



Research Article

Association and Path analysis for seed cotton yield improvement in interspecific crosses of Cotton (*Gossypium* spp)

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Abstract :

Correlation studies made with parents, F_1 's of 15 (lines) \times 4 (testers) and one check hybrid (TCHB 213) in interspecific crosses of cotton (*Gossypium* spp) revealed that plant height, number of sympodial branches per plant, number of bolls per plant along with 2.5 per cent span length, bundle strength and elongation percentage showed significant positive association with seed cotton yield per plant at genotypic level indicating that these characters can be improve simultaneously. The direct and indirect effect of path analysis revealed that the number of bolls per plant, boll weight, number of sympodial branches per plant, plant height, 2.5 per cent span length, bundle strength, elongation percentage, lint index and seed index are the major yield contributing traits in interspecific crosses and should be considered for improving yield under wide hybridization in cotton. The correlation and path co-efficient analysis revealed that simultaneous selection based on plant height, number of bolls per plant, number of sympodial branches per plant, 2.5 per cent span length, bundle strength and elongation percentage may be promising in improving the seed cotton yield per plant.

Key words:

cotton, association analysis, seed cotton yield.

Introduction

Cotton is an important commercial crop providing lint as a raw material to the textile industry. It is an important natural fibre crop of global importance and widely referred as 'King of fibre crops'. The hybrid cotton occupies about 45 per cent of the total area and contributes about 55 per cent to the total production (Dongre and Parkhi, 2005). 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.

In order to enhance the yield potential of cotton varieties, an understanding of the relationship among different plant character is of more importance, besides, 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.

Materials and methods

The materials for present investigation consisted of 80 genotypes, i.e, 15 lines, four testers, 60 hybrids and one check hybrid (TCHB 213). Experiment was evaluated in randomized block design (RBD) replicated thrice during winter 2008-09 at Department of Cotton, Tamil Nadu Agricultural University, Coimbatore. The experimental materials were raised in two rows of 6 m length with the spacing of 120 \times 60 cm. Recommended agronomic practices and need based plant protection measures were followed under irrigated condition to obtain good crop stand. Observations were recorded on days to 50 per cent flowering (DFF), plant height (cm) (PH), number of sympodial branches per plant (NSy), number of bolls per plant (NB), boll weight (g) (BW), number of seeds per boll (NSB), ginning percentage (%) (GP), lint index (LI), seed index (SI), 2.5 per cent span length (mm) (SL), bundle strength (g/tex) (BS), fibre fineness (micronaire) (FF), uniformity ratio (UR) and elongation percentage (%) (EP). Datas were recorded on five randomly selected plants of each genotype in each replication. On the mean basis, the character association was carried out by method suggested by Fisher and Yates (1963) and path analysis according to method suggested by Deway and Lu (1959).

Results and discussion

The correlation co-efficients provide a reliable measure of association among the characters and help to differentiate vital associates useful in breeding from those of the non vital ones (Falconer, 1981). The genotypic correlation co-efficient between seed cotton yield with fourteen biometric characters such as yield and fibre quality components and also among the traits themselves for parents, hybrids and one check hybrid were worked out and presented in Table 1.

In the present study, seed cotton yield was significant and positively correlated with seven traits namely number of bolls per plant (0.938) followed by number of sympodial branches per plant (0.893), plant height (0.689), 2.5 per cent span length (0.531), bundle strength (0.507), seed index (0.368) and elongation percentage (0.337). Following these characters, lint index and boll weight recorded positive correlation with yield. Hence, selection for these characters will help in selecting genotypes with high seed cotton yield per plant. Similar results for positive correlation between yield and fibre quality related traits were already reported by Basbag and Gencer (2007), Aguado *et al.* (2008), Do-Thi-Haan *et al.* (2008), Kalpande *et al.* (2008) and Reddy and Reddy (2008). The fibre quality traits exhibited positive intercorrelation among themselves with some of them showing significance. This is in conformity with the findings of Dutt *et al.* (2004) and Basbag and Gencer (2007). Fibre quality traits like 2.5 per cent span length, fibre fineness and elongation percentage had positively significant inter correlation with plant height, number of sympodial branches per plant and number of bolls per plant. This is in line with the findings of Altaher and Singh (2003), Sakthi *et al.* (2007) and Do-Thi-Haan *et al.* (2008).

Hence for undertaking a selection programme in interspecific cross combinations, selection based on important yield contributing traits *viz.*, plant height, number of sympodial branches per plant, number of bolls per plant along with 2.5 per cent span length, bundle strength and elongation percentage will bring about breakthrough in cotton yields under wide hybridization.

Path co-efficients are the subdivision of genotypic correlation co-efficients of individual characters with seed cotton yield. Path co-efficient analysis is done in order to study the direct and indirect effects of individual component characters on the dependent variable, seed cotton yield per plant. Study of path co-efficients enable breeders to concentrate on the variable which shows high direct effect on seed cotton yield. Ultimately we can reduce the time in

looking for more number of component traits by restricting selection to one or few important traits (Dewey and Lu, 1959). The genotypic correlation co-efficients of seed cotton yield with other yield and fibre quality traits was further partitioned into direct and indirect effects and the results are presented in Table 2.

The component of residual effect of path analysis in yield and fibre quality traits was 0.069. The lower residual effect indicated that the characters chosen for path analysis were adequate and appropriate. From this study, very high positive direct effect was observed for number of bolls per plant (1.030) and high positive effect for boll weight (0.411). The remaining characters namely 2.5 per cent span length (0.065), number of sympodial branches per plant (0.055), ginning percentage (0.040), seed index (0.029), fibre fineness (0.025), uniformity ratio (0.024), days to 50 per cent flowering (0.005) and elongation percentage (0.002) recorded positive effect on seed cotton yield per plant. This is in accordance with the findings of Sakthi *et al.* (2007) and Do-Thi-Haan *et al.* (2008) for number of bolls per plant and boll weight; Ahuja *et al.* (2008) for 2.5 per cent span length, Samba Murthy and Chamundeswari (2006) for ginning percentage, seed index, fibre fineness and uniformity ratio and Ahuja and Dhayal (2007) for number of sympodial branches per plant. The high indirect positive effect on seed cotton yield per plant was noticed by plant height, number of sympodial branches per plant, 2.5 per cent span length, bundle strength, elongation percentage through number of bolls per plant followed by lint index and seed index *via* boll weight.

Hence, the direct and indirect effect of number of bolls per plant, boll weight, number of sympodial branches per plant, plant height, 2.5 per cent span length, bundle strength, elongation percentage, lint index and seed index are the major yield contributing traits under interspecific crosses and should be considered for improving yield under wide hybridization in cotton.

The conclusion of correlation and path co-efficient analysis revealed that simultaneous selection based on plant height, number of bolls per plant, number of sympodial branches per plant, 2.5 per cent span length, bundle strength and elongation percentage may be promising to breakthrough in seed cotton yield per plant under interspecific hybridization.

References

- Aguado, A., B.D.L. Santos, C. Blanco and F. Romero. 2008. Study of gene effects for cotton yield and



- Verticillium* wilt tolerance in cotton plant (*Gossypium hirsutum* L.). Field Crops Res., 107: 78–86.
- Ahuja, S.L. and L.S. Dhayal. 2007. Comparative characteristics and gene action in three petal-spotted mutants of *Gossypium hirsutum*. J. Genet., 86.
- Ahuja, S.L., L.S. Dhayal and R. Prakash. 2008. Comparative yield component analysis in *Gossypium hirsutum* parents using fibre quality grouping. Euphytica, 161: 391–399.
- Altaher, A.F. and R.P. Singh. 2003. Yield components analysis in upland cotton (*Gossypium hirsutum* L.). J. Indian Soc. Cotton Improv., 28: 151–157.
- Basbag, S. and O. Gencer. 2007. Investigation of some yield and fibre quality characteristics of interspecific hybrid (*Gossypium hirsutum* L. × *G. barbadense* L.) cotton varieties. Hereditas, 144: 33–42.
- Dewey, D.R. and K.H. Lu. 1959. A correlation and path co-efficient analysis of components of crested wheat grass seed production. Agron. J., 51: 515–518.
- Dongre, A. and V. Parkhi. 2005. Identification of cotton hybrid through the combination of PCR based RAPD, ISSR and microsatellite markers. J. Plant Biochem. Biotechnol., 14: 53–55.
- Do-Thi-Haan, R. Ravikesavan and K. Iyanar. 2008. Genetic advance and heritability as a selection index for improvement of yield and quality in cotton. J. Cotton Res. Dev., 22: 14–18.
- Dutt, Y., X.D. Wang, Y.G. Zhu and Y.Y. Li. 2004. Breeding for high yield and fibre quality in coloured cotton. Plant Breed., 123: 145–151.
- Falconer, D.S. 1981. Introduction to quantitative genetics. Second edition. Longman, New York.
- Fisher, R.A. and F. Yates. 1963. Statistical tables for biological agricultural and medical research. Oliver and Boyd, London. pp46–63.
- Kalpande, H.V., S.D. Bhale, U.V. Kale, J.D. Deshmukh, V.K. Gite and S.S. Kakde. 2008. Genetic variability and correlation studies in F₃ generation of cotton (*Gossypium hirsutum* L.). Intl. J. Plant Sci., 3: 94–97.
- Reddy, Y.R. and C.V.C.M. Reddy. 2008. Association and path analysis in inter and intraspecific hybrids of cotton. Plant Archives, 8: 355-357.
- Sakthi, A.R., M. Kumar and R. Ravikesavan. 2007. Variability and association analysis using morphological and quality traits in cotton (*Gossypium hirsutum* L.). J. Cotton Res. Dev., 21: 148–152.
- Samba Murthy, J.S.V. and N. Chamundeswari. 2006. Yield component analysis in introgressed lines of upland cotton (*Gossypium hirsutum* L.). J. Cotton Res. Dev., 20: 1–4.

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

Characters	DFE	PH	NSy	NB	BW	NSB	GP	LI	SI	SL	BS	FF	UR	EP	Correlation coefficient
DFE	0.005	0.005	-0.027	-0.553	0.114	-0.029	0.016	-0.025	-0.002	-0.018	0.018	0.008	0.008	-	-0.479
PH	-0.001	-0.021	0.045	0.609	0.066	0.029	-0.020	-0.015	0.016	0.028	-0.034	-0.011	-0.005	0.0009	0.689
NSy	-0.002	-0.017	0.055	0.893	-0.029	0.026	-0.019	0.001	0.009	0.028	-0.036	-0.011	-0.007	0.0009	0.893
NB	-0.003	-0.012	0.048	1.030	-0.126	0.032	-0.020	0.018	0.005	0.031	-0.040	-0.013	-0.012	0.0006	0.938
BW	0.001	-0.003	-0.004	-0.316	0.411	-0.028	0.004	-0.060	0.015	0.002	0.004	0.003	0.005	-	0.033
NSB	0.002	0.008	-0.019	-0.427	0.148	-0.078	0.028	-0.004	-0.017	-0.043	0.059	0.014	0.013	-	-0.317
GP	0.002	0.010	-0.025	-0.518	0.043	-0.054	0.040	-0.027	-0.019	-0.054	0.066	0.020	0.014	-	-0.501
LI	0.001	-0.004	-0.001	-0.211	0.285	-0.003	0.012	-0.087	0.016	-0.001	0.005	0.005	0.003	0.0002	0.022
SI	-0.001	-0.011	0.017	0.187	0.203	0.045	-0.025	-0.049	0.029	0.045	-0.051	-0.012	-0.008	0.0002	0.368
SL	-0.001	-0.009	0.024	0.513	0.012	0.054	-0.035	0.002	0.021	0.062	-0.073	-0.021	-0.018	-	0.531
BS	-0.001	-0.009	0.024	0.516	-0.018	0.058	-0.033	0.006	0.019	0.057	-0.080	-0.018	-0.014	0.0001	0.507
FF	0.002	0.009	-0.024	-0.541	0.051	-0.042	0.032	-0.019	-0.015	-0.051	0.058	0.025	0.016	0.0001	-0.498
UR	0.002	0.004	-0.016	-0.516	0.082	-0.041	0.024	-0.011	-0.010	-0.047	0.047	0.017	0.024	0.0005	-0.442
EP	-0.001	-0.010	0.027	0.326	-0.007	0.011	-0.001	-0.011	0.003	-0.006	-0.003	0.001	0.007	0.0018	0.337

Residual effect = 0.069

Bold figures in Diagonals indicate direct effect on seed cotton yield