The Andhra Agric. J 57(2):173-176, 2010

Character Association and Path Coefficient Analyses for Yield and Component Traits in Upland Cotton (*Gossypium hirsutum* L.)

K Venkateswarlu, V Chenga Reddy, J S V Samba Murthy, V Srinivasa Rao, C Panduranga Rao, K V SivaReddy and J Sateesh Babu
Department of Genetics and Plant Breeding, Agricultural College, Bapatla 522101, Andhra Pradesh

ABSTRACT

Correlation and path coefficient analyses were carried out with 50 genotypes of cotton obtained from different cotton research centres across the country for yield and yield component traits. The character association studies revealed that seed cotton yield plant^{-1} had positive significant correlation with plant height, number of sympodia plant^{-1}, number of bolls plant^{-1}, boll weight, micronaire, oil content and lint yield plant^{-1}. Path coefficient analysis revealed that lint yield per plant exerted strong direct positive effect on seed cotton yield plant^{-1}.

Key words : Character Association, Path Analysis, Upland Cotton

Seed cotton yield is a complex and polygenically controlled character and highly influenced by a number of components. Selection based on the component characters has been considered to be more effective as compared to the selection of yield *per se*. Both correlation and path coefficient analysis form a basis for selection and also help in understanding those yield components affecting yield improvement through the study of direct and indirect effects.

MATERIAL AND METHODS

The present study was carried out with 50 genotypes of cotton (*Gossypium hirsutum* L.) obtained from different research centres across the country. The experiment was conducted in randomized block design with three replications at Regional Agricultural Research Station (RARS), Lam, Guntur during *kharif* 2008-09. The inter- and intra-row spacing adapted was 120cm x 60cm. Each plot consisted of one row of 6m length and observations were recorded on five randomly selected plants from each genotype per replication for 16 characters *viz.,* plant height (cm), number of monopodia plant^{-1}, number of sympodia plant^{-1}, number of bolls plant^{-1}, boll weight (g), seed index (g), lint index (g), lint yield plant^{-1} and seed cotton yield plant^{-1}. Days to 50% flowering, ginning out-turn (%), 2.5% span length (mm), micronaire (10^{-6}g/in), bundle strength (g/tex), uniformity ratio and oil content (%) were recorded on plot basis. The fibre quality characters were analyzed at CIRCOT regional unit at RARS, Lam, Guntur. The data were statistically analyzed to estimate genotypic and phenotypic correlation coefficients and path coefficient analysis following Falconer (1964) and Dewey and Lu (1959).

RESULTS AND DISCUSSION

Genotypic correlation coefficients, in general, were higher than phenotypic correlation coefficients (Table 1). Plant height, number of sympodia plant^{-1}, number of bolls plant^{-1}, boll weight, micronaire, oil content and lint yield plant^{-1} showed significant positive correlation with seed cotton yield plant^{-1}. These results are in broad agreement with Tuteja *et al.,* (2006) and Leela Pratap *et al.,* (2007). Ginning out-turn showed significant negative association with seed cotton yield plant^{-1} at both the levels. Where as lint index and 2.5% span length exhibited significant and negative association with seed cotton yield plant^{-1} at genotypic level only which is in agreement with Padmavathi (2008). Plant height showed significant positive association with number of sympodia plant^{-1}, number of bolls plant^{-1}, oil percentage, lint yield plant^{-1} and seed cotton yield plant^{-1} as also reported by Tuteja *et al.* (2006) and Padmavathi (2008). While days to 50% flowering showed significant positive association with number of sympodia plant^{-1} and bundle strength as also reported by Karunakar Raju *et al.,* (2005). Number of sympodia plant^{-1} had significant positive association with number of bolls plant^{-1}, bundle strength, lint yield plant^{-1} and seed cotton yield plant^{-1} as also reported by Leela Pratap *et al.* (2007) and Tuteja *et al.*, (2006). Number of bolls plant^{-1} had highly significant positive association with seed cotton yield plant^{-1} and lint yield plant^{-1}, while significant association with oil content and micronaire as also reported by Karunakar Raju *et al.* (2005).

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlations for 16 characters in 50 cotton (*Gossypium hirsutum* L.) genotypes

Character	Plant height	Days to 50% flowering	No. of monopodia plant^{-1}	No. of sympodia plant^{-1}	No. of bolls plant^{-1}	Boll weight	Ginning outturn	Seed index	Lint index	2.5% span length	Uniformity ratio	Micronaire	Bundle strength	Oil content (%)	Lint yield plant^{-1}	Seed cotton yield plant^{-1}
Plant height	—	0.09	0.00	0.32**	0.37**	0.13	-0.01	-0.00	0.02	-0.05	-0.02	0.12	-0.03	0.28**	0.38**	0.37**
Days to 50% flowering	0.12	—	0.12	0.21**	-0.07	-0.19*	-0.01	-0.03	-0.05	0.10	-0.17*	-0.14	0.29**	-0.21**	-0.11	-0.10
No. of monopodia plant^{-1}	0.01	0.13	—	0.00	-0.01	-0.18*	0.01	-0.08	-0.07	0.22**	-0.21**	-0.20*	0.16*	-0.05	-0.11	-0.10
No. of sympodia plant^{-1}	0.38**	0.31**	0.05	—	0.46**	0.12	-0.17*	-0.09	-0.17*	-0.01	-0.33**	0.06	0.24**	0.07	0.45**	0.46**
No. of bolls plant^{-1}	0.46**	-0.09	0.00	0.56**	—	0.03	-0.37**	-0.07	-0.24**	-0.15	-0.13	0.22**	-0.02	0.21**	0.87**	0.90**
Boll weight	0.21**	-0.25**	-0.27**	0.18*	0.12	—	0.08	0.24**	0.24**	-0.10	0.03	0.19*	0.00	0.26**	0.39**	0.36**
Ginning outturn	-0.01	-0.05	0.06	-0.23**	-0.45**	0.02	—	-0.04	0.34**	-0.07	0.13	0.05	-0.10	0.09	-0.14	-0.29**
Seed index	-0.01	-0.04	-0.11	-0.17*	-0.09	0.28**	-0.06	—	0.83**	0.02	0.24**	0.10	0.13	0.18*	0.00	0.01
Lint index	-0.00	-0.05	-0.09	-0.29**	-0.31**	0.22**	0.38**	0.89**	—	-0.06	0.30**	0.11	0.02	0.17*	-0.09	-0.14
2.5%span length	-0.08	0.15	0.28**	-0.01	-0.23**	-0.15	-0.11	0.01	-0.07	—	-0.44**	-0.61**	0.65**	-0.12	-0.15	-0.14
Uniformity ratio	-0.08	-0.31**	-0.32**	-0.63**	-0.11	0.21**	0.24**	0.40**	0.52**	-0.63**	—	0.39**	-0.41**	0.16*	-0.12	-0.14
Micronaire	0.19*	-0.25**	-0.23**	0.09	0.34**	0.28**	0.08	0.18*	0.21**	-0.76**	0.64**	—	-0.46**	0.28**	0.23**	0.21**
Bundle strength	0.01	0.43**	0.24**	0.41**	-0.06	0.02	-0.13	0.13	-0.01	0.80**	-0.65**	-0.66**	—	-0.10	-0.01	-0.00
Oil content (%)	0.35**	-0.24**	-0.05	0.10	0.27**	0.37**	0.11	0.24**	0.25**	-0.14	0.20*	0.33**	-0.12	—	0.29**	0.27**
Lint yield plant^{-1}	0.52**	-0.15	-0.13	0.58**	0.91**	0.48**	-0.26**	-0.00	-0.16*	-0.25**	-0.08	0.40**	-0.02	0.40**	—	0.98**
Seed cotton yield plant^{-1}	0.49**	-0.13	-0.12	0.58**	0.93**	0.44**	-0.42**	0.00	-0.22**	-0.23**	-0.11	0.36**	-0.00	0.36**	0.98**	—

*, ** = Significant at 5% level and 1% level, respectively.

Table 2. Direct and indirect effects (genotypic) of yield components on seed cotton yield per plant in 50 genotypes of cotton (*Gossypium hirsutum* L.).

Character	Plant height	Days to 50% flowering	No. of monopodia plant^{-1}	No. of sympodia plant^{-1}	No. of bolls plant^{-1}	Boll weight	Ginning out-turn	Seed index	Lint index	2.5% span length	Uniformity ratio	Micro naire	Bundle strength	Oil content (%)	Lint yield plant^{-1}	Correlation with seed cotton yield/ plant(g)
Plant height	**0.0024**	0.0003	0.0000	0.0009	0.0011	0.0005	0.0000	0.0000	0.0000	-0.0002	-0.0002	0.0005	0.0000	0.0009	0.0013	**0.4943****
Days to 50% flowering	0.0022	**0.0176**	0.0024	0.0055	-0.0017	-0.0044	-0.0009	-0.0009	-0.0010	0.0028	-0.0056	-0.0046	0.0077	-0.0044	-0.0027	**-0.1328**
No. of monopodia plant^{-1}	-0.0001	-0.0012	**-0.0090**	-0.0005	0.0000	0.0025	-0.0006	0.0010	0.0009	-0.0026	0.0029	0.0021	-0.0022	0.0005	0.0012	**-0.1250**
No. of sympodia plant^{-1}	-0.0015	-0.0013	-0.0002	**-0.0040**	-0.0023	-0.0007	0.0010	0.0007	0.0012	0.0001	0.0025	-0.0004	-0.0017	-0.0004	-0.0023	**0.5888****
No. of bolls plant^{-1}	0.0938	-0.0189	0.0003	0.1130	**0.2002**	0.0247	-0.0910	-0.0180	-0.0624	-0.0466	-0.0235	0.0694	-0.0135	0.0543	0.1823	**0.9385****
Boll weight	0.0134	-0.0159	-0.0176	0.0116	0.0078	**0.0631**	0.0019	0.0183	0.0141	-0.0097	0.0137	0.0178	0.0017	0.0235	0.0308	**0.4484****
Ginning out-turn	0.0004	0.0012	-0.0014	0.0054	0.0102	-0.0007	**-0.0225**	0.0014	-0.0086	0.0025	-0.0055	-0.0019	0.0030	-0.0027	0.0059	**-0.4208****
Seed index	-0.0033	-0.0127	-0.0290	-0.0454	-0.0232	0.0745	-0.0161	**0.2576**	0.2315	0.0040	0.1038	0.0483	0.0338	0.0634	-0.0017	**0.0015**
Lint index	0.0013	0.0145	0.0261	0.0786	0.0822	-0.0590	-0.1009	-0.2372	**-0.2639**	0.0185	-0.1377	-0.0573	0.0042	-0.0680	0.0435	**-0.2213****
2.5% span length	0.0013	-0.0025	-0.0044	0.0003	0.0036	0.0024	0.0018	-0.0002	0.0011	**-0.0156**	0.0099	0.0119	-0.0126	0.0023	0.0040	**-0.2306****
Uniformity ratio	0.0022	0.0084	0.0085	0.0166	0.0031	-0.0057	-0.0065	-0.0106	-0.0137	0.0168	**-0.0263**	-0.0170	0.0173	-0.0053	0.0023	**-0.1176**
Micronaire	-0.0048	0.0062	0.0055	-0.0022	-0.0083	-0.0068	-0.0020	-0.0045	-0.0052	0.0183	-0.0155	**-0.0239**	0.0159	-0.0080	-0.0097	**0.3669****
Bundle strength	-0.0007	-0.0156	-0.0087	-0.0149	0.0024	-0.0009	0.0048	-0.0047	0.0006	-0.0289	0.0235	0.0237	**-0.0357**	0.0045	0.0008	**-0.0001**
Oil content (%)	0.0049	-0.0034	-0.0008	0.0014	0.0037	0.0051	0.0016	0.0034	0.0036	-0.0020	0.0028	0.0046	-0.0018	**0.0138**	0.0056	**0.3663****
Lint yield plant^{-1}	0.3830	-0.1096	-0.0966	0.4226	0.6595	0.3536	-0.1913	-0.0048	-0.1194	-0.1880	-0.0623	0.2936	-0.0163	0.2919	**0.7240**	**0.9854****

*, ** = Significant at 5% level and 1% level ,respectively. Residual effect = 0.04, Bold and diagonal values indicate direct effect

Ginning out-turn exhibited significant positive association with lint index. Seed index exhibited significant positive association with lint index, uniformity ratio and oil percentage (%), in accordance with Leela Pratap *et al.* (2007). Significant positive association was observed for boll weight with seed cotton yield plant^{-1}, lint yield plant^{-1}, oil percentage, micronaire, lint index and seed index. Lint index had highly significant positive correlation with uniformity ratio and oil per centage. 2.5% span length showed significant positive association with bundle strength. Micronaire showed significant positive association with oil percentage, lint yield plant^{-1} and seed cotton yield plant^{-1}, as also reported by Karunakar Raju *et al.,* (2005).

Path coefficient analysis revealed that lint yield plant^{-1} exerted highest direct effect on seed cotton yield plant^{-1} followed by number of bolls plant^{-1}, number of monopodia plant^{-1}, boll weight, seed index, oil percentage, number of sympodia plant^{-1}, uniformity ratio and days to 50% flowering. These results are in accordance with Leela Pratap *et al.,* (2007) (lint yield plant^{-1}, number of bolls plant^{-1} and number of sympodia plant^{-1}), Karunakar Raju *et al.* (2005) (uniformity ratio), Padmavathi (2008) (boll weight and seed index), Muthu *et al.,* (2004) (number of monopodia plant^{-1}), Patel *et al.,*(2003) (oil percentage) and Tuteja *et al.,* (2006) (days to 50% flowering). Ginning out-turn, bundle strength, plant height, lint index, micronaire and 2.5 % span length exerted negative direct effect on seed cotton yield plant^{-1}. Similar results were reported by Padmavathi (2008) for ginning out-turn and plant height, Leela Pratap *et al.,* (2007) for lint index and Karunakar Raju *et al.,* (2005) for bundle strength and micronaire.

Correlation studies and path analysis indicated strong positive true relationship among number of bolls plant^{-1}, oil content and lint yield plant^{-1} with seed cotton yield plant^{-1} and improvement of seed cotton yield may be made through these traits with desirable fibre qualities by adopting restriction selection model. There is scope for improvement of oil content through cyclic hybridization.

LITERATURE CITED

Dewey D R and Lu K H 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal 51 (9): 515-518.

Falconer D S 1964. An Introduction to Quantitative Genetics. Oliver and Boyd, Edinburgh, London pp.312-324.

Karunakar Raju G B, Chenga Reddy V and Panduranga Rao C 2005. Multivariate analysis of genetic diversity in upland cotton. The Andhra Agricultural Journal 52(1&2): 66-74.

Leela Pratap K, Chenga Reddy V, Rama Kumar P V and Srinivasa Rao V 2007. Correlation and path coefficient analyses for yield and yield component traits in cotton (*Gossypium hirsutum* L.). The Andhra Agricultural Journal 54 (1&2): 31-35.

Muthu R, Kandasamy G and Jayaramachandran N 2004. Correlation and path coefficient analysis for yield and fibre quality traits in cotton (*Gossypium hirsutum* L.). Journal of the Indian Society for Cotton Improvement 29 (1): 17-20.

Padmavathi A 2008. Characterization of cotton germplasm (*Gossypium hirsutum* L.). M.Sc.(Ag) thesis, Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad.

Patel K V, Varghese S, Patel P G, Patel U G, Darji V B and Patel J S 2003. Character association for cotton seed oil content in different genotypes of cotton. Journal of Maharashtra Agricultural Universities 28 : (2): 203-205.

Tuteja O P, Sunil Kumar and Mahendar Singh 2006. Selection parameters and yield enhancement of upland cotton (*Gossypium hirsutum* L.) under irrigated ecosystem of North India. Indian Journal of Agricultural Sciences 76(2): 77-80.

(Received on 20.11.2009 and revised on 23.12.2009)