Pak. J. Bot., 27(2): 425-429, 1995.

GENETICS OF SEED COTTON YIELD AND ITS PRIMARY COMPONENTS IN *GOSSYPIUM HIRSUTUM* L.

MAZHAR DIN KEERIO, MUHAMMAD SHABAN KALWAR, MUHAMMAD ISHAQUE MEMON AND ZAHEER AHMED SOOMRO

Department of Plant Breeding & Genetics, Sindh Agriculture University, Tandojam, Sindh, Pakistan.

Abstract

Combining ability analysis was conducted for yield and its primary components in *Gossypium hirsutum* L. The results indicated that variance due to GCA and SCA were significant for all the characters except ginning percentage. The additive gene action was more important than non-additive. Highly significant GCA effects were found in lines S-12 for all traits and CRIS-7A for seed weight, lint weight and seed cotton yield and testers CYTO-127 for seed weight, lint weight and seed cotton yield and CYTO-130 for seed weight and seed cotton yield. The crosses S-12 x Cyto-127 and BH-36 x CRIS-54 for all characters except ginning percentage, while NH-26 x CYTO-130 and CRIS-7A x CYTO-130 for lint weight and seed cotton yield per plant exhibited significant SCA effects.

Introduction

For the synthesis of genetically superior cotton cultivar possessing harmonious combinations of parameters, a comprehensive information on the mechanism of genetic control of the parameters in different cross combination under a prevailing condition is a prerequisite step. Several workers like Khan *et al.*, (1990), Rahman *et al.*, (1991), Khan & Ghafoor (1991), Ayub *et al.*, (1991) and Tang Bing *et al.*, (1993), have reported additive and non-additive gene action for lint weight, ginning percentage and seed cotton yield. Considering the importance of this type of research and its lasting impact upon the future cotton breeding strategy, genetic analysis of certain parameters was therefore, carried out to evaluate different cotton varieties for their potential in different cross combinations for various quantitative traits.

Materials and Methods

The experimental material comprised of upland cotton cultivars viz., 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. The F_1 were grown in randomized complete block design consisting of 3 replications. Data on seed weight, lint yield, ginning percentage and seed cotton yield per plant were recorded. Family average in respect of each character was calculated and the genotypic difference among the parents and their hybrids were detected after Steel & Torrie (1980) and combining ability analysis was carried out by the methods developed by Kempthorne (1957) to determine the combining ability effects for parents and hybrids.

Table 1. Average performance and ANOVA (mean squares) for genotype means of F_1 hybrids and their parents for various traits.

Genotypes	Seed weight (gms)	Lint weight (gms)	Ginning percentage	Seed cotton Yield (gms)
S-12 x CRIS-54	89.16 bcdef	57.00 ab	39.08 a	146.16 abcde
S-12 x CYTO-127	111.30 ab	68.93 a	38.25 a	180.23 ab
S-12 x CYTO-130	69.36 efghi	44.30 bcdef	38.66 a	113.66 defghi
NH-26 x CRIS-54	49.10 hi	28.26 h	36.55 abcde	77.36 hi
NH-26 x CYTO-127	2.13 defghi	44.60 bcdef	38.28 a	116.66 cdefgh
NH-26 x CYTO-130	83.53 bcdefg	52.63 abcd	38.04 a	136.13 bcdef
SL-1 x CRIS-54	60.63 fghi	29.56 gh	32.61 g	90.20 fghi
SL-1 x CYTO-127	94.20 bcde	48.13 bcdef	33.95 efg	142.33 bcde
SL-1 x CYTO-130	79.70 cdefgh	45.80 bcdef	35.08 bcdefg	122.50 cdefgh
CRIS-7A x CRIS-54	71.43 defghi	41.80 cdefg	36.92 abcd	113.23 defghi
CRIS-7A x CYTO-127	107.96 abc	54.56 abc	33.76 fg	162.53 abc
CRIS-7A x CYTO-130	127.66 a	36.50 defgh	33.13 fg	191.33 a
BH-36 x CRIS-54	91.76 bcde	50.46 bcde	35.44 bcdef	142.23 bcde
BH-36 x CYTO-127	84.90 bcdefg	44.06 bcdef	33.99 efg	128.96 cdefg
BH-36 x CYTO-130	101.60 abcd	51.90 abcde	33.80 efg	153.50 abcd
S-12	74.10 defghi	39.66 cdefgh	34.82 cdefg	113.76 defghi
NH-26	54.33 ghi	32.66 fgh	37.67 ab	87.00 fghi
SL-1	71.23 defghi	38.36 cdefgh	35.31 bcdefg	109.60 defghi
CRIS-7A	44.24 i	23.06 h	37.23 abc	67.26 i
BH-36	67.26 efghi	34.90 efgh	34.29 cdefg	102.16 defghi
CRIS-54	72.13 defghi	35.06 efgh	32.71 g	107.20 defghi
CYTO-127	87.40 bcdef	46.26 bcdefg	34.60 cdefg	133.66 bcdefg
CYTO-130	87.60 bcdef	46.46 bcdefg	34.66 cdefg	134.03 bcefg
L.S.D. at 5-1/0	30.68	17.04	2.70	47.53
M.S	1218.21**	372.12**	12.69**	2836.06**
Genotypes				
GCA (male)	2180.89**	543.60**	0.87	4816.22**
GCA (female)	1588.71**	425.88**	42.81**	3389.57**
SCA	894.78*	272.24*	5.56	2101.41*
ERROR	346.03	106.75	2.69	830.80

**Significant at 1% level of probability.

*Significant at 5% level of probability.

Results and Discussion

Variances due to GCA line and tester parents were highly significant for all characters except ginning percentage, which was non-significant in case of tester parents (Table 1) whereas variance due to SCA were significant for all the traits except ginning percentage. Variances due to GCA were much higher than SCA mean squares in all characters. This indicated that the additive gene action constituted the major portion of the genetic variation to the hybrids in this study. Such similar results have been reported by Khan *et al.*, (1990), Rahman *et al.*, (1991), Khan & Ghafoor (1991), Ayub *et al.*, (1991) and Tang Bing *et al.*, (1993).

COMBINING ABILITY EFFECT

Seed Weight: Cultivar S-12, NH-26, BH-36, CYTO-127 and CYTO-130 exhibited highly significant positive GCA effects while rest of the varieties showed non-significant positive or negative GCA effects for seed weight (Table 2). Six out of 15 hybrids displayed positive SCA effects while crosses S-12 x CYTO-127 and BH-36 x CYTO-127 manifested highly significant SCA effects indicating the preponderance of non-allelic gene action.

Lint Weight: GCA effects for lint weight were positive for 3 maternal and 2 paternal varieties (Table 2). Only S-12, CRIS-7A and CYTO-127 revealed highly significant GCA values (+8.39, +4.93 and +3.71 respectively) and proved to be the good general combiners. With regard to specific combining ability the best general combiners, S-12 and CYTO-127, produced hybrid with highly significnt SCA value. Highly significant positive SCA effects were obtained also for crosses between good and poor combiners e.g., S-12 x CRIS-54. Some combinations of poor parents produced highly significant positive SCA values viz., NH-26 x CYTO-130, CRIS-7A x CYTO-130 and BH-36 x CRIS-54. The present results also confirm the findings of Tang Bing *et al.*, (1993).

Ginning percentage: GCA effects for 3 of the 8 parents i.e., S-12 and NH-26 were significant for this trait. The remaining 6 varieties were poor or negative general combiners. A few significant SCA effects were detected in this study such as SL-1 x CYTO-130 and CRIS-7A x CRIS-54 for ginning percentage. The present results also agree with the findings of Khan *et al.*, (1990), Ayub *et al.*, (1991) and Tang Bing *et al.*, (1993).

Seed cotton yield: Estimates of GCA effects were significant for 4 out of 8 parental cultivars (Table 2). It is evident that the hybrids in which CYTO-130 was used as pollen parent produced superior combinations and manifest higher value of SCA effects for the character seed cotton yield. In the present study 3 out of 8 cultivars showed significant positive GCA effects for atleast 3 economic traits while S-12 was the only parent which exhibited significant positive GCA effects for all the traits. The results of the present study are in accordance with the findings of Khan *et al.*, (1990), Rahman *et al.*, (1991) and Khan & Ghafoor (1991) and indicated bright chances for getting segregates with elite performance during selection in the later generations.

Table 2. Estimates of General and Specific combining ability effects.

Parents/Crosses		Seed weight (gms)	Lint weight (gms)	Ginning %	Seed cotton yield (gms)
GENERAL COMBINING ABILITY EFFECTS					
LINES					
S-12		+8.39	+8.39	+2.80	+12.21
NH-26		-18.05	-6.53	+1.89	-24.42
SL-1		-8.19	-7.19	-1.98	-16.13
CRIS-7A		+16.03	+4.93	-1.26	+21.23
BH-36		+6.45	+0.46	-1.45	+7.09
S.E.		±6.20	±3.44	±0.54	±9.60
TESTERS					
CRIS-54		-13.88	-6.93	+0.26	-20.63
CYTO-127		+7.80	+3.71	-0.22	+11.67
CYTO-130		+6.10	+2.27	-0.50	+8.95
S.E.		±4.80	±2.66	±0.42	±7.44
SPECIFIC COMBINING ABILITY EFFECTS					
S-12	x CRIS-54	+1.13	+7.19	+0.17	-38.35
S-12	x CYTO-127	+13.56	+8.48	-0.19	+21.88
S-12	x CYTO-130	-26.68	-15.71	+0.05	+24.70
NH-26	x CRIS-54	-5.27	-17.27	-1.46	-12.06
NH-26	x CYTO-127	-3.93	-0.93	+0.75	-5.06
NH-26	x CYTO-130	+9.18	+7.51	+0.70	+17.13
SL-1	x CRIS-54	-3.66	-4.67	-1.53	-7.51
SL-1	x CYTO-127	+8.23	+3.26	+0.29	+12.32
SL-1	x CYTO-130	-4.57	+1.37	+1.25	-4.79
CRIS-7A	x CRIS-54	-17.10	-4.55	+2.06	+21.84
CRIS-7A	x CYTO-127	-2.25	-2.43	-0.62	-4.84
CRIS-7A	x CYTO-130	-19.23	+6.95	-1.42	+26.68
BH-36	x CRIS-54	+12.79	+8.99	+0.77	+21.07
BH-36	x CYTO-127	-15.65	+12.05	-0.20	-24.27
BH-36	x CYTO-130	+2.75	+0.23	-0.56	+2.99
S.E.		±10.73	±5.96	±0.94	±16.64

References

Ayub, M., S. Rahman and M. Amin. 1991. Combining ability analysis for some quality characters in various crosses of cotton (*Gossypium hirsutum* L.). *Sarhad J. of Agric.*, 7: 707-716.

Kempthorne. O. 1957. *An introduction to genetic statistics*. New York, John Wiley and Sons, Inc., London.

Khan, I.A., M.A. Khan, F.M. Khan and M.Ahmed. 1990. Graphical analysis for gene action controlling different quantitative characters of upland cotton plant. *Pak. J. Sci. Ind.*, 33: 339-341.

Khan, M.A. and A. Ghafoor. 1991. Combining ability for yield and its components in up-land cotton. *Pak. J. Agric. Res.*, 12: 18-23.

Rahman, S., M. Ahmed, M. Ayub and M. Amin. 1991. Genetic architecture of yield components in cotton (*Gossypium hirsutum* L.). *Sarhad J. of Agric.*, 7: 113-128.

Steel, R.G.D. and J.H. Torrie. 1980. *Principles and procedures of statistics*. McGraw Hill Book Co. Inc., New York.

Tang Bing, J.N. Jenkins, J.C. McCarthy and C.E. Watson. 1993. F_2 hybrids of host-plant resistant germplasm and cotton cultivars: 1. Heterosis and combining ability for lint yield and yield components. *Crop Sci.*, 33: 700-705.

(Received for Publication 22 December 1994)