

## BIOMETRICAL ANALYSIS OF SOME METRICAL TRAITS OF *GOSSYPIUM HIRSUTUM* L. COMBINING ABILITY

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An experiment was conducted to estimate the combining ability in 8 cultivars of *G. hirsutum* L. General combining ability (GCA) mean squares for testers were significant for boll number only, whereas GCA for lines and SCA for hybrids were highly significant for boll number and seedcotton yield. The larger proportion of variance for GCA revealed that the nature of gene action was predominantly additive for these traits. S-12 for boll number and seedcotton yield. CRIS-7A for sympodia, boll number and seed cotton yield, and CYTO-127 and CYTO-130 for seed cotton yield proved to be the best general combiners. The crosses S-12 x CYTO-127 and BH-36 x CRIS-54 manifested highly significant SCA effects for boll number and seedcotton yield per plant.

**Key words:** *Gossypium hirsutum*, Combining ability, Yield components.

### Introduction

Cotton assumes an unending importance in Pakistan's economy which necessitates genetically superior and physiologically efficient genotypes of cotton adapted to local conditions. In order to achieve these objectives, some basic studies relating to the genetic basis of characters to be improved and some information on the general and specific combining abilities of the parents involved in the crossing programme are essential before embarking upon an improvement programme. It is, therefore, imperative that thorough studies with respect to quantitative genetic analysis be carried out for some important economic characters in order to provide first hand information to cotton breeders. Various workers [1-4] have reported both additive and non-additive gene action for boll number and seedcotton yield per plant. The present study thus envisaged the analysis of some important cotton cultivars to ascertain the relative performance regarding their general and specific combining abilities.

### Materials and Methods

Eight upland cotton cultivars, namely S-12, NH-26, SL-1, CRIS-7A and BH-36 as seed parents and CRIS-54, CYTO-127 and CYTO-130 as pollen parents were used. The F<sub>1</sub>S were grown in a randomized complete block design consisting of three replications. Data were recorded on number of sympodia, boll number, boll weight and seedcotton yield per plant. Family averages were calculated and genotypic differences among the parents and their hybrids were detected, following the methods outlined by Steel and Torrie [5] Combining ability analysis was carried out by the methods developed by Kempthorne [6], to determine the combining ability effects for parents and hybrids.

### Results and Discussion

*Combining ability variances.* Variances due to GCA, testers were highly significant for seedcotton yield (Table 2) Variances due to GCA among lines were significant for boll

TABLE 1. ESTIMATES OF GENERAL AND SPECIFIC COMBINING ABILITY EFFECTS.

Parents	Bolls number	Seedcotton yield (gm).
<i>Lines</i>		
S-12	+9.20	+12.21
NH-26	-5.58	-24.42
SL-1	-8.03	-16.31
CRIS-7A	+12.31	+21.23
BH-36	-7.91	+7.09
S.E.	+3.00	+9.60
<i>Testers</i>		
CRIS-54	-3.31	-20.63
CYTO-127	+2.29	+11.67
CYTO-130	+0.95	+8.95
S.E.	+2.32d	-7.44
<i>Crosses</i>		
S-12 x CRIS-54	-1.86	-38.35
S-12 x CYTO-127	+11.93	+21.88
S-12 x CYTO-130	-10.08	+24.70
NH-26 x CRIS-54	-10.85	-12.06
NH-26 x CYTO-127	+6.38	-5.06
NH-26 x CYTO-130	+4.38	+17.13
SL-1 x CRIS-54	+2.70	-7.51
SL-1 x CYTO-127	-4.87	+12.32
SL-1 x CYTO-130	+2.17	-4.79
CRIS-7A x CRIS-54	-0.64	+21.84
CRIS-7A x CYTO-127	-2.53	-4.84
CRIS-7A x CYTO-130	+3.16	+26.68
BH-36 x CRIS-54	+10.58	+21.07
BH-36 x CYTO-127	-10.96	-24.27
BH-36 x CYTO-130	+0.38	+2.99
S.E.	±16.64	±16.64

TABLE 2. AVERAGE PERFORMANCE AND ANOVA (MEAN SQUARES) FOR GENOTYPE MEANS AND COMBINING ABILITY OF F<sub>1</sub> HYBRIDS AND THEIR PARENTS FOR VARIOUS METRICAL TRAITS.

Genotypes	Sympodia per Plant	Bolls No.	Boll weight (gm)	Seedcotton yield/plant (gm)
S-12 x CRIS-54	26.00 abc	50.00 bcde	2.93	146.16 abcde
S-12 x CYTO-127	23.00 abcd	69.93 a	2.60	180.23 ab
S-12 x CYTO-130	21.66 abcd	46.00 cdef	2.43	113.66 defghi
NH-26x CRIS-54	21.33 abcd	26.33 ij	3.06	77.36 hi
NH-26x CYTO-127	25.33 abcd	49.00 bcde	2.33	116.66 cdefgh
NH-26x CYTO-130	25.33 abcd	45.66 cdef	3.03	136.13 bcdef
SL-1 x CRIS-54	24.00 abcd	37.33 efghij	2.43	90.20 fghi
SL-1 x CYTO-127	22.66 abcd	35.33 efghij	3.93	142.33 bcde
SL-1 x CYTO-130	18.66 cd	41.00 deffgh	3.06	122.50 cdefgh
CRIS-7AxCRIS-54	25.00 abcd	54.33 bed	2.10	113.23defghi
CRIS-7AxCYTO-127	26.66 ab	58.00 ab	2.80	162.53abc
CRIS-7AxCYTO-130	23.66 abcd	62.33 ab	3.06	191.33 a
BH-36 x CRIS-54	18.00 d	45.33 defg	3.06	142.23 abcde
BH-36 x CYTO-127	19.33 bcd	29.33 ghij	3.96	28.96 cdefg
BH-36 x CYTO-130	22.33 abcd	39.33 efghi	3.86	153.50 abcd
S-12	18.33 d	31.00 fghij	3.66	113.76 defghi
NH-26	26.00 abc	27.33 ghij	3.20	87.00 fghi
SL-1	19.33 bcd	35.83 efghij	3.06	109.60 defghi
CRIS-7A	24.00 abcd	29.96 fghij	2.23	67.26 i
BH-36	21.33 bcd	22.66 j	4.00	102.11 efghi
CRIS-54	29.00 a	48.00 cde	2.26	107.20 defghi
CYTO-127	19.00 cd	42.06 efgh	3.16	133.66 bcdefg
CYTO-130	20.33 bcd	42.40 defgh	3.16	134.03 bcdefg
L.S.D. at 5%	7.43	14.85	—	47.53
Genotypes	27.94	426.96**	1.37	2836.06**
GCA (tester)	4.26	126.59	—	4816.22**
GCA (line)	37.91	887.07**	—	3389.57**
SCA	17.81	264.81**	—	2101.41*

Any two means having a common letter are not significantly different at 5% level according to DMRT. \*\* Significant at 1% level of probability. \* Significant at 5% level of probability.

number and seedcotton yield. SCA variances were highly significant for boll number and seedcotton yield. Variances due to GCA were much higher than SCA mean squares in all characters indicating that the additive gene action constituted the major portion of the genetic variation among the hybrids in this study. Present results are in agreement with the earlier findings [1-4].

*Combining ability effects number of bolls.* It has been observed that the data of the two parents i.e S-12 and CRIS-7A showed highly significant GCA effects for bolls per plant. All other parents manifested nonsignificant positive or negative GCA effects. Regarding all 15 combinations, 3 hybrids, S-12 x CYTO-127, NH-26 x CYTO-127 and BH-36 x CRIS-54, exhibited highly significant SCA, effects suggesting presence of non-additive gene effects. Present results are consistent with the findings of earlier workers [1-4].

*Seed cotton yield.* It is generally accepted among researchers that most of the superior hybrid combinations in-

volve at least one good general combiner with respect to yield per plant and that the parent which are good combiners for yield are also good combiners for at least one or more yield components. It has been reported that high estimates of SCA effects are usually recorded in hybrids which involve diverse interacting parents. It was observed that 4 parents which were good combiners for seedcotton yield were also good combiners for at least one other trait. The parent S-12 and CRIS-7A were good combiners for boll number coupled with seedcotton yield which proved the hypothesis of other workers.

It is noted from Table 1 that SCA effects were highly significant in 6 out of 15 hybrids i.e S-12 x CYTO-127 S-12 x CYTO-130, CRIS-7A x CRIS-54, CRIS-7A x CYTO-130 and BH-36 x CRIS-54. This suggest that the character was influenced by non-allelic genes. Present results agree with the findings of Khan *et al.* [1], Rahman *et al.* [2], Khan and Ghafoor [3] and Tang Bing *et al.* [4].

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