Pak. J. Agri. Sci., Vol. 30, No. 3, 1993

THE ESTIMATES OF HERITABILITY AND GENETIC ADVANCE FOR VARIOUS PLANT TRAITS IN SEGREGATING POPULATION OF *GOSSYPIUM HIRSUTUM* L. I. YIELD AND RELATED CHARACTERS

Sultan Bahadur, Iftikhar Ahmad Khan & Syed Sadaqat Mehdi
Department of Plant Breeding & Genetics,
University of Agriculture, Faisalabad

The estimates of broadsense heritability and genetic advance for number of bolls, yield of seed cotton and boll weight were made in an F_2 population developed through a 4 x 4 diallel cross in cotton. All the traits indicated high estimates for both the heritability and genetic advance.

INTRODUCTION

Yield is a complex character and is greatly susceptible to environments. Therefore, a breeder has to screen the available germplasm very carefully. Information regarding the heritability of various plant traits and genetic advance in the segregating populations help the breeder a lot while looking for a promising genotype. Thus, based on such information, identification and selection for the promising genetic material may become easier. The other workers, i.e. Singh *et al.* (1971), El-Adl *et al.* (1978), Tikka *et al.* (1980), Seth and Singh (1984) had also emphasised upon the importance of such studies in breeding cotton plant.

MATERIALS AND METHODS

The present studies pertaining to heritability estimates, genetic advance and relative expected genetic advance for yield traits in intraspecific crosses of *Gossypium hirsutum* L. were conducted at the Postgradute Agricultural Research Station (PARS), University of Agriculture, Faisalabad during the year 1990. The experimental material used in this study consisted a complete diallel set of F_2 crosses originated from crossing four cultivars of cotton viz. S-12, B-496, BJA-592 and Arkugo No. 4. The seed of the 16 genotypes was sown in the field in a triplicated randomised complete block design. The distance between the plants was kept 30 cm and between the rows was 75 cm. There were three rows of a genotype having 20 plants in a replication. At maturity, observations on individual plant were recorded for number of bolls, yield of seed cotton and boll weight.

In F_1 generation, the material was handled for genetic studies by Khan (1990) and it was assumed that the crosses had no reciprocal differences. Based on this assumption, the single crosses and reciprocals were composited for computation purposes. The variance of the parents and of the F_2 population were computed separately for each trait according to Steel and Torrie (1980). The estimates of broadsense heritability were calculated by the formula described by Mahmud and Kramer (1951):

$$h2_{BS} = \frac{VF_2 - /VP_1 \times VP_2}{VF_2} \times 100$$

where

h^2_{BS} = the heritability estimates in broadsense,
VF_2 = the variance of F_2;
VP_1 = the variance of parent 1 and 2,
and VP_2 respectively.

Genetic advance based on 10% selection intensity was calculated by using the following formula:

$$G.A. = i.\hat{6}p.h^2$$

where

G.A. = the genetic advance,
i = the selection intensity at 10% with a value of 1.755,
$\hat{6}p$ = the phenotypic standard deviation of F_2 and
h^2 = the broadsense heritability in fraction.

RESULTS AND DISCUSSION

For number of bolls, the estimates (Table 1) indicated that the cross S-12 x B-496 had maximum broadsense heritability (78.02%). The lowest value of heritability (62.78%) was observed in the cross S-12 x BJA-592. The cross combination S-12 x B-496 by virtue of its maximum heritability showed the highest genetic advance (12.94) and relative expected genetic advance (76.16%). For yield of seed cotton (Table 2), the cross combination S-12 x B-496 revealed maximum estimates of broadsense heritability (69.64%) while S-12 x BJA-592 the lowest (50.31%). The value of genetic advance ranged between 14.17 in cross S-12 x BJA-592 to 23.85 g in S-12 x B-496. The relative expected genetic advance for yield of seed cotton in F_2 crosses ranged from 32.72 (S-12 x BJA-592) to 52.51% (S-12 x B-496).

The boll weight (Table 3) revealed that the cross combination S-12 x Arkugo No. 4

Table 1. Estimates of heritability and genetic advance for number of bolls plant^{-1} in F_2 involving four parental lines of cotton

Parental line/ F2 cross	$\bar{X}$	V	C.V. (%)	h^2 (%)	G.A.	R.E.G.A. (%)
S12	21.23	23.31	22.73			
B-496	15.00	16.80	37.31			
BJA-592	15.47	21.85	30.22			
Arkugo	15.75	13.75	23.54			
S12 x B 496	16.99	89.25	55.60	78.02	12.94	76.16
S12 x BJA-592	16.30	60.63	47.80	62.78	8.58	52.66
S12 x Arkugo	17.91	72.49	47.54	75.30	11.25	62.79
B-496 x BJA-592	16.66	52.65	43.56	63.61	8.11	48.64
B-496 x Arkugo	15.10	51.55	47.55	70.52	8.89	58.85
BJA-592 x Arkugo	15.44	64.80	51.81	72.92	10.24	66.31

Table 2. Estimates of heritability and genetic advance for yield of seed cotton in F_2 crosses involving four parental lines of cotton

Parental line/ F2 cross	$\bar{X}$	V	C.V. (%)	h^2 (%)	G.A.	R.E.G.A. (%)
S12	60.63	104.23	16.84			
B-496	42.88	128.28	26.42			
BJA-592	47.98	157.30	26.14			
Arkugo	49.73	105.04	20.61			
S12 x B 496	45.42	380.87	42.95	69.64	23.85	52.51
S12 x BJA-592	43.31	257.69	37.06	50.31	14.17	32.72
S12 x Arkugo	45.57	243.26	34.23	56.99	15.60	34.24
B-496 x BJA-592	46.63	319.12	38.31	54.49	17.08	36.63
B-496 x Arkugo	40.22	256.16	39.79	54.69	15.36	38.18
BJA-592 x Arkugo	41.26	279.11	40.46	53.95	15.82	38.36

Table 3. Estimates of heritability and genetic advance for boll weight in F_2 crosses involving four parental lines of cotton

Parental line/ F2 cross	$\bar{X}$	V	C.V. (%)	h^2 (%)	G.A.	R.E.G.A. (%)
S12	2.85	0.23	18.60			
B-496	2.97	0.20	14.81			
BJA-592	3.21	0.32	17.76			
Arkugo	3.17	0.25	15.80			
B12 x B 496	2.92	0.66	26.87	68.00	0.93	31.88
B12 x BJA-592	2.92	0.70	28.67	61.00	0.90	30.80
B12 x Arkugo	2.78	0.81	32.12	73.02	1.11	39.78
B-496 x BJA-592	2.94	0.71	28.77	64.72	0.95	32.45
B-496 x Arkugo	2.90	0.75	29.86	70.37	1.06	36.62
BJA-592 x Arkugo	2.97	0.81	30.20	64.94	1.03	34.54

$\bar{X}$ = Mean, V = variance, c.v. = Coefficient of variability, h^2 = Heritability in broadsense, G.A. = Genetic advance, R.E.G.A. = Relative Expected Genetic Advance.

had maximum estimate of broadsense heritability (73.03%). The lowest value (61.0%) was obtained by cross S-12 x BJA-592. The cross combination S-12 x Arkugo No. 4, by virtue of its maximum heritability had the highest value of genetic advance and relative expected genetic advance for this character. Similar results for these traits were reported by several workers. Singh *et al.* (1971) and Tikka *et al.* (1980) reported high heritability for number of bolls. For yield of seed cotton and weight El-Adl *et al.* (1978) and Seth and Singh (1984) recorded high heritability estimates.

High heritability estimates along with high genetic advance and relative expected genetic advance for all the characters in the present studies indicated that more additive gene effects may be present in the phenotypic manifestation of these traits. This situation suggests the possibility of improving the cotton cultivars regarding these three important traits.

REFERENCES

El-Adl, A.M., Z.A. Kosba and M.A. Megahed. 1978. Diallel crosses of yield and yield components in *G. barbadense* L. Alexandria J. Agri. Res. 26: 391-396. (Plant Breed. Abst. 49: 6071; 1979).

Khan, J.A. 1990. Genetic analysis of various plant characters in cotton *(Gossypium hirsutum* L.) under different nitrogen levels. M.Sc. Thesis, Dept. Plant Breed. Genetics, Univ. Agri., Faisalabad.

Mahmud, I. and H.H. Kramer. 1951. Segregation for yield, height and maturity following soybean. Agron. J. 43: 605-609.

Seth, S. and D.P. Singh. 1984. Studies on heritability and variability for yield components in upland cotton *(G. hirsutum* L.). Haryana Agri. Univ. J. Res. 14: 313-317. (Plant Breed. Abst. 55: 4686; 1985).

Singh, R.B., M.P. Gupta and D. Pal. 1971. Genetics of certain yield characters in upland cotton in a diallel analysis. J. Genetics, 60: 241-249. (Plant Breed. Abst. 42: 3026; 1972).

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. A Biometrical Approach. 2nd Ed., McGraw Hill Book Pub. Co. Inc., NY, USA.

Tikka, S.B.S., S.N. Badaya, R.R. Patel and N.P. Mehta. 1980. Genetic parameters and association analysis in segregating populations of interspecific crosses of diploid cotton. Gujrat Agri. Res. J. 5: 1-4. (Plant Breed. Abst. 51: 7387; 1981).