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# ASSESSMENT OF *GOSSYPIUM HIRSUTUM* $F_1$ HYBRIDS AGAINST COMMERCIAL VARIETIES NIAB-78 AND CRIS-9 IN SAKRAND CONDITIONS

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Fourteen intraspecific hybrids of cotton were evaluated against commercial varieties NIAB-78 and CRIS-9 in respect of yield per plant, number of bolls per plant, boll weight, ginning outturn percent and staple length. All the hybrids yielded more than NIAB-78 and CRIS-9 except BH-41 x CRIS-54 which yielded lower than CRIS-9. 13 hybrids produced more number of bolls per plant, 7 ginned better and all the hybrids produced heavier bolls than the commercial varieties. 10 hybrids measured longer staple length. Several hybrids have the potential to be commercial hybrids.

***Key words:*** *Gossypium hirsutum,* F.hybrids, Heterosis.

## Introduction

The present target of area and production of cotton in Pakistan is about 2.7 million hectares and 9.5 million bales, respectively. Besides, providing the livelihood to millions of farmers, cotton sustains our textile industry, the major industrial sector in Pakistan. Cotton not only provides employment to millions of people in cotton trade, processing and manufacturing but also earns valuable foreign exchange through exports of raw cottonyarn and cotton textile. Therefore efforts should be made to enhance the productivity at much higher level than at present through development of viable technology and its transfer to cotton growers.

The breakthrough in cotton production may be achieved through development of commercial cotton hybrids as has been achieved in India (Basu and Paroda 1995). The object of the present study is to confirm the nature and extent of heterosis of seed cotton yield and yield components in some intervarietal crosses of *G hirsutum.* To explore the possibility of developing commercial hybrids for boosting the cotton production, selection of parents to form better combinations is of utmost importance in hybrid program as there is need to develop environmentally stable male sterile and effective fertility restorer lines for seed production with minimum labour and cost. The success of hybrids depends upon the magnitude of heterosis expressed by these parents in $F_1$ generation.

Turner (1953) produced 21 hybrids and tested for their yielding ability in comparison with prevailing commercial variety and observed that 7 hybrids gave seed cotton yield significantly higher than the standard variety. Singh *et al* (1964) reported that intra-hirsutum hybrids excelled standard variety by 21.3% in seed cotton yield. The increase in yield was subjected to increase in boll number and boll size. Meredith and Bridge (1972) have explained term 'Useful heterosis', which is defined as the increase in yield over the standard commercial check variety. Sundaram (1975) reported increase in yield of hirsutum-barbadense hybrids. Mirza and Chaudhry (1985), stated highly significant differences among the varieties at 1% level of probability, $F_1$ hybrid of CIM 46 x NIAB-78 to be particularly high yielding. Ahmed and Panhwar (1987) found highly significant differences in average yield per plant between various hybrids and Qalandri standard. Kalsy and Garg (1989), found that hybrid vigor ranged from 6.0 to 92.1% over the better parents for seed cotton yield. The average increase in yield of hybrids over the better parent was 10.1%.

In case of lint percent, (Fryxell *et al* 1958; Omran *et al* 1974; Marani 1963, 1967; Ahmed and Panhwar 1987 negative heterosis was observed because seed index markedly increased where as lint index increased by low margin. Kalsy and Garg (1989) reported that heterotic effect in characters like halo length and GOT% was not noticed.

Afzal (1949) was of the opinion that boll number per plant contributed towards the ultimate yield of seedcotton. Fryxell *et al* (1958) and Marani (1967) reported high degree of heterosis for number of bolls per plant. Ahmed and Panhwar (1987), expressed that, average yield per plant is the product of average boll weight and average number of bolls per plant in hybrids and the standard variety Qalandri. Kalsy and Garg (1989) observed that yield has direct correlation with boll number and so the hybrids that showed high heterosis for yield also exhibited high heterotic effects for boll number indicating a great scope of increase in yield by exploiting the

hybrid vigor for boll number.

Balls (1915) explained that staple length was a heritable character but it was subjected to environmental changes. Mirza and Chaudhry (1985) obtained all the hybrids statistically superior to both the standards i.e. MNH-93 and B-557. Ahmed and Panhwar (1987) observed significantly longer staples in hybrids compared to Qalandri except two.

## Materials and Methods

Fourteen intra-specific crosses made during 1992-93, were sown in 1993-94 in four randomized replications, plot size being 2.5' x 10'. The recommended agro-cultural practices and plant protection measures were adopted. The performance of hybrids was evaluated for average yield per plant, average boll weight, boll number, ginning outturn and staple length as against the commercial cultivars NIAB-78 and CRIS-79. Fiber length was measured on computerized fibrograph. The data were statistically analyzed and finally subjected to DMR test in order to find out the differences among the genotypes.

## Results and Discussion

The data presented in Tables 1 and 2 shows that BH-41 x CRIS-52 recorded significantly highest yield among the hybrids over NIAB-78 and CRIS-9. The heterobeltiosis for seedcotton yield to the extent of 148% was recorded for cross BH-41 x CRIS-52 against CRIS-9. The cross CRIS-9 x CRIS-52 was also promising for seedcotton yield. It exhibited higher mean heterosis of 130% over better check CRIS-9. The range of significant increase in yield per plant of superior hybrids varied from 66.3 to 130.1 grams per plant over better standard variety CRIS-9. The result are in conformity with those of Jones & Loden (1951) who noticed an increase in $F_1$ over the average of both the parents. Researchers like Marani (1963); Hawkins *et al* (1965), Young and Murray (1966) and Rafique (1972) confirmed the heterosis for yield and other agronomic characters in cotton.

The increase in yield of seedcotton was associated with heterosis in average number of bolls per plant and boll weight. In fact both the characters directly contribute towards yield, as average yield per plant is the product of average number of bolls and average boll weight. In the present study there exists significant differences for average boll number and average boll weight between hybrids and the controls i.e. NIAB-78 and CRIS-9. In case of number of bolls per plant, the cross CRIS-9 x CRIS-52 was on the top followed by crosses BH-41 x CRIS-54, CRIS-9 x CRIS-54 and CRIS-52 x CRIS-122, which were of the same order in DMR test (Table 1). As regards boll weight the cross Alseemi-515 x CRIS-9 was found to be the highest followed by Reshmi x CRIS-9. It was further noticed that both the crosses proved to be the

**Table 1**

Average performance of $F_1$ hybrids

| Sr. No. | Cross combination | Yield per plant (g) | Ginning outturn (%) | No.of bolls per plant | Boll weight (g) | Staple length (mm) |
|---|---|---|---|---|---|---|
| 1. | Alseemi-515 x CRIS-9 | 134.1bc | 34.1b | 30.0bc | 4.8a | 27.9ab |
| 2. | CRIS-9 x CRIS-52 | 206.3ab | 36.8ab | 58.7a | 3.3c | 27.6b |
| 3. | CRIS-9 x CRIS-54 | 174.0ab | 38.8a | 50.0ab | 3.2cd | 27.6b |
| 4. | BH-41 x CRIS-52 | 218.3a | 33.5b | 54.7ab | 4.1b | 26.3c |
| 5. | CRIS-53 x CRIS-122 | 152.0b | 36.5ab | 47.7ab | 3.7bc | 26.4c |
| 6. | CRIS-53 x CRIS-121 | 120.7bc | 34.0b | 38.0bc | 3.8bc | 25.6cd |
| 7. | CRIS-52 x CRIS-121 | 111.9bc | 34.2b | 35.0bc | 3.3c | 26.2c |
| 8. | CRIS-52 x CRIS-5A | 138.0bc | 34.1b | 43.3ab | 3.0cd | 26.8bc |
| 9. | CRIS-52 x CRIS-122 | 133.9bc | 37.4ab | 42.0b | 3.3c | 28.8c |
| 10. | BH-41 x CRIS-54 | 76.6c | 37.2ab | 21.3c | 3.8bc | 26.8bc |
| 11. | CRIS-53 x CRIS-5A | 124.9bc | 33.7bc | 35.7bc | 3.4c | 25.1d |
| 12. | Reshmi x CRIS-54 | 116.9bc | 34.0b | 31.0bc | 4.1b | 27.5b |
| 13. | Reshmi x CRIS-9 | 92.7bc | 36.7ab | 26.7bc | 4.4ab | 28.0ab |
| 14. | Reshmi x NIAB-78 | 94.5bc | 34.8b | 25.0c | 4.1b | 28.5a |
| 15. | NIAB-78 (Control) | 68.6c | 33.5b | 22.3c | 2.8d | 26.2c |
| 16. | CRIS-9 (Control) | 88.2c | 34.3b | 25.0c | 2.9d | 26.1c |

**Table 2**

Percentage increase in different traits of cotton hybrids over NIAB-78 and CRIS-9

| Sr. No. | Cross combination | Yield per plant(g) | | | Ginning outturn(%) | | | No.of bolls$^{-1}$plant | | | Boll weight(g) | | | Staple length(mm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hybrid mean | %increase over NIAB-78 | CRIS-9 | Hybrid mean | % increase over NIAB-78 | CRIS-9 | Hybrid mean | % increase over NIAB-78 | CRIS-9 | Hybrid mean | % increase over NIAB-78 | CRIS-9 | Hybrid mean | %increaseover NIAB-78 | CRIS-9 |
| 1. | Alseemi-515xCRIS-9 | 134.1 | 98 | 52 | 34.1 | 2 | - | 30.0 | 35 | 20 | 4.8 | 71 | 66 | 27.9 | 6 | 7 |
| 2. | CRIS-9 x CRIS-52 | 206.3 | 201 | 134 | 36.8 | 10 | 7 | 58.7 | 163 | 135 | 3.3 | 18 | 14 | 27.6 | 5 | 6 |
| 3. | CRIS-9 x CRIS-54 | 174.0 | 154 | 97 | 38.8 | 16 | 13 | 50.0 | 124 | 100 | 3.2 | 14 | 10 | 27.6 | 3 | 4 |
| 4. | BH-41 x CRIS-52 | 218.3 | 218 | 148 | 33.5 | 6 | 4 | 54.7 | 145 | 119 | 4.1 | 46 | 41 | 26.3 | 0.5 | 1 |
| 5. | CRIS-53 x CRIS-122 | 152.0 | 122 | 72 | 36.5 | 9 | 6 | 47.7 | 114 | 91 | 3.7 | 32 | 28 | 26.4 | 0.5 | 1 |
| 6. | CRIS-53 x CRIS-121 | 120.7 | 76 | 37 | 34.0 | 1 | - | 38.0 | 70 | 52 | 3.8 | 36 | 31 | 25.6 | - | - |
| \7. | CRIS-52 x CRIS-121 | 111.9 | 63 | 27 | 34.2 | 2 | - | 35.0 | 57 | 40 | 3.3 | 18 | 14 | 26.2 | - | 0.5 |
| 8. | CRIS-52 x CRIS-5A | 138.0 | 101 | 56 | 34.1 | 2 | - | 43.3 | 94 | 73 | 3.0 | 7 | 3 | 26.8 | 2 | 3 |
| 9. | CRIS-52 x CRIS-122 | 133.9 | 95 | 52 | 37.4 | 12 | 9 | 42.0 | 88 | 68 | 3.3 | 18 | 14 | 25.8 | - | - |
| 10. | BH-41 x CRIS-54 | 76.6 | 15 | - | 37.2 | 11 | 8 | 21.3 | - | - | 3.8 | 36 | 31 | 26.8 | 2 | 3 |
| 11. | CRIS-53 x CRIS-5A | 124.9 | 82 | 42 | 33.7 | 1 | - | 35.7 | 60 | 43 | 3.4 | 21 | 17 | 25.1 | - | - |
| 12. | Reshmi x CRIS-54 | 116.9 | 70 | 33 | 34.0 | 1 | - | 31.0 | 39 | 24 | 4.1 | 46 | 41 | 27.5 | 5 | 6 |
| 13. | Reshmi x CRIS-9 | 92.7 | 35 | 5 | 36.7 | 10 | 7 | 26.7 | 20 | 7 | 4.4 | 57 | 52 | 28.0 | 7 | 8 |
| 14. | Reshmi x NIAB-78 | 94.5 | 38 | 7 | 34.8 | 4 | 1 | 25.0 | 12 | - | 4.1 | 46 | 41 | 28.5 | 9 | 10 |
| 15. | NIAB-78 (Control) | 68.6 | - | - | 33.5 | - | - | 22.3 | - | - | 2.8 | - | - | 26.2 | - | - |
| 16. | CRIS-9 (Control) | 88.2 | - | - | 34.3 | - | - | 25.0 | - | - | 2.9 | - | - | 26.1 | - | - |

CRIS-121, CRIS-52 x CRIS-122 and CRIS-53 x CRIS-5A produced longer staple than NIAB-78 and CRIS-9. The hybrid Reshmi x NIAB-78 produced the longest staple showing an increase of 2.3 and 2.4 mm over NIAB-78 and CRIS-9 respectively. These findings are in conformity with those of Ahmed and Panhwar (1987) and Mirza and Chaudhry (1985).

## References


Afzal M 1949 *Growth and Development of Cotton Plant and its Improvement in the Punjab.* Govt. Printing Press, Lahore.

Ahmed M, Panhwar G N 1987 Assessment of *G hirsutum, G barbadense* $F_1$ hybrids against commercial variety Qalandri. *The Pak Cottons* **31**(1) 25-30.

Balls W L 1915 *Development and Properties of New Cottons.* A & C Block Ltd London pp 107.

Basu A K, Paroda R S 1995 *Hybrid Cotton in India, A Success Story.* Asia Pacific Association of Bangkok pp38.

Fryxell P A, Staten G, Porter J H 1958 Performance of some wide crosses in *Gossypium. New Mex Agri Exp Sta Bult* **419** 1-15.

Hawkins B S, Peacock H A, Ballard W W 1965 Heterosis and combining ability in upland cotton; Effect on yield. *Crop Sci* **5** 543-546.

Jones J E, Loden H D 1951 Heterosis and combining ability in upland cotton. *Agron J* **43** 514-516.

Kalsy H S, Garg H R 1989 Heterosis in intervarietal crosses of upland cotton *(Gossypium hirsutum L). J Ind Soc for Cotton Improv* **2** 159-162.

Khan I A, Khan M A, Iqbal M 1985 Study of heterosis and combining ability in cotton *(Gossypium hirsutum L). The Pak Cottons* **29**(2) 77-84.

Marani A 1963 Heterosis and combining ability for yield and components of yield in a diallel cross of two species of cotton. *Crop Sci* **3** 552-555.

Marani A 1967 Heterosis and combining ability in intraspecific and inter-specific crosses of cotton. *Crop Sci* **7** 519-522.

Meredith W R Jr, Bridge R R 1972 Heterosis and gene action in cotton *G hirsutum L. Crop Sci* **12** 304-310.

Mirza M Y, Chaudhry M R 1985 Identification of parents for use in hybrid cotton programs in Pakistan. *The Pak Cottons* **29**(2) 63-75.

Omran A O, El-Ganayani A E, Galal H 1974 Heterosis and combining ability in crosses between *G hirsutum* and *G barbadense. Cotton Grow Rev* **51**(3) 192-209.

Rafique M 1972 Heterosis studies in *G hirsutum L* crosses. M.Sc thesis, WPAU, Lyuallpur.

Singh G, Anjula A S, Singh A J 1964 Studies on heterosis and combining ability in intra-*hirsutum and hirsutum* x *barbadense* crosses. *Ind Cott Gr Rev* **18** 121-137.

Sundram K 1975 Development of hybrid cotton. *Cotton Int* **43** 166-168.

Turner J E 1953 A study of heterosis in upland cotton. (1) Yield of hybrids as compared to standard. *Agron J* **45** 484-486.

Young F F Jr, Murray J C 1966 Heterosis and inbreeding depression in diploid and tetraploid cotton. *Crop Sci* **6** 436-438.