

Correlation and path coefficient analysis for yield and fibre quality traits in upland cotton (*Gossypium hirsutum* L)

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ABSTRACT : Sixty eight diverse genotypes of American cotton *Gossypium hirsutum* L. were evaluated for 13 qualitative and quantitative traits. The correlation study revealed that seed cotton yield was found to be positively and significantly correlated with traits like bolls/plant, plant height, seed index, boll weight, lint index, 2.5 per cent span length, monopodial branches and bundle strength, whereas it had negative association with ginning outturn and uniformity ratio. Path analysis revealed that bolls/plant, 2.5 per cent span length, uniformity ratio, lint index and seed index showed positive direct effect on seed cotton yield which suggested that selection for these traits would be quite effective to improve the seed cotton yield in upland cotton.

Keywords: Correlation, fibre quality, *Gossypium hirsutum*, path coefficient analysis, yield

Cotton is an important commercial crop of the country. It plays a key role in the national economy in terms of contribution in trade, industrial activities, employment and foreign exchange earnings in India (Gite *et al.*, 2006). It is an important natural fibre crop of global importance and widely referred as 'King of Fibre Crops'. Globally, India ranks first in cotton area but occupies second position in production, next to China. Lower productivity in India is mainly due to cultivation of more than 75 per cent of cotton under rainfed conditions besides non adoption of quality seeds, nutrient management and plant protection measures. Yield is a complex trait, polygenic in inheritance, more prone to environmental fluctuations than other characters. Understanding the association between yield and its components is of paramount importance for making the best use of these relationships in selection whereas, knowledge about the direct contribution of different characters to seed cotton yield would be highly important for formulating a selection programme. The present investigation was carried out to obtain the information on correlations and direct and indirect effects of different attributes on seed cotton yield for utilization in the improvement of crop.

Sixty eight diverse genotypes of American cotton were grown at Research Area of Cotton Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar during *kharif*,

2011-2012 in randomized block design with three replications having row length 4.2 m with row to row 67.5 cm and plant to plant 30 cm. The observations were recorded on 5 competitive plants for 13 characters, *viz* days to first flowering, plant height (cm), monopods/plant, bolls/plant, boll weight (g), seed index (g), lint index (g), ginning outturn (%), 2.5 per cent span length (mm), fibre fineness (micronaire value), bundle strength (g/tex), uniformity ratio (%) and seed cotton yield/plant (g). The lint quality parameters were studied in Central Institute for Research on Cotton Technology (CIRCOT), Regional Research Station, Sirsa. The analysis of correlation coefficient and path analysis were carried out.

The correlation coefficient provided a reliable measure of association among the characters and help to differentiate vital associates useful in breeding from those of the non vital ones. In the present study, the genotypic correlation coefficients were higher in magnitude than their respective corresponding phenotypic correlation coefficients for most of the characters indicating the depression of phenotypic expression by the environmental influence. The genotypic correlation coefficient between seed cotton yield with 13 biometric characters such as yield and fibre quality components presented in Table 1. Seed cotton yield/plant was found to be positively and significantly correlated with boll/plants, plant

Table 1. Genotypic correlation coefficients between seed cotton yield with yield components and fibre quality traits

Characters	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂	X ₁₃
X ₁	1	0.115	0.437**	0.104	-0.436**	0.116	0.180**	-0.027	-0.060	-0.038	-0.068	-0.037	-0.073
X ₂		1	0.052	0.547**	0.237**	-0.194**	0.357**	-0.000	0.211**	-0.136	0.219**	-0.097	0.502**
X ₃			1	0.347**	-0.303**	0.296**	0.105	0.188**	0.043	-0.071	0.079	-0.134	0.174*
X ₄				1	-0.153*	-0.506**	-0.151*	-0.225**	0.120	-0.231**	0.181**	-0.114	0.805**
X ₅					1	0.237**	0.708**	0.230**	0.328**	-0.458**	-0.006	-0.182**	0.267**
X ₆						1	0.899**	-0.847**	0.953**	-0.737**	0.496**	-0.370**	0.399**
X ₇							1	0.735**	0.145*	-0.308**	-0.003	-0.113	0.268**
X ₈								1	-0.686**	0.413**	-0.704**	0.681**	-0.248**
X ₉									1	-0.369**	0.840**	-0.778**	0.221**
X ₁₀										1	-0.244**	0.466**	-0.304**
X ₁₁											1	-0.495**	0.164*
X ₁₂												1	-0.224**
X ₁₃													1

* Significant at 5% level, ** Significant at 1% level

Table 2. Path coefficients of seed cotton yield with yield components and fibre quality traits

Characters	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂
X ₁	-0.374	-0.010	-0.092	0.116	0.199	0.023	0.088	0.000	-0.054	0.002	0.045	-0.019
X ₂		-0.087	-0.011	0.614	-0.108	-0.038	0.175	0.000	0.189	0.007	-0.145	-0.050
X ₃			-0.211	0.389	0.138	0.060	0.051	-0.006	0.038	0.004	-0.052	-0.069
X ₄				1.122	0.070	-0.101	-0.074	0.007	0.107	0.072	-0.120	-0.060
X ₅					-0.458	0.428	0.839	-0.007	0.295	0.025	0.003	-0.094
X ₆						0.201	1.917	0.062	0.856	0.040	-0.329	-0.713
X ₇							0.492	-0.024	0.130	0.017	0.001	-0.059
X ₈								-0.034	-0.6173	-0.0227	0.468	0.354
X ₉									0.899	0.0203	-0.558	-0.404
X ₁₀										-0.055	0.162	0.242
X ₁₁											-0.665	-0.257
X ₁₂												0.520

Residual effect = 0.1289**Bold figures in Diagonals indicate direct effect on seed cotton yield**X₁ - Days to first flowering, X₂ - Plant height(cm), X₃ - Monopods/plant, X₄ - Bolls/plant, X₅ - Boll weight (g), X₆ - Seed index (g),X₇ - Lint index (g), X₈ - Ginning outturn (%),X₉ - 2.5 per cent span length (mm), X₁₀ - Fibre fineness (micronaire value),X₁₁ - Bundle strength (g/tex), X₁₂ - Uniformity ratio (%), X₁₃ - Yield of seed cotton/plant (g)

height, seed index, lint index, boll weight, 2.5 per cent span length, monopods/plants and bundle strength. Such positive association of seed cotton yield/plant with these traits was also observed by Yadav *et al.*, (2000). However seed cotton yield was negatively and significantly correlated with ginning outturn and uniformity ratio.

The estimates of correlation coefficient mostly indicated inter relationship of different characters but it did not furnish information on cause and effect. Under such situation path analysis helped the breeder to identify the index of selection. Path coefficient analysis was done in order to study the direct and indirect effects of individual component characters on the dependent variable *i.e.* seed cotton yield/plant. Study of path coefficients enable breeders to concentrate on the variable which shows high direct effect on seed cotton yield. The genotypic correlation coefficients of seed cotton yield with other yield and fibre quality traits was further partitioned into direct and indirect effects and the results were presented in Table 2.

The component of residual effect of path analysis in yield and fibre quality traits was 0.128. The lower residual effect indicated that the characters chosen for path analysis were adequate and appropriate. Bolls/plant showed the highest positive direct effect on seed cotton yield/plant (Table 3) followed by with 2.5 per cent span length, uniformity ratio, lint index and seed index. These traits also showed positive and significant correlation with seed cotton yield/plant except uniformity ratio. Therefore, considering these traits as selection criteria will be advantageous in bringing improvement in American cotton. These results are in conformity with the findings of Sakthi *et al.*, (2007). On the other hand bundle strength, boll weight, days to

first flowering, plant height, monopods/plant, bolls/plant and fibre fineness had negative direct effect on seed cotton yield/plant. Out of these fibre fineness had also been negatively correlated with seed cotton yield/plant. The high indirect positive effect on seed cotton yield/plant was notified in seed index through lint index (1.917) and 2.5 per cent span length (0.8668) followed by days to 50% flowering with bolls/plant (0.1164) and boll weight (0.1992), plant height with bolls/plant (0.6139), monopods/plant with bolls/plant (0.3891), boll weight with seed index (0.4286) and lint index (0.8396), ginning outturn with bundle strength (0.4680) and uniformity ratio and finally fibre fineness with uniformity ratio (0.2424). Thus, the material studied is of diverse nature and information emanated would help in designing the selection methodology which can further be used in the breeding programme for improvement of seed yield.

REFERENCE

- Gite, V.K., Misal, M. B. and Kalpande, H.V. 2006.** Correlation and path analysis in cotton (*Gossypium hirsutum*.L). *J. Cotton Res. Dev.* **20** : 51-54.
- Sakthi, A.R., Kumar, M. and Ravikesavan, R. 2007.** Variability and association analysis using morphological and quality traits in cotton (*Gossypium hirsutum* L.). *J. Cotton Res. Dev.*, **21**: 148-52.
- Yadav, O. P., Lather, B. P. S. and Dahiya, B. N. 2000.** Studies on variability, correlation and path analysis in *desi* cotton (*Gossypium arboretum* .L). *J. Cotton Res. Dev.* **14**: 143-46.

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