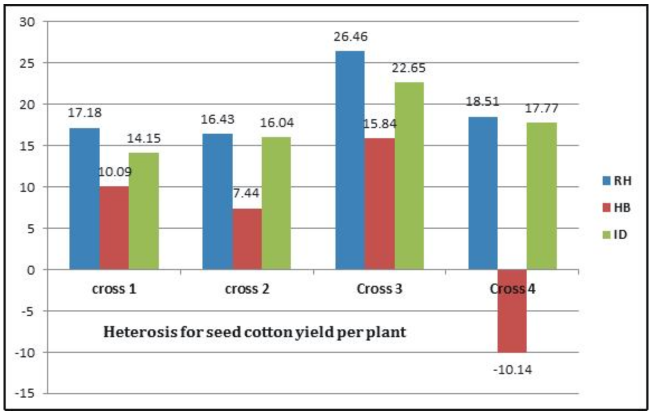

Fig. 1 : Graph depicting Relative heterosis (RH%), Heterobeltiosis (HB%) and Inbreeding depression (ID %) for seed cotton yield per plant (g).

depression for ginning percentage were also reported by Komal *et al.* (2014), Khan *et al.* (2017) and Tigga *et al.* (2017).

For seed index, negative value of heterosis is desirable as low seed index value corresponds to high lint yield. Here, for all crosses evaluated, the magnitude of relative heterosis recorded has positive values. Relative heterosis ranged from 0.17% (cross G Cot 10 x Surat dwarf) to 3.26 % (cross GN Cot 22 x GBHV 200). Highest positive (undesirable) significant relative heterosis was found in cross GN Cot 22 x GBHV 200 (3.26%) followed by cross GN Cot 26 x GBHV 253 (2.53%) and cross G Cot 16 x GISV 361 (1.55%). The estimates of inbreeding depression were positive (undesirable) and significant for all crosses ranging from 3.60% (cross GN Cot 22 x GBHV 200) to 8.53% (cross G Cot 16 x GISV 361). Highest positive significant inbreeding depression was found for cross G Cot 16 x GISV 361(8.53 %) followed by cross G Cot 10 x Surat dwarf (7.47 %) and cross GN Cot 22 x GBHV 200 (3.60%). Similar results of positive inbreeding depression have also been earlier reported by Hussain *et al.* (2009), Komal *et al.* (2014), Tigga *et al.* (2017) and AL-Hibbiny *et al.* (2020).

For Lint index (%), high positive values are desirable. Thus, two crosses *viz*., cross GN Cot 22 x GBHV 200 (7.21%) and cross G Cot 16 x GISV 361 (13.09%) recorded significant positive values for relative heterosis, hence it is desirable. While in cross GN Cot 26 x GBHV 253 (2.06%) and cross G Cot 10 x Surat dwarf (4.06 %) non-significant and positive values of relative heterosis were recorded. The magnitude of heterobeltiosis ranged from -3.16% (cross GN Cot 26 x GBHV 253) to 4.83% (cross G Cot 16 x GISV 361). The significant positive heterobeltiosis was observed only in cross G Cot 16 x GISV 361 (4.83%), which is desirable. The magnitude of inbreeding depression for crosses under evaluation vary from negative (desirable) to positive (undesirable). Significant and positive (undesirable) inbreeding depression was found in cross GN Cot 22 x GBHV 200 (9.58 %) and cross G Cot 16 x GISV 361 (5.35 %).While, negative (desirable) significant inbreeding depression was observed only in cross GN Cot 26 x GBHV 253 (-5.72%). Similar results were also reported earlier by Hussain *et al.* (2009) Karademir *et al.* (2011), Komal *et al.* (2014), and Tigga *et al.* (2017).

Conclusion

All the four crosses showed significant relative heterosis in desired direction for days to flowering, bolls per plant, boll weight, sympodia per plant, seed cotton yield per plant and ginning percentage. While, only for ginning percentage, all the four crosses showed significant and desirable heterobeltiosis. For traits like bolls per plant, boll weight and sympodia per plant all the crosses recorded positive heterobeltiosis some had significant positive while others have positive but non-significant heterobeltiosis.

Among four crosses, only G Cot 16 x GISV 361 registered significant and desirable (positive) heterobeltiosis for seed cotton yield per plant. This cross also manifested significant and desirable heterobeltiosis for seed cotton yield components like days to flowering, days to boll opening, bolls per plant, monopodia per plant, sympodia per plant,ginning percentage, seed index and lint index. This cross also registered non-significant but desiraleheterobeltiosis for traits like boll weight and fibre elongation. Thus, cross combination *i.e.* G Cot 16 x GISV 361 looks promising so it need to be evaluated thoroughly for testing its commercial suitability for farmers benefit in particular.

Result of inbreeding depression indicated that negligible to severe amount of inbreeding depression was present in all most all the crosses for most of all traits. This indicated that superiority of F_1s over F_2s is due to amount of heterozygosity in F_1s Among eleven traits studied; in only plant height, neither of the cross registered inbreeding depression. This indicated that the presence of a greater number of superior recombinants having dwarf plant stature in F_2 population of all the four crosses. For monopodia per plant in crosses *viz;* G Cot 16 x GISV 361 and G Cot 10 x Surat dwarf inbreeding depression was completely absent suggesting better scope of isolating plants having lesser monopodia than their corresponding F_1.

In GN Cot 26 x GBHV 253 inbreeding depression was completely absent for lint index and fibre elongation while in G Cot 16 x GISV 361, for fibre strength, inbreeding depression was negative (desirable) and significant revealing segregating (F_2) population has more fibre strength than its F_1 generation thus suggesting presence of superior recombinants in F_2.

It is desirable to have high, significant and positive heterobeltiosis for seed cotton yield per plant with absence or low magnitude of inbreeding depression for seed cotton yield and its components. In this investigation, neither of the cross registered absence of inbreeding depression for seed cotton yield per plant but G Cot 16 x GISV 361 recorded significant positive heterobeltiosis along with absence of inbreeding depression for plant height, monopodia per plant, fibre strength and to some extent in ginning percentage.

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