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## Study Pertaining to the Estimation of Variability, Heritability and Genetic Advance in Upland Cotton

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### Abstract

Four cotton varieties viz. 1517-75, D2-L-9-68, M-4 and CIM-240 were crossed in 4 × 4 complete diallel fashion. Means, coefficients of variability, broad sense heritability and genetic advance for various cotton plant traits were calculated. All the characters showed low coefficients of variability except yield of seed cotton and number of bolls per plant. Broad-sense heritability estimates were prominent for number of bolls per plant, boll weight and yield of seed cotton thus suggestion that improvement for these traits can be made through selection.

**Key words:** Heritability, genetic advance and seed cotton yield

### Introduction

The presence of genetic variability in the segregating population is a pre-requisite for the execution of an efficient breeding programme. The researchers in the past have emphasized the importance of partitioning of genetic variance in to its components alongwith the genetic mechanisms involved in the inheritance of various plant traits in cotton. Heritability and genetic advance has been advocated as dependable tools to aid in selection by number of workers including Percival (1982), Atta *et al.* (1982), Lancon (1987), Zubair (1993), Khan *et al.* (1995) and Saeed *et al.* (1996).

The present study is also an endeavour in that direction and the information generated from it will be useful to utilize in future cotton breeding programmes.

### Materials and Methods

The present study was conducted in the experimental area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, during the year 1993. The experimental material comprised of a set of diallel crosses, in F<sub>2</sub> generation, among four cotton varieties viz., 1517-75, D2-L-9-68, M-40 and CIM-240. The seed of ten genotypes obtained from this diallel set of crosses (four parents and six crosses) was sown in the field with a distance of 30 cm within and 75 cm between the plants, in a triplicated randomized complete block design during the month of June, 1993. Each genotypes was represented by three rows having 20 plants in a replication. At maturity of the crop, the information on an individual plant basis for number of bolls per plant, boll weight (g), number of seeds per boll and yield of seed cotton (g) was obtained.

**Statistical Analysis:** Heritability estimates in broad sense were computed by the formula of Mahmud and Kramer, (1951). Coefficient of variability (C.V%) was calculated as

$$C.V\% = \frac{S.D.}{X} \times 100$$

Genetic advance (GA) was determined at 10% selection intensity (1.755) with following formula:

$$G.A. = i. Gp. h^2$$

### Results and Discussion

Means, coefficients of variability and heritability and genetic advance values for various cotton plant traits are presented in Table 1 and 2, respectively. The highest mean values for number of bolls and seed cotton yield per plant were shown by the parents D2-L-9-68 and CIM-240 while among the crosses by D2-L-9-68 × M-4. All the genotypes (parents and crosses) showed consistency in mean values for boll weight. Greatest number of seeds per boll were produced by parents 1517-75 and D2-L-9-68 and their hybrid combination 1517-75 × D2-L-9-68.

The magnitude of coefficients of variability was generally on the lower side in case of boll weight and number of seeds per boll while higher estimates of coefficient of variability were recorded for number of bolls per plant and yield of seed cotton. Broad sense heritability estimates ranged from 44.22 to 85.77 for boll weight in the six crosses. simple selection for improving boll weight was proposed by Atta *et al.* (1982) and Khan *et al.* (1995). The cross 1517-75 × D2-L-9-68 which showed highest heritability for boll weight manifested highest heritability value (62.69) for yield of seed cotton as well. However, the heritability values for rest of the crosses for the trait were lower than 50%. Low heritability for the trait was also observed Lancon (1987). The estimates of heritability for number of bolls per plant were generally above 50% except in crosses D2-L-9-68 × CIM-240 (15.19%) and CIM-240 × M-4 (43.17%). Similar findings for boll number were also observed by Zubair (1993) and Saeed *et al.* (1996). The estimates were measurably low in case of number of seeds per boll ranging between 16.26 to 40.34%. Similar results regarding heritability of number of seeds per boll were also reported by Percival (1982).

Table 1: Means and coefficients of variability for yield and its components in cotton.

Parental lines/F <sub>2</sub> crosses	Yield of seed cotton (g)		Boll weight (g)		No. of bolls plant <sup>-1</sup>		No. of seeds boll <sup>-1</sup>	
	1	2	1	2	1	2	1	2
1517-75	28.28	20.68	3.52	9.65	7.64	21.99	28.00	9.11
D2-L-9-68	29.94	20.37	3.32	6.93	8.41	23.31	28.00	8.68
CIM-240	29.60	23.31	3.66	10.38	8.43	19.93	25.13	10.54
M-4	24.97	25.19	3.28	10.06	7.65	18.56	25.45	8.92
1517-75 x D2-L-9-68	24.10	40.58	3.37	21.36	7.39	36.81	27.55	10.38
1517-75 x CIM-240	24.16	33.11	3.22	22.05	7.50	35.60	26.31	12.50
1517-75 x M-4	24.88	32.92	0.33	18.62	7.73	26.24	27.33	10.35
D2-L-9-68 x C1M-240	24.98	29.57	3.32	11.75	7.54	26.13	27.45	11.40
D2-L-9-68 x M-4	28.23	29.29	3.34	12.27	8.51	29.02	27.31	11.13
CIM-240 x M-4	26.04	26.65	3.25	17.85	7.74	26.48	26.92	9.95

Table 2: Broad sense heritability estimates and relative expected genetic advance values for yield and its components in six cotton crosses.

Genotypes	Yield of seed cotton (g)		Boll weight (g)		No. of bolls plant <sup>-1</sup>		No. of seeds boll <sup>-1</sup>	
	1	2	1	2	1	2	1	2
1517-75 x D2-L-9-68	62.69	44.65	85.77	32.05	55.53	35.86	24.29	4.43
1517-75 x CIM-240	36.93	21.44	75.18	29.19	60.45	37.76	35.57	7.79
1517-75 x M-4	45.15	26.08	71.05	23.12	53.92	27.68	27.68	5.01
D2-L-9-68 x C1M-240	22.71	11.78	44.22	9.04	15.19	6.90	34.38	6.85
D2-L-9-68 x M-4	43.90	22.56	56.37	11.98	54.34	27.61	40.34	7.87
CIM-240 x M-4	9.89	4.61	63.50	20.00	43.17	20.02	16.26	2.82
Average	36.88	21.85	66.02	20.90	47.1	25.97	29.75	5.80

1 = Mean; 2 = Coefficients of variability

Prominent relative expected genetic advance values were secured by the cross 1517-75 x D2-L-9-68 for seed cotton yield (144.65) boll weight (32.05) and number of bolls per plant (35.86). The maximum genetic advance values for number of seeds per boll were shared by the crosses 1517-75 x C1M-240 (7.79) and D2-L-9-68 x M-4 (7.87). Heritability estimates taken as an average of six crosses were 36.88, 66.02, 47.1 and 29.75 percent for yield of seed cotton, boll weight, number of bolls per plant and number of seeds per boll, respectively. As yield improvement is the main objective of any breeding programme, in this regard the progeny of the cross 1517-75 x D2-L-9-68 should be given due importance in order to select high yielding segregants as this cross showed highest heritability and genetic advance for the trait under discussion.

## References

- Atta, Y.T., H.Y. Awad and M.A. El-Gharbawy, 1982. Inheritance of some quantitative characters in a cotton cross Ashmouny X (Giza-72 X Delecero). Agric. Res. Rev., 60: 17-31.
- Khan, A.A., M.A. Khan and K. Aziz, 1995. Diallel analysis of some agronomic characters in *Gossypium hirsutum* L. J. Agric. Res., 33: 403-412.
- Lancon, J., 1987. Behaviour of sixteen agronomic traits and fiber properties in two diallel crosses involving African and American varieties of Upland cotton (*Gossypium hirsutum* L.). Cotton Fibres Tropicales, 42: 255-266.
- Mahmud, I. and H.H. Kramer, 1951. Segregation for yield, height and maturity following a soybean cross. Agron. J., 43: 605-609.
- Percival, A.E., 1982. Comparison of the gene action controlling metric characters in differing types of Upland cotton, *Gossypium hirsutum* L. Dissertation Abstract Internationals, B-43(3): 627B.
- Saeed, F., Tanveer-us-Salam and M. Akram, 1996. Gene action in interspecific hybrids of (*Gossypium hirsutum* L.) for yield parameters. J. Agric. Res., 34: 65-71.
- Zubair, M., 1993. Estimation of variance, heritability and genetic advance of some traits in cotton (*Gossypium hirsutum* L.). Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, Pakistan.