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Genetic Parameters and Association Analysis in Segregating Populations of Inter-specific Crosses of Diploid Cotton

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ABSTRACT

Genetic parameters and interrelationships among seed cotton yield and its contributing characters in twenty-four F_2 populations of *herbaceum* x *arboreum* crosses were estimated. Out of eight characters studied; bolls/plant, plant height and first fruiting node possessed high genetic coefficient of variation, heritability as well as genetic advance, indicating that phenotypic selection would be effective for these characters. Seed cotton yield was found to be positively and significantly correlated with bolls/plant, plant height and first fruiting node. Partitioning of the correlations into their direct and indirect effects through path coefficient analysis confirmed the importance of bolls/plant in selection programmes.

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INTRODUCTION

Genetic variability present in the population is a prerequisite for any breeding programme. Also the extent to which the desirable characters are heritable and the extent of expected genetic gain through selection should be known in order to formulate rational breeding programme. Furthermore, a proper understanding of the relationship between yield and yield components is necessary in bringing improvement in yield. When more variables are included in the correlation studies, the indirect association becomes complex. Under such situations, the path coefficient analysis technique developed by Wright (1921) provides an effective method of partitioning the direct and indirect causes of association.

Reports on such type of studies are available for segregating population as well as advance progenies of upland cotton (Balakotaih, 1973; Rana and Singh, 1974), however, no such information is available for segregating populations of *herbaceum*×*arboreum* crosses. The present study was, therefore, undertaken to estimate the genetic parameters of seed cotton yield and component characters, correlations between seed cotton yield and other quantitative characters and to find out the direct and indirect contribution of yield components towards seed cotton yield.

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MATERIALS AND METHODS

The material for the present study comprised 24 F_2 populations developed from single crosses of Digvijai, Sujai and Wagotar as *herbaceum* varieties and G-27, 231-Rosea, Chandrolla and HLS-2 as *arboreum* varieties. These populations were grown in two replications in a randomised block design at the Regional Cotton Research Station, Maktampur (Broach) during *kharif* 1976-77. Each plot consisted of two rows 15 m long. The rows were spaced at a distance of 90 cms with plant to plant distance of 60 cms. Detailed observations were recorded on 15 randomly selected plants from each repeat for eight characters viz. bolls/plant, plant height, first fruiting node, mean halo length, ginning percentage, seed index, lint index and seed cotton yield/plant.

The data were analysed for each character by analysis of variance method. The genetic coefficient of variation, heritability estimates and expected genetic advance in per cent of mean were worked out by standard statsitical procedures. Correlation coefficients were worked out according to Snedecor (1955). The path coefficients were calculated by the method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The analysis of variance reveal that the populations chosen for the present study were significantly different from one another in respect of different plant characters under study. The parameters of variability, heritability and genetic advance are given in Table 1. A high magnitude of genetic coefficient of variation in some of the plant characters viz. first fruiting node, plant height and bolls/plant indicated the presence of high genetic diversity among populations in respect of these characters. Excepting seed cotton yield (35.4 per cent), the remaining characters had reasonably high heritability values. The genetic advance expressed in per cent of mean ranged from 6.50 per cent for ginning percentage to 43.62 per cent for plant height. From these results, it implies that phenotypic selection would be effective for three characters viz. bolls/plant, plant height and first fruiting node.

The association of seed cotton yield with other characters and among the characters themselves was estimated. Seed cotton yield/plant was significantly and positively correlated with three characters viz. bolls/plant (+0.7346), plant height (+0.4618) and first fruiting node (+0.4063). Bolls/plant also had significant positive association with plant height (+0.5015). The mean halo length showed significant positive association with seed index (+0.5604). It thus appears that seed cotton yield can be improved favourably by selecting for any of these three characters.

The data given in Table 2 reveal high positive correlation of bolls/plant with yield primarily due to its own direct effect, the indirect effects being negligible through plant height and first fruiting node. Plant height which was significantly and positively correlated with seed cotton yield possessed a little direct effect. Its indirect effect through bolls/plant was of moderate magnitude and mainly contributed towards its positive correlation. Similarly, for first fruiting node, the indirect effect through bolls/plant was also moderate in addition to its own direct effect. It is important to note that simple correlation coefficient and path coefficient analysis reflect a different picture of association between yield and yield components. These differences are obviously due to the fact that correlations simply measure the mutual association without regard to causation, while the path coefficient analysis specifies the causes and measure their relative contributions.

An overall examination of the results presented above indicate that it would be rewarding to lay more stress on bolls/plant and first fruiting node while making selection for the improvement of seed cotton yield in segregating populations of *herbaceum* × *arboreum* crosses.

TABLE 1

Range, mean, genetic coefficient of variation, heritability and genetic advance for different characters in *herbaceum* x *arboreum* crosses.

Character	*Range*	*Mean* ± *S.E.*	*G.C.V.*	*H%*	*Genetic advance(%)*
Bolls/plant (No.)	28.50 – 64.10	42.37 ± 5.39	26.92	69.09	38.31
Plant height (cm)	95.56 – 131.50	108.40 ± 4.91	22.84	92.70	43.62
First fruiting node (No.)	2.10 – 5.10	2.86 ± 0.19	22.03	84.74	38.46
Mean halo length (mm)	17.54 – 24.08	19.69 ± 0.35	7.82	90.47	14.57
Ginning percentage	32.20 – 41.65	36.66 ± 1.28	5.60	56.36	6.50
Seed index	5.62 – 7.53	6.46 ± 0.19	6.60	71.70	9.75
Lint index	2.95 – 5.10	3.76 ± 0.53	13.41	85.39	23.59
Seed cotton yield/plant(g)	85.50 – 198.50	117.19 ± 18.92	16.90	35.40	12.32

TABLE 2

Direct and indirect effect of yield components *herbaceum* x *arboreum* crosses.

characters	*Path coefficients*
Bolls/plant vs. yield	
Direct effect of bolls/plant	+0.6331
Indirect effect via plant height	+0.0490
Indirect effect via fruiting node	+0.0525
Total (r)	+0.7346
Plant height vs. yield	
Direct effect of plant height	+0.0977
Indirect effect via bolls/plant	+0.3175
Indirect effect via fruiting node	+0.0466
Total (r)	+0.4618
Fruiting node vs. yield	
Direct effect of fruiting node	+0.2622
Indirect effect via bolls/plant	+0.1267
Indirect effect via plant/height	+0.0174
Total (r)	+0.4063

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