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ASSESSMENT OF USEFUL HETEROSIS IN GLANDLESS *GOSSYPIUM HIRSUTUM* COTTON STRAINS THROUGH THEIR PERFORMANCE IN HYBRID COMBINATION

ABDUL RAZAQUE SOOMRO

Central Cotton Research Institute, Sakrand, Sindh, Pakistan.

Abstract

Field studies were conducted in 1997 at Central Cotton Research Institute, Sakrand to evaluate useful heterosis in seven hybrids derived from glandless cotton varieties crossed with local advance strains against two commercial varieties NIAB-78 and CRIS-9 in respect of seed cotton yield per plant, number of bolls per plant, boll weight, ginning outturn percent, staple length and uniformity ratio. Six hybrids yielded more seed cotton and number of bolls per plant than both commercial checks NIAB-78 and CRIS-9. All hybrids produced heavier bolls and five gave more ginning outturn percent than both the check varieties. As regards staple length and uniformity ratio, all the hybrids measured longer staple and produced more uniform fibers than both the checks. The maximum heterosis for seed cotton yield per plant of 39.7% was observed against NIAB 78 and 32.8% against CRIS-9.

Introduction

The hybrid vigor in respect of yield is generally defined as increase in yield of hybrid over the mean of the two parents or over the better parent. Meredith & Bridge (1972), suggested the term "useful heterosis" which is defined as increase in yield of hybrid over the standard commercial check variety. Therefore F_1 hybrids derived from glandless parents have been assessed against two prevailing commercial varieties of Sindh viz., NIAB-78 and CRIS-9 to assess useful heterosis.

Singh *et al.*, (1980) reported that intra-hirsutum hybrids excelled standard variety by 21.3% for seed cotton yield. Khan & Ali (1980) in their study observed that all the twelve hybrids manifested positive heterosis for yield. Aslam & Khan (1983) reported heterosis in boll number, boll weight and lint yield per plant. Khan *et al.*, (1984) observed heterosis and heterobelteiosis for staple length and reported that the varieties manifesting good general combining ability behaved negatively in their specific combinations. Kotle & Thombre (1984) reported promising heterosis for sympodia, boll number and seed cotton yield per plant. Mehmood *et al.*, (1987) found that all the traits under study exhibited heterosis and heterobelteiosis with maximum display for the yield of seed cotton per plant attaining the magnitude of 81.0 and 68.2%, respectively. Malik *et al.*, (1988) found the manifestation of heterosis and heterobelteiosis for bolls per plant and seed cotton yield. Rehman *et al.*, (1989), Hussain *et al.*, (1990) and Patil *et al.*, (1991) observed significant heterosis and heterobelteiosis for bolls per plant, boll weight, seed cotton yield and staple length. Katageri *et al.*, (1991) observed significantly positive heterosis over the mid parent for seed cotton yield and boll number.

Baluch *et al.*, (1993) observed highly positive heterotic response of the F_1 over the mid parental value for the number of bolls per plant. Khan *et al.*, (1993) reported heterosis and heterobelteiosis for seed cotton yield, the extent measured was 99.79% and 56.0%, respectively. Soomro *et al.*, (1996) recorded maximum heterosis of 157.2% in hirsutum-barbadense crosses, 33.7% in intra-hirsutum crosses and 28.3% in intra-barbadense crosses in respect of seed cotton yield per plant. Keerio *et al.*, (1996) observed positive heterosis for sympodia, number of bolls, boll weight and seed cotton yield per plant.

Material and Methods

During 1996-97 crop season, four exotic and one local glandless varieties were crossed with four advance strains developed by Central Cotton Research Institute, Sakrand and Multan to produce following seven cross combinations:

1. Cyto-7/91 x CRIS-407
2. Cyto-7/91 x CIM-243
3. F-281 x CRIS-133
4. Gregg-25 V x CRIS-133
5. Gregg-25 V x CRIS-134
6. Stoneville-902 x CRIS-133
7. Stoneville-gl x CRIS-133

The F_0 seed of above combinations was sown in 1997-98 to raise F_1 hybrids in four randomized replications of single rows against two commercial varieties viz., NIAB-78 and CRIS-9. The distance maintained between rows was 5 feet and that of plants was 2 feet to allow enough free space to plants for their growth. The recommended agro-cultural practices were applied with adequate plant protection measures. Ten plants per row were studied. The hybrids were evaluated for the following characters:

1. Average yield per plant in grams.
2. Average number of bolls per plant.
3. Average boll weight (Average of 3 bolls, lower, mid and upper from 3 plants in each repeat).
4. Average ginning outturn percentage (Weight of lint divided by weight of seed cotton x 100).
5. Average staple length in millimeters (Measured on Fibrograph).
6. Average percent uniformity ratio (Fibrograph span length-2 divided by span length-1 x 100).

Results and Discussion

The average performance of hybrids in respect of six characters studied against two commercial varieties NIAB-78 and CRIS-9 revealed highly significant differences for average yield per plant between various hybrids and both the commercial varieties (Table 1). According to DMR Test all the hybrids significantly excelled check varieties except hybrid Cyto-7/91 x CRIS-407 which performed poorer. The range of increase over standard NIAB-78 recorded was 19.1% to 39.7% and over CRIS-9 was 9.9% to 32.8%. Khan *et al.*, (1993), Soomro *et al.*, (1996) and Keerio *et al.*, (1996) have reported similar results for manifestation of heterosis in respect of seed cotton yield per plant. The highest degree of useful heterosis was manifested by hybrids Stoneville-gl x

CRIS-133, Gregg-25 V x CRIS-134, F-281 x CRIS-133 and Gregg-25 V x CRIS-133. The parent CRIS-133 and CRIS-134 are known for their heat resistance and early maturity.

Table 1. Average performance of F_1 hybrids.

Sr. No.	Cross combination	Yield/ plant (g)	No. of bolls/ plant	Boll weight (g)	Ginning otturn (%)	Staple length (mm)	U.R. (%)
1.	Cyto-7/91 x CRIS-407	88.2 e	22 d	4.2 a	41.36 a	26.2 c	53.53 a
2.	Cyto-7/91 x CIM-243	171.0 b	45 bc	3.8 ab	41.40 a	28.0 a	53.81 a
3.	F-281 x CRIS-133	185.5 ab	53 ab	3.5 b	36.75 bc	27.0 b	51.32 bc
4.	Gregg-25 V x CRIS-133	182.0 ab	52 ab	3.5 b	35.78 c	26.1 c	48.67 d
5.	Gregg-25 V x CRIS 134	185.5 ab	53 ab	3.5 b	35.68 c	26.2 c	49.71 cd
6.	Stoneville-902 x CRIS-133	141.0 c	47 bc	3.0 c	36.30 bc	25.8 cd	52.33 b
7.	Stoneville-gl x CRIS-133	189.1 a	61 a	3.1 c	38.47 b	25.5 d	52.43 b
8.	NIAB-78 (Check)	106.4 d	38 c	2.8 d	35.58 c	25.5 d	48.11 d
9.	CRIS-9 (Check)	118.9 d	41 bc	2.9 d	36.21 bc	25.5 d	49.10 cd

This is an indication that heat resistance and early maturity play vital role in heterosis manifestation and merit significant attention in the production of hybrid cotton. The yield per plant is the product of boll weight and number of bolls per plant hence both these characters are direct contributors towards yield. In the present studies there existed highly significant differences for average boll weight and number of bolls per plant between hybrids and commercial checks. All the hybrids significantly excelled both the standard varieties in respect of boll weight, whereas in respect to number of bolls per plant, all the hybrids showed superiority over the checks except hybrid Cyto-7/91 x CRIS-407 which produced heaviest bolls but number of bolls remained minimum which proves the negative correlation of boll weight and boll number (Table 1). Numerically all the hybrids except Cyto-7/91 x CRIS-407 have shown considerable heterosis. This indicates that heterosis in production of number of bolls is more important than boll weight and mainly contributed towards heterosis in yield. These findings confirm the results obtained by Aslam & Khan (1983), Kotle & Thombre (1984), Malik *et al.*, (1988), Rehman *et al.*, (1989), Hussain *et al.*, (1990) and Patil *et al.*, (1991).

In respect of ginning outturn percent (Table 1), highly significant differences were observed between hybrids and two check cultivars. Hybrids Cyto-7/91 x CRIS-407 and Cyto-7/91 x CIM-243 were at the top and ginned 41.36% and 41.40%, respectively, as compared to NIAB-78 (35.58%) and CRIS-9 (36.21%). Statistically these hybrids were of the same order. Hybrid Stoneville-gl x CRIS-133 also significantly excelled both the standards by giving 38.47% ginning outturn. Statistically rest of the hybrids were at par with the standards one or the other way.

As regards staple length and uniformity ratio, Table 1 indicated highly significant differences between hybrids and two commercial varieties NIAB-78 and CRIS-9. Hybrid Cyto-7/91 x CIM-243 significantly ranked first by measuring 28.0 mm staple length followed by hybrid F-281 x CRIS-133 (27.0 mm). This confirms the studies

conducted by Khan *et al.*, (1984), Khan *et al.*, (1993), Hussain *et al.*, and Patil *et al.*, (1991).

Similarly hybrids Cyto-7/91 x CRIS-407 and Cyto-7/91 x CIM-243 were at the top by producing uniform fibers of 53.53% and 53.81%, respectively and statistically were of the same order. All the hybrids produced more uniform fibers than both the standards one or the other way.

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