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# Heterosis Studies for Fibre Quality Traits in Upland Cotton (*Gossypium hirsutum* L.)

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**ABSTRACT**

Heterosis is commercially exploited in cotton in the form of hybrids and are very popular among the farming community over the varieties. Development of hybrids is one of the main objectives in cotton breeding programmes. In the present investigation, 45 crosses developed by making crosses among the 10 selected genotypes having very good combining ability for quality traits in half diallel fashion. These crosses were evaluated for quality traits over the commercial checks (Bunny BT and KCH 707) for their standard heterosis before they are being considered for commercial cultivation. The cross combination, BBGH-77 x BBGH-1, expressed the highest heterotic effects for all the quality characters over the check Bunny Bt and may be considered for commercial release after confirming its superiority over locations.

**Key words:** *Cotton, diallel, hybrids, standard heterosis.*

Cotton is one of the most important fibre crop with high commercial value. Breeding of high yielding varieties of cotton is necessary in the present condition of decreasing arable land and increasing demand. Commercial exploitation of heterosis in cotton is profitable and is important that the crosses are compared with released hybrids rather than merely comparing with their mid/better parents. So in the present study the performance of the experimental crosses were compared with that of the most popular varieties and hybrids in order to estimate the magnitude of standard heterosis. Heterosis (Shull, 1914) refers to the increase (or) decrease in $F_1$ value over the parents. The main objective of the present study is to identify the best standard heterotic cross combinations.

## MATERIAL AND METHODS

Heterotic studies in upland cotton for quality traits were undertaken at Regional Agricultural Research Station, Lam Farm of Andhra Pradesh during *kharif* 2013-14. The experimental material was composed of 57 genotypes, comprised of 10 parents of cotton, 45 hybrids generated by crossing these parents in half diallel fashion along with two checks (BUNNY Bt and KCH 707) were grown in randomized block design with three replications. Each plot consisted of two rows each of 6 m length with a spacing of 120 x 60 cm. All the necessary cultural practices and plant protection measures are followed for a better crop stand. The data were recorded on plot basis per entry per replication on the quality traits *i.e.*, 2.5% span length (mm), bundle strength (g/tex), fibre elongation %, uniformity ratio and micronaire ($10^{-6}$ g/inch). The data was collected using the (premier HFT 9000 V 2.1.5 SP high volume instrument) machine located at CIRCOT Regional centre, Lam Farm, Guntur. The mean data collected is analysed for standard heterosis estimation using the following formula.

$$\text{Standard heterosis} = \frac{F_1 - SP}{SP} \times 100$$

Where,

$F_1$ = Mean value of $F_1$ ;
SP = Mean value of standard check

## RESULTS AND DISCUSSION

Heterosis refers to the increase (or) decrease in $F_1$ value over the parents. From the view point of plant breeding, increased yield of $F_1$ over the better (or) best commercial variety is more relevant. So in the present study the performance of the experimental crosses were compared with that of the most popular varieties and hybrids in order to estimate the magnitude of standard heterosis. So that the crosses with high heterotic potential could be exploited for further evaluation before they are being exploited for commercial cultivation. The estimates of standard heterosis over high yielding check, Bunny Bt are presented in Table 1.

Standard heterosis for 2.5 % span length ranged between -9.70 (BBGH-26 x BGH-94) and 22.18 (BBGH-77 x BGH-23) with thirteen positive significant heterotic hybrids over standard check in desirable direction. Positive heterosis is desirable for 2.5 % span length. Among the thirteen significant heterotic hybrids, the hybrids BBGH -77 X BGH-23 (22.18) and BBGH-77 X BL-7 (20.62) found to be the best heterotic hybrids for 2.5 % span length. The results are in accordance with Shivakumar (2017), Chinchane (2018), Patel *et al.* (2014), Monicashree (2017).

**Table 1. Standard heterosis of hybrids for fibre quality characters in cotton (*Gossypium hirsutum* L.) during *kharif* 2013-14.**

| S.No. | Hybrid | 2.5% Span length (mm) | Bundle strength (g/Tex) | Fibre elongation (%) | Uniformity ratio | Micronaire ($10^{-6}$ g $Inch^{-1}$) |
|---|---|---|---|---|---|---|
| 1 | BBGH-77 x BBGH-3 | 4.11** | 5.25** | -3.98* | -6.31** | 1.63 |
| 2 | BBGH-77 x BBGH-26 | -2.73* | 4.84** | -0.55 | -3.72 | -5.35 |
| 3 | BBGH-77 x BBGH-33 | 0.13 | 6.47** | -0.43 | -3.88 | 8.40* |
| 4 | BBGH-77 x BBGH-1 | -4.74** | 13.94** | 12.29** | -0.87 | 12.41** |
| 5 | BBGH-77 x GHL-5 | 1.09 | 4.85** | 3.24 | -6.16** | 3.05 |
| 6 | BBGH-77 x BL-7 | 20.62** | 4.85** | 9.85** | -5.98** | 0.15 |
| 7 | BBGH-77 x GHL-8 | 3.63** | -6.52** | 9.72 | -4.42* | -0.3 |
| 8 | BBGH-77 x BGH-94 | 13.33** | 5.37** | 7.03** | -1.15 | -3.19 |
| 9 | BBGH-77 x BGH-23 | 22.18** | 5.65** | 4.28* | -5.97** | 1.56 |
| 10 | BBGH-3 x BBGH-26 | -9.69** | 7.67** | 10.52** | -1.07 | 10.92** |
| 11 | BBGH-3 x BBGH-33 | 14.15** | 5.79** | -2.26 | -1.65 | -10.40** |
| 12 | BBGH-3 x BBGH-1 | -9.00** | 12.05** | -0.06 | -4.77* | -1.71 |
| 13 | BBGH-3 x GHL-5 | -0.7 | 6.55** | 8.93** | -2.88 | 3.12 |
| 14 | BBGH-3 x BL-7 | -2.96* | 6.24** | -6.24** | -9.84** | 7.73* |
| 15 | BBGH-3 x GHL-8 | -3.35** | 3.89* | -7.34** | -10.28** | 8.47* |
| 16 | BBGH-3 x BGH-94 | -9.69** | 2.33 | 10.28** | -2.93 | 1.71 |
| 17 | BBGH-3 x BGH-23 | 13.32** | -0.88 | -9.97** | -5.27* | -5.35 |
| 18 | BBGH-26 x BBGH-33 | -3.27** | 11.46** | -5.87** | -7.12** | 1.63 |
| 19 | BBGH-26 x BBGH-1 | -3.15 | 6.65** | 9.79** | -5.25* | -6.24 |
| 20 | BBGH-26 x GHL-5 | -1.36 | 2.31 | 6.79** | -7.77** | -7.88* |
| 21 | BBGH-26 x BL-7 | -4.40** | 1.71 | 10.76** | -13.83** | -1.11 |
| 22 | BBGH-26 x GHL-8 | -6.23** | 6.79** | 9.91** | -14.14** | -8.10* |
| 23 | BBGH-26 x BGH-94 | -9.70** | 4.35** | 11.13** | -9.99** | 3.71 |
| 24 | BBGH-26 x BGH-23 | -6.23** | -4.32** | 7.52** | -8.22** | -8.69** |
| 25 | BBGH-33 x BBGH-1 | -6.26** | 8.54** | 8.87** | -8.49** | -10.10** |
| 26 | BBGH-33 x GHL-5 | -2.21 | 5.16** | 0.12 | -6.01** | 2.3 |
| 27 | BBGH-33 x BL-7 | 17.15** | 6.09** | -3.91* | -1.3 | -15.38** |
| 28 | BBGH-33 x GHL-8 | -2.09 | 6.47** | -8.62** | -4.35* | -13.82** |
| 29 | BBGH-33 x BGH-94 | -4.72** | 2.3 | -8.75** | -10.88** | -0.89 |
| 30 | BBGH-33 x BGH-23 | 6.78** | 6.49** | -5.87** | -9.67** | -8.84** |
| 31 | BBGH-1 x GHL-5 | -3.89** | -3.70* | -5.81** | -10.34** | -10.55** |
| 32 | BBGH-1 x BL-7 | -1.87 | -2.07 | 11.80** | -1.42 | -8.84** |
| 33 | BBGH-1 x GHL-8 | -2.56* | 6.82** | -4.16* | -9.64** | 5.2 |
| 34 | BBGH-1 x BGH-94 | -2.29 | 1.48 | 9.97** | -6.22** | 12.18** |
| 35 | BBGH-1 x BGH-23 | 3.33** | 2.25 | -0.86 | -2.87 | -10.70** |
| 36 | GHL-5 x BL-7 | 1.9 | 1.33 | -2.08 | -4.46* | 2.6 |
| 37 | GHL-5 x GHL-8 | 3.81** | 10.57** | -0.8 | -1.81 | -7.88* |
| 38 | GHL-5 x BGH-94 | 0 | 0.23 | -0.31 | -2.99 | -1.34 |
| 39 | GHL-5 x BGH-23 | 15.64** | -2.16 | -2.51 | -5.28** | -4.16 |
| 40 | BL-7 x GHL-8 | -0.12 | -3.49** | 3.18 | -4.09* | 5.5 |
| 41 | BL-7 x BGH-94 | -0.18 | 2.15 | 5.69** | -4.56* | 0.07 |
| 42 | BL-7 x BGH-23 | -0.01 | -2.09 | 8.07** | -5.88** | -6.24 |
| 43 | GHL-8 x BGH-94 | -0.5 | -6.06** | 6.54** | -4.33* | 1.78 |
| 44 | GHL-8 x BGH-23 | -0.5 | 0.67 | 6.97** | -4.76* | 8.25* |
| 45 | BGH-94 x BGH-23 | 11.05** | 5.37** | 9.05** | -4.70* | -2.6 |

** = Significance at 1% level    *= Significance at 5% level

The standard heterosis for bundle strength (g/tex) ranged between -6.52 (BBGH-77 x GHL-8) and 13.94 (BBGH-77 x BBGH-1) with twenty six positive significant heterotic hybrids. Positive heterosis is desirable for the bundle strength. Among the twenty six positive significant hybrids, BBGH-77 X BBGH-1 (13.94) and BBGH-3 X BBGH-1 (12.05) are the best hybrids for the bundle strength (g/tex). Similar results are reported by Shivakumar (2017), Chinchane (2018), Amit *et al*. (2013) and Kumar *et al.* (2013).

For fibre elongation % standard heterosis ranged between -9.97 (BBGH-3 x BGH-23) and 12.29 (BBGH-77 x BBGH-1). Twenty one heterotic hybrids were found significant, among which, BBGH-77 X BBGH-1 (12.29) and BBGH-1X BL-7 (11.80) found to be the best hybrids for fibre elongation. Positive heterosis is desirable for fibre elongation. Similar findings reported by Shivakumar (2017), Chinchane (2018), Mohan (2011) and Tuteja *et al*. (2011).

Standard heterosis for uniformity ratio ranged from-14.14 (BBGH-26 x GHL-8) to -0.87 (BBGH-77 x BBGH-1) with no significant heterotic hybrids. Positive heterosis was desirable for the character.

For Micronaire ($10^{-6}$ g/inch), the range of standard heterosis was between -15.38 (BBGH-33 x BL-7) and 12.41 (BBGH-77 x BBGH-1) with seven positive significant heterotic hybrids. Positive heterosis is desirable for the character. The hybrids BBGH-77 X BBGH-1 (12.41) and BBGH-3 X BBGH-26 (10.92) are the best heterotic hybrids for Micronaire in the study. The results are in accordance with Shiva Kumar *et al*. (2017), Chinchane (2018), Nidagundi *et al*. (2012) and Sekhar *et al*. (2012).

## CONCLUSION

The cross combination BBGH-77 x BBGH-1 expressed highest significant heterotic effects for all the quality characters except for 2.5 % span length and uniformity ratio over the check Bunny Bt.

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## LITERATURE CITED

**Amit S, Ram A, Sheoran R K, Ashish J and Gaurav D 2013** Heterosis in genetic male sterility based desi cotton hybrids for seed cotton yield and component traits. *Annals of Biology.* 29 (1): 32-34.

**Chinchane V N, Thombre K R and Jayewar N E 2018** Heterosis Studies for Fibre Quality Traits in Desi Cotton (Gossypium arboreum L.). International Journal of Current Microbiology & Applied Science Special Issue-6: 983-989

**Kumar K A, Kumar K S and Ravikesavan R 2013** Heterosis studies for fiber quality of upland cotton (*Gossypium hirsutum* L.) in line x tester design. *African Journal of Agricultural Research.* 8 (48): 6359-6365.

**Mohan M K 2011** Combining ability analysis for fibre quality in inter-specific hybrids of cotton. *M.Sc. (Ag) Thesis.* Acharya. N. G. Ranga Agricultural University, Hyderabad, India.

**Monicashree C, Amala Balu P and Gunasekaran M 2017** Combining ability and heterosis studies on yield and fibre quality traits in upland cotton (*Gossypium hirsutum* L.) International Journal Current Microbiology and Applied Sciences 6(8) : 912-927.

**Nidagundi J M, Patil S S, Salimath P M, Kajjidoni S T, Patil B C and Hedge M G 2012** Heterobeltiosis in multiple environments for seed cotton yield and yield attributes in cotton (*G. hirsutum* L.). *Karnataka Journal of Agricultural Sciences.* 25 (3): 301-304.

**Patel D H, Patel D U and Kumar V 2014** Heterosis and combining ability analysis in tetraploid cotton (*Gossypium hirsutum* L. and *Gossypium barbadense* L.). *Electronic Journal of Plant Breeding.* 5(3): 408-414.

**Sekhar L, Khadi B M, Rajesh S P, Katageri I S Vamadevaiah H M, Chetti M B and Nadaf H L 2012** Study of heterosis in thermo sensitive genetic male sterility (TGMS) based diploid cotton hybrids for yield, yield component and fibre quality characters. *Karnataka Journal of Agricultural Sciences*. 25(3): 313-321

**Shiva Kumar K J M and Hosamani A C 2017** Estimation of Commercial Heterosis for Fiber Quality Traits in Cotton under Rainfed Conditions. International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Volume 6 (4) pp. 2145-2152

**Shull G H 1914** Duplicate genes for capsule form in Bursa bursa -pastoris Zectscher, *Induki Abstramm Verebungsi* 12: 97- 149

**Tuteja O P, Banga M and Nirania K S 2011** Heterosis studies on GMS based hybrids in *Gossypium hirsutum* cotton. *Journal of Cotton Research and Development*. 25 (2): 162-164.

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