INHERITANCE OF QUANTITATIVE TRAITS IN COTTON (*G. HIRSUTUM* L.) I. YIELD AND YIELD COMPONENTS

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A 4 x 4 diallel cross experiment for genetic analysis of five yield and related characters of cotton (*G. hirsutum* L.) was conducted. Additive effects with partial dominance predominated in the phenotypic manifestation of the characters. Epistatic effects were also observed to be involved in the expression of these characters. No heterosis was observed as indicated by the non-significance of parent vs crosses mean squares for all the characters studied.

INTRODUCTION

Cotton plant (*G. hirsutum* L.) is one of the most important cash crop of Pakistan and its continuous genetic improvement is not only vital to the progress and prosperity of the country but also as a source of its political strength. Therefore, to have our cotton plant more productive per unit area and per unit of time, a comprehensive information about various genetic systems controlling its traits of economic importance is very crucial. Such endeavors have been made by the researchers who provided useful information in this respect. But to have a similar information under the Faisalabad conditions, a programme of genetic analysis of plant traits like yield and its components was undertaken in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad.

MATERIALS AND METHODS

Four varieties of cotton (NIAB-78, AU 59, Genetic cotton and Coker 201) were crossed in a diallel fashion to obtain twelve F_1 crosses including reciprocals. The F_1 crosses and their parents were sown during 1987-88 in a randomized complete block design with four replications at Postgraduate Agricultural Research Station (PARS), University of Agriculture, Faisalabad. Each genotype comprised of ten plants in a row spaced 30 cm apart, keeping 75 cm distance from row to row.

Yield related characters, i.e. number of bolls per plant, boll weight, ginning outturn percentage and seed index were analysed statistically (Steel and Torrie, 1980). Information regarding the gene action expressed as the phenotypic manifestation of the characters was then studied following Hayman (1954), Jinks (1954) and Khan (1963).

RESULTS AND DISCUSSION

Analysis of variance (Table 1) showed that the genotypes differed significantly for number of bolls, yield per plant, ginning outturn percentage, boll weight and seed index. No heterosis was observed as indicated by the non-significance of parent vs crosses mean squares for all the characters studied.

Variance (Vr) vs covariance (Wr) graphs are shown in Figure 1 to V.

Table 1. Mean squares from the analysis of variance for yield and yield components in 4 x 4 diallel cross of *G. hirsutum* L.

S.O.V.	d.f.	Number of bolls	Boll weight (g)	Yield/ plant (g)	G.O.T. (%)	Seed index (g)
Replications	3	62.30	0.08	614.53	0.60	0.44
Genotypes	15	154.22**	0.34*	892.45**	1.84**	0.96*
Parents (p)	3	159.38**	0.32*	1150.45**	3.58*	0.92*
Crosses (C)	11	51.66**	0.57**	707.73*	2.84**	0.97*
Pvs C	1	36.60	2.50	2150.43	8.27	0.97
Error	45	25.94	0.15	243.17	0.58	0.39
Rep x Parents	9	13.78	0.05	101.28	0.58	0.18
Rep x Crosses	33	31.28	0.14	292.56	0.44	0.43
Rep x Pvs C	3	11.22	1.94	376.83	6.38	1.68

*, ** = Significant at 0.05 and 0.01 probability levels, respectively.

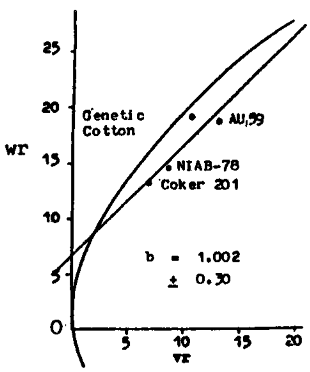

Fig. 1. Number of bolls.

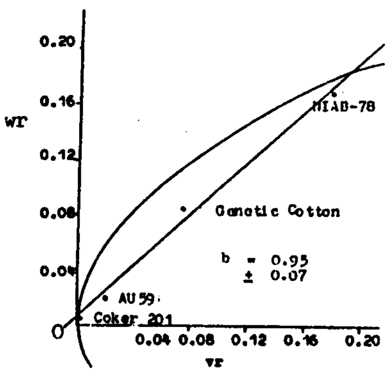

Fig. 2. Boll weight.

A reference to Figure 1 for number of bolls per plant showed that the regression line cut the Wr-axis above the origin signifying additive type of gene action with partial dominance. As the line deviated significantly from a unit slope, some non-allelic interaction appeared affecting the phenotypic manifestation of this trait. From the position of the array points on the regression line "Coker-201" being nearer to the origin occupied the dominant genes, while AU 59 being away

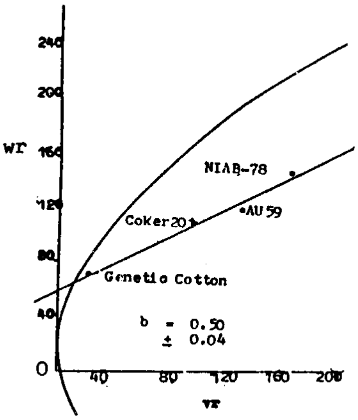

Fig. 3. Yield of seed cotton.

had the recessive ones. These findings substantiated the results reported by Khan *et al.* (1983) and Kassem *et al.* (1986) who also reported additive with partial dominance type of gene action with non-allelic interaction.

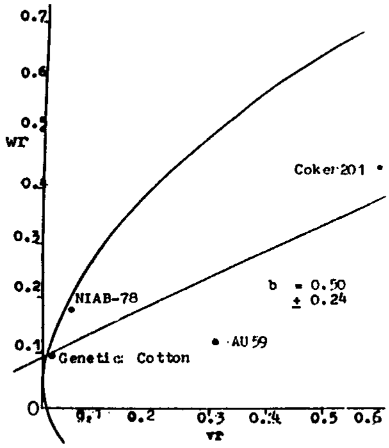

Fig. 4. Ginning outturn (%).

For boll weight the Vr/Wr relationship (Fig. 2) showed that the regression line cuts the covariance axis just above the origin showing thereby additive type of gene action with partial dominance. As the line deviated significantly from a unit slope some non-allelic interaction appeared affecting the phenotypic manifestation of this character. From the position of the array points on the regression line, it is evident that "Coker-201" seemed to possess most of the dominant genes and NIAB 78 most of the recessives being the closest and the farthest from the origin, respectively. These results are in line with those of Mirza and Khan (1984) and Kassem *et al.* (1986) who concluded that this character was governed by additive with partial dominance type of gene action with some non-allelic interaction.

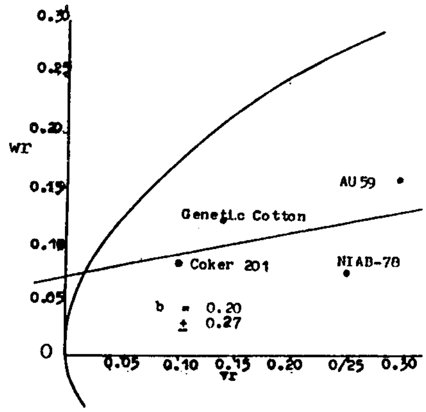

Fig. 5. Seed index.

An observation of Figure 3 indicated additive type of gene action with partial dominance involved in the inheritance pattern of yield of seed cotton. Again the regression line deviated significantly from a unit slope showing involvement of interaction of genes in this respect. From the position of array points the variety "Genetic Cotton" by virtue of being nearer to the origin possessed the dominant genes while NIAB 78 being away from the origin had the recessive ones. These results are in accordance with the findings of Gaziyant and Zhalilov (1983) and Green and Clup (1990) who observed that yield of seed cotton was controlled by additive with partial dominance type of gene action and also involvement of interaction of genes in this respect.

Ginning outturn percentage (Fig. 4) was again the result of additive type of gene action with partial dominance and complicated by some epistatic effects. Similarly, "Genetic Cotton" maintained its dominant position as in case of yield of seed cotton but the recessive genes for this character was secured by Coker-201. The findings of this study are supported by Mirza and Khan (1984) and Virk *et al.* (1984) who reported additive type of gene action with partial dominance and complicated by some epistatic effects for this character.

It was evident from Figure 5 for seed index, that the regression line cuts the covariance axis above the origin, so there appeared additive type of gene action with partial dominance along with interaction of genes as the regression line deviated significantly from a unit slope. The dominance relationship of the varieties revealed that "Coker-201" being nearer to the origin possessed the dominant position while AU 59 had recessive genes being at a distal position in this respect. These results are in agreement with those of Mirza and Khan (1984) and Singh *et al.* (1985) who showed that seed index was governed by additive with partial dominance type of gene action with interaction of genes.

Predominance of additive type of gene action with partial dominance involved in the phenotypic manifestation of all the characters in these studies gives the possibility of their improvement through simple selection procedures but the involvement of non-allelic interaction impair the predictability of performance. The present results are therefore not so dependable for the improvement of these characters as could be if they were controlled by simple additive gene action.

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