# Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of plant Sciences
Volume 1 Number 2: 126-127, 2002

# Performance of Intra-Hirsutum F1 Hybrids (*Gossypium hirsutum* L.)

Mohammad Yousif Solang, M. J. Baloch, M. H. Solangi, M. S. Chang and A. R. Lakho
Central Cotton Research Institute, Sakrand, Sindh, Pakistan

**Abstract**: Six intra specific F1 hybrids of *Gossypium hirsutum* L. cultivars were studied for the manifestation of heterosis in seed cotton yield, bolls per plant, boll weight, ginning out turn percentage and staple length. The data showed significant differences between mid parents and F1 hybrids for all the traits studied. The maximum positive heterotic response of F1 hybrids over mid and better parents, respectively were 139.0 and 120.0% for seed cotton yield, 119.2 and 81.1% for number of bolls, 3.4 over better parent and −6.3% over mid parent, and 6.3% for boll weight, 5.7 and 2.3% for ginning out turn percentage and 5.7 and 3.7% for staple length.

**Key words:** Heterosis, intra specific, F1 hybrids and *G. hirsutum* L.

## Introduction

Cotton plant can be grown as pure varieties or hybrids, specially F1. In country like Pakistan, growing pure varieties is a traditional method whereas hybrids can be an alternative approach. F1 hybrids which manifest heterosis for yield and many other traits are developed by crossing selected male and female parents. Thus, it becomes imperative for hybrid cotton development that parents be identified which in cross combinations manifest high magnitude of heterosis. In inter specific crosses, Baloch *et al.* (1993) recorded maximum mid parent heterosis of 20.62 in yield, 19.3 in boll per plant, 15.22 in boll weight, 3.25 in lint %, and 7.63% in staple length. The feasibility of economic heterosis either in intra or inter specific hybrids of Gossypium is only possible at commercial level where man-power is cheaper for making hand pollination (Khan and Khan 1979; Salam 1991 and Baloch *et al.*, 1993).

In the exploitation of heterosis for quantity traits like seed cotton yield of crop can be significantly improved. Choudhry *et al.* (1978), Bhatade *et al.* (1980), Khajjidani *et al.* (1984). Khan *et al.* (1984), Khan and Aslam (1986) and Mahmood *et al.* (1987) observed significant heterosis for seed and lint indices and seed cotton yield. An average heterosis of 42% in yield over mid parent and several hybrids over better parents have also been reported by Baloch *et al.* (1993), Chang *et al.* (2001). The first step towards the development of commercial hybrid cotton is to exploit best parents among hundreds which in F1 combination may express high degree of heterosis in the desired economical and developmental characters. For commercial success of F1 hybrids, they ought to manifest 25 to 50% increase in yields, 1 to 20% increase in ginning out turn percentage, and 29.5 to 34.4% in staple length as compared to commercial varieties (Baloch *et al.*, 1994). Thus the present study was aimed to evaluate the amount of the heterosis manifested in intra specific hybrids of *Gossypium hirsutum* L.

## Materials and Methods

The studies were carried out to determine the magnitude of heterosis in six intra hirsutum F1 hybrids. All the six crosses along with their respective parents were sown in a Randomized Complete Block Design with four replications at Central Cotton Research Institute, Sakrand. The row to row and plant to plant distances were 2.5 feet and one foot, respectively and the length of row was 25 feet. At maturity, ten central plants from each repeat of each genotype were taken as experimental units, where as one plant on either side of the rows was treated as discard. Thus total of 40 plants from each genotype were taken as index plants for recording the data on yield of seed cotton per plant in grams, a number of bolls per plant, boll weight in gm, ginning out turn percentage and staple length measured in millimeters The data were subjected to analysis of variance by Steel and Torrie (1980). Heterosis was calculated as percentage increase (+) or decrease (-) of F1 hybrid over mid and better parent values.

## Results and Discussion

The analysis of variance yielded highly significant differences among F1s and their parents for all the characters (Table 1).

**Seed cotton yield per plant (gm)**: The data (Table 2) revealed that all the hybrids showed an appreciable amount of heterosis over mid and better parents. The magnitude of heterosis when compared with mid parents ranged from 17.4% (CRIS-52 X CRIS-121) to 139.0% (CIM-240 X CRIS-121), while comparing with better parents, these values varied from 9.2% (CRIS-52 X CRIS-121) to 120.0% (CIM-240 X CRIS-121). A remarkable degree of heterosis has been observed for this character is also supported with the findings of Ali and Khan (1983), Khan *et al.* (1984;1985), Khan and Aslam (1986) and Keerio *et al.* (1996)

Table 1: Mean squares from analysis of variance for different characters

| | | Mean squares | | | | |
|---|---|---|---|---|---|---|
| Source of variation | d.f | Yield per plant | No. of bolls per plant | Boll weight | Ginning out turn (%) | Staple length |
| Replications | 3 | 221.4 | 25.6 | 0.04 | 0.5 | 0.2 |
| Hybrids and parents | 13 | 3702.5** | 538.9** | 0.4** | 6.3** | 3.0** |
| Error | 39 | 257.0 | 54.7 | 0.05 | 0.2 | 0.7* |

* and ** Significant at 5 and 1% level of probability

Table 2: Heterosis performance of F1 hybrids against their mid and better parents

| | | | | | | Percentage increase (+) or decrease (-) of F1 over | |
|---|---|---|---|---|---|---|---|
| Name of character | Name of hybrid | Mother parent | Pollen parent | Mid parent | F1 hybrid | Mid parent | Better parent |
| Seed cotton yield (gm) | CRIS-52 x CRIS121 | 60.7 | 65.8 | 63.3 | 74.3 | 17.4 | 12.9 |
| | CRIS-52 x CRIS-122 | 60.7 | 45.8 | 53.2 | 66.3 | 24.6 | 9.2 |
| | CRIS-54 x CRIS-121 | 56.0 | 65.8 | 60.9 | 100.4 | 65.0 | 52.06 |
| | PD-4548 x CRIS-121 | 69.0 | 65.8 | 67.7 | 130.4 | 93.0 | 87.6 |
| | CRIS-7A x CIM-109 | 71.8 | 62.6 | 67.2 | 115.4 | 71.7 | 60.7 |
| | CIM-240 x CRIS-121 | 55.5 | 65.8 | 60.6 | 144.8 | 139.0 | 120.0 |

Table 2: Continued

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. of bolls per plant | CRIS-52 x CRIS121 | 18.4 | 21.0 | 19.7 | 30.3 | 53.8 | 44.3 |
| | CRIS-52 x CRIS-122 | 18.4 | 21.1 | 19.7 | 25.0 | 26.3 | 18.4 |
| | CRIS-54 x CRIS-121 | 17.5 | 21.0 | 19.3 | 36.0 | 86.5 | 71.4 |
| | PD-4548 x CRIS-121 | 27.4 | 21.0 | 24.2 | 44.5 | 83.9 | 62.4 |
| | CRIS-7A x CIM-109 | 20.9 | 21.5 | 21.2 | 37.8 | 78.3 | 75.8 |
| | CIM-240 x CRIS-121 | 32.2 | 21.0 | 26.6 | 58.3 | 119.2 | 81.1 |
| Boll weight (gm) | CRIS-52 x CRIS121 | 3.5 | 3.2 | 3.4 | 2.5 | 26.5 | -28.6 |
| | CRIS-52 x CRIS-122 | 3.5 | 3.1 | 3.3 | 2.7 | 18.2 | -22.9 |
| | CRIS-54 x CRIS-121 | 3.5 | 3.2 | 3.4 | 2.8 | 17.6 | -20.0 |
| | PD-4548 x CRIS-121 | 2.5 | 3.2 | 2.9 | 3.0 | 3.4 | -6.3 |
| | CRIS-7A x CIM-109 | 3.5 | 2.9 | 3.1 | 3.0 | 3.3 | -14.0 |
| | CIM-240 x CRIS-121 | 2.8 | 3.2 | 3.0 | 2.9 | 3.2 | -9.4 |
| Ginning out turn %age | CRIS-52 x CRIS121 | 31.3 | 35.1 | 33.2 | 35.1 | 5.7 | 0.0 |
| | CRIS-52 x CRIS-122 | 31.3 | 35.2 | 33.3 | 34.6 | 3.9 | -1.7 |
| | CRIS-54 x CRIS-121 | 33.0 | 35.1 | 34.3 | 34.6 | 1.8 | -1.4 |
| | PD-4548 x CRIS-121 | 33.8 | 35.1 | 34.5 | 34.1 | -1.2 | -2.8 |
| | CRIS-7A x CIM-109 | 33.2 | 35.4 | 34.3 | 36.2 | 5.5 | 2.3 |
| | CIM-240 x CRIS-121 | 34.5 | 35.1 | 34.8 | 35.4 | 1.7 | 0.9 |
| Staple length (mm) | CRIS-52 x CRIS121 | 25.6 | 26.1 | 25.9 | 26.9 | 3.9 | 3.1 |
| | CRIS-52 x CRIS-122 | 25.6 | 27.1 | 26.4 | 28.9 | 5.7 | 3.0 |
| | CRIS-54 x CRIS-121 | 25.6 | 26.1 | 25.9 | 26.5 | 2.3 | 1.5 |
| | PD-4548 x CRIS-121 | 28.3 | 26.1 | 27.3 | 26.8 | -1.5 | -3.9 |
| | CRIS-7A x CIM-109 | 26.2 | 27.4 | 26.8 | 27.0 | 0.7 | -1.5 |
| | CIM-240 x CRIS-121 | 26.7 | 26.1 | 26.4 | 27.4 | 3.8 | 3.7 |

**Number of bolls per plant:** For number of bolls per plant, heterosis was observed in all the hybrids when compared with mid and better parents. The data (Table 2) shows that the magnitude of heterosis over mid parents ranges from 26.3% (CRIS-52 X CRIS-122) to 119.2% (CIM-240 X CRIS-121), while against better parents, heterosis ranged from 18.5% (CRIS-52 X CRIS-122) to 81.1% (CIM-240 X CRIS-121). It is also noted that maximum heterosis in both number of bolls and seed cotton yield was manifested by CIM-240 X CRIS-121 hybrid. It complied that the plants showing more heterosis for number of bolls, also yield more. This confirms it with the findings of Khan *et al.*, 1979;1980.

**Boll weight (gm)**: There is significant difference in boll weight amongst hybrids and their parents (Table 2). Only one hybrid (PD-4548 x CIM-121) gave positive heterosis over mid parents. This confirms it with the findings of Nasir *et al.* (1978) , Khan *et al.* (1980) and Mukhtiar *et al.* (2000).

**Ginning out turn percentage**: The differences in ginning our turn percentage between hybrids and parental values were highly significant (Table 2). Results further show that except PD-4548 X CRIS-121 which manifested negative heterosis (-1.2%) all the other hybrids gave positive heterosis over their mid parent values. However, hybrids, (CRIS-7A x CIM-109) and (CIM-240 x CRIS-121) gave positive heterosis of 2.3% and 0.9% over their better parents respectively. Where as other hybrids gave negative heterosis. These findings are in conformity with those of Khan *et al.* (1978). Nasir *et al.* (1978), Khan *et al.* (1980) and Soomro (1999).

**Staple length (mm)**: Regarding staple length, it is clear from Table 2 that all the hybrids except PD-4548 x CRIS-121, gave positive heterosis over mid parent and the values range from 0.7% (CRIS-7a X CIM-109) to 5.7% (CRIS-52 X CRIS-122) but for better parents, this value varied from 1.5 (CRIS-54 X RIS-121) to 3.7% (CIM-240 X CRIS-121) Hybrid has also been observed in this character by khan *et al.* (1978), Nasir *et al.* (1978), khan and Khan (1979).

## References


Ali, N. and M. A. Khan, 1983. Study of heterosis for lint percentage, staple length, seed and lint indices in some inter-varietal crosses of *G. hirsutum*, L. The Pak. Cottons, 27: 83-88.

Baloch, M. J., G. H. Tunio and A. R. Lakho, 1993. Performance of F1 hybrids from intra-hirsutum crosses of upland cottons. Pak. J. Sci. Ind. Res., 36 No.1.

Baloch, M. J., A. R. Lakho, B. A. Soomro and M. M. Rajpar, 1994. Evaluation of heterosis in intra- specific crosses of *G. hirsutum* L. Pak. J. Agric. Engg. Vet. Sci., 10: 44-48.

Bhatade, S. S., M. R. Shobhane and P. K. Unchega Nkas, 1980. Heterosis and combining ability in *G. hirsutum* L. Ind. J. Agric.. Sci., 50: 310-316.

Chang, M. S., M. A. Chang, A. R. Lakho, A. W. Soomro and G. H. Tunio, 2001. Expression of hybrid vigor for seed cotton and its components in upland cotton (*Gossypium hirsutum*L.). Pak. J. Biol. Sci., 1: 86-88.

Choudhry, M. A., M. A. Khan and M. A. Khan, 1978. Heterosis for quality traits in intra specific crosses of cotton (*G. hirsutum* L.). The Pak. Cottons, 23: 49-58.

Khajjidani, S. T., K. G. Hiremath, S. N. Kadapa and J. V. Coul, 1984. Heterosis and combining ability in *G. herbaceum* and *G. arboreum*, Ind. J. Agric... Sci., 54: 9-16.

Khan, M. A. and I. A. Khan, 1979. Commercial use of hybrid vigor for increasing cotton production in Pakistan. National Seminar on cotton production, Lahore.

Khan, M. D., F. M. Azhar and H. U. Ranna, 1984. Heterosis and combining ability in intra specific crosses of *G. hirsutum* L.II Quality characters. J. Agric.. Res., 22: 1867-197.

Khan, M. F. M. Azhar and H. Rana, 1980. Heterosis and combining ability in intra specific crosses of *Gossypium hirsutum* L. yield and its components. The Pak . Cottons, 24: 306-315.

Khan, M. A., M. A. Choudhry and M. A. Khan, 1976. Heterosis for seed cotton yield and its components in *G. hirsutum* cross. The Pak. Cottons, 21: 19-30.

Khan, I. A., M. A. Khan and M. Iqbal, 1985. Study of heterosis and combining ability in cotton (*G. hirsutum* L.). The Pak. Cottons, 28: 77-84.

Khan, M. A. and M. Aslam, 1986. Estimation of heterosis and heterobeltiosis and inbreeding depression of quality traits in some intra-hirsutum crosses. The Pak. Cottons, 50: 39-45.

Khan, W. S., A. Latif, M. Arshad and H. Ali, 1978. Heterosis in some intra specific crosses of cotton (*Gossypium hirusutm* L.) and their performance in F2 generations. The Pak. Cottons, 22: 139-145.

Keerio, M. D., M. S. Kalwar, M. I. Memon and M. J. Baloch, 1996. Estimates of economic heterosis for some material traits of (*Gossypium hirsutum* L.). The Pak. Cottons, 40: 18-12.

Mahmood, G., S. Hussain, N. H. Shah and G. Hassan, 1987. Estimation of hybrid vigor for some quality traits in intra-hirsutum diallel crosses of cotton. The Pak. Cottons, 31: 187-94.

Mukhtiar, M. S. and T. M. Khan, 2000. Estimation of heterosis for yield and yield components in cotton (*Gossypium hirsutum* L.) Pak. J. Biol. Sci., 3: 1412-1413.

Nasir, Z. A., M. A. Khan and I. A. Khan, 1978. Heterosis studies in *G. hirsutum* L. Crosses. The Pak. Cottons, 22: 91-96.

Steel, R. G. D. and J. H. Torrie, 1980. Principles and procedures of statistics: A biological approach. Sec. Ed. McGraw Hill-Inc., New York.

Salam, C. A., 1991. Status of intra-specific commercial hybrids in the Punjab. The Pak. Cottons, 35: 5-17.

Soomro, A. R., M. H. Channa, A. A. Channa, G. H. Kalwar, G. N. Dayo, and A. H. Memon, 1999. Study the heterosis in intra specific crosses of upland cotton. The Pak. Cottons, 43: 41-45.