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Correlation and Path Coefficient Analyses in Cotton (*Gossypium hirsutum* L.)

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ABSTRACT

Correlation and path coefficient analyses were carried out in 60 genotypes of cotton that were collected from all the three cotton growing zones of India for different agronomical and fibre quality traits. The correlation studies revealed that plant height, number of sympodia per plant, number bolls per plant, boll weight, seed index, lint index, micronaire, uniformity ratio, elongation and lint yield per plant had significant positive association with seed cotton yield per plant. The path coefficient analysis revealed that plant height, days to 50% flowering, number of monopodia per plant, number of bolls per plant, seed index, lint index, uniformity ratio and lint yield per plant exerted direct positive effect on seed cotton yield per plant. Selection based on these attributes may be helpful in evolving high yielding varieties of upland cotton.

Key words : Cotton, Correlation and Path Analysis.

Cotton is an important commercial crop of the country. It plays a key role in the national economy in terms of its contribution to trade, industrial activities and employment and foreign exchange earnings. Seed cotton yield is a complex polygenic character and it is influenced by a number of components. Correlation studies provide an estimate on the degree of association between characters, where as path analysis helps to resolve the correlations into direct and indirect contribution of different component characters to yield. Hence, the present investigation was conducted to obtain information on nature and magnitude of character association, direct and indirect effect of different attributes on seed cotton yield in cotton genotypes.

MATERIAL AND METHODS

The present study was carried out with 60 genotypes of cotton (*Gossypium hirsutum L.*) obtained from different cotton growing zones of India. The experiment was conducted in randomized complete block design with three replications during *kharif* 2007. The inter- and intra-row spacing adapted was 105 × 60 cm. Each plot consisted of two rows of 6m length and observations were recorded on five competitive plants from each genotype or plot basis per replication, for the characters *viz*., plant height (cm), days to 50% flowering, number of monopodia per plant, number of sympodia per plant, number of bolls per plant, boll weight (g), ginning out-turn (%), seed index (g), lint index (g), 2.5% span length (mm), micronaire (10^{-6} g/in), bundle strength (g/tex), uniformity ratio (%), elongation (%), lint yield per plant (g) and seed cotton yield per plant (g) .The fibre quality characters were analyzed at CIRCOT regional unit at RARS Lam, Guntur. The data were statistically analyzed to estimate the genotypic and phenotypic correlation coefficients and path coefficient relationships following the procedure of Falconer (1964) and Wright (1921), respectively.

RESULTS AND DISCUSSION

The seed cotton yield per plant exhibited (Table 1) positive genotypic correlation with number of sympodia per plant, plant height, number of bolls per plant, boll weight, seed index, lint index, micronaire, uniformity ratio, elongation and lint yield per plant which is in conformity with Karunakar Raju (2005) and Leela Pratap (2006). Number of bolls per plant was positively and significantly associated with number of sympodia, boll weight, ginning out-turn, plant height, days to 50% flowering, micronaire and lint yield per plant which is in agreement with Muthu *et al*. (2004), Karunakar Raju (2005),Leela Pratap *et al*. (2007) and Vijayalaxmi (2008).

Boll weight was significantly and positively associated with number of bolls per plant, number of sympodia per plant, ginning out-turn, uniformity ratio and lint yield per plant. While, it was significantly and negatively correlated with fibre elongation which is in agreement with Muraleedhar (2005), Karunakar Raju (2005) and Neelima *et al*. (2005). Ginning out turn showed significant negative association with seed index and uniformity ratio which is in accordance with Leela Pratap (2007) and Vijayalaxmi (2008).

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlation for 16 characters in 60 cotton (*Gossypium hirsutum* L.) genotypes

Character	Plant height (cm)	Days to 50% flowering	No. of monopodia /plant	No. of sympodia / plant	No. of bolls /plant	Boll weight (g)	Ginning out-turn (%)
Plant height (cm)	—	-0.0885	0.0265	0.1816*	0.1432	0.2114**	-0.0235
Days to 50% flowering	-0.0522	—	0.0516	-0.1022	-0.0125	-0.0877	-0.1358
No. of monopodia /plant	0.0333	0.0918	—	-0.0166	-0.1106	-0.1225	0.1153
No. of sympodia/plant	0.2754**	-0.2835**	-0.0404	—	0.2344**	0.0599	0.0795
No. of bolls/plant	0.2052**	0.2051**	-0.1668*	0.2036**	—	0.0701	0.1282
Boll weight (g)	0.3137**	-0.2664**	-0.2162**	0.1808*	0.1526*	—	0.1357
Ginning out-turn (%)	-0.0251	-0.1968**	0.1491*	0.3636**	0.2127**	0.2294**	—
Seed index (g)	0.3574**	0.2027**	0.1819*	0.0216	0.0562	-0.1137	-0.3459**
Lint index (g)	0.0988	-0.1179	0.0227	0.1183	0.0995	0.0510	0.3302**
2.5%span-length (mm)	0.1686*	0.2014**	-0.0653	0.0009	0.0542	-0.0529	-0.0242
Micronaire (10^{-6} g/in)	0.2301**	-0.2582**	0.0533	0.3545**	0.3933**	0.0937	0.1930**
Bundle strength (g/tex)	-0.0083	-0.2572**	0.2548**	0.4947**	-0.0473	0.0459	0.5313**
Uniformity ratio (%)	-0.1558*	-0.2292**	0.1335	0.2696**	-0.0307	0.3217**	-0.1550*
Elongation (%)	-0.0098	0.1076	0.2890**	0.4776**	-0.1379	-0.3835**	-0.1064
Lint yield/plant (g)	0.2243**	-0.0247	-0.1110	0.3003**	0.5540**	0.1967**	0.2697**
Seed cotton yield/plant (g)	0.2296**	0.0891	-0.1028	0.2655**	0.6971**	0.2060**	0.0828

Seed index(g)	Lint index (g)	2.5% Span.length (mm)	Micronaire (10^{-6} g/in)	Bundle strength (g/tex)	Uniformity ratio (%)	Elongation (%)	Lint yield /plant (g)	Seed cotton yield / plant (g)
0.1522*	0.1529*	0.1254	0.1813*	0.0113	-0.0765	-0.0153	0.1771*	0.1929**
0.1495*	0.0020	0.0484	-0.0957	-0.0583	0.0901	0.1204	-0.0451	-0.0003
0.0644	-0.0246	-0.0364	0.0118	0.0609	0.0777	0.0679	-0.0832	-0.0728
0.0898	0.0347	-0.0086	0.2080**	0.0721	0.1512*	0.1200	0.1520*	0.1365
-0.0438	-0.0065	0.0077	0.1856*	-0.0476	-0.0400	-0.0777	0.3574**	0.3926**
-0.0823	0.0431	-0.0290	0.0792	0.0011	0.1475*	-0.0002	0.2041**	0.1608*
-0.4114**	0.2690**	-0.0472	0.1125	0.2316**	-0.0572	-0.0024	0.1861*	0.0066
—	0.4529**	0.1919**	0.2952**	-0.1212	-0.0484	0.0537	0.0132	0.1230
0.6200**	—	0.0975	0.3411**	-0.0335	-0.0600	0.0824	0.0756	0.1050
0.3161**	0.1301	—	-0.1148	0.1588*	-0.3304**	-0.1378	-0.0244	-0.0489
0.4006**	0.3713**	-0.2106**	—	-0.2146**	0.0674	0.1014	0.3227**	0.2423**
0.1194	0.2926**	0.3800**	-0.0052	—	-0.1228	0.0549	-0.0098	-0.0619
-0.1552*	-0.3053**	-0.5501**	0.0922	-0.1767*	—	-0.0780	0.1308	0.1527*
0.6861**	0.8322**	0.0675	0.6371**	-0.4185**	-0.4200**	—	0.1051	0.0734
0.0456	0.0765	-0.0469	0.4485**	0.0499	0.2597**	0.2706**	—	0.8647**
0.1610*	0.1497*	-0.0754	0.3744**	-0.0939	0.3900**	0.1807*	0.9342**	—

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

Table 2. Direct and indirect effects (phenotypic) of yield components on seed cotton yield per plant in 60 genotypes of cotton (*Gossypium hirsutum* L.).

Character	Plant height (cm)	Days to 50% flowering	No. of mono.podia /plant	No. of sympodia / plant	No. of bolls /plant	Boll weight (g)	Ginning out-turn (%)
Plant height (cm)	**0.0213**	-0.0019	0.0006	0.0039	0.0031	0.0045	-0.0005
Days to 50% flowering	-0.0004	**0.0045**	0.0002	-0.0005	-0.0001	-0.0004	-0.0006
No. of monopodia /plant	0.0009	0.0018	**0.0348**	-0.0006	-0.0039	-0.0043	0.0040
No. of sympodia/plant	0.0000	0.0000	0.0000	**-0.0001**	0.0000	0.0000	0.0000
No. of bolls/plant	0.0179	-0.0016	-0.0138	0.0293	**0.1250**	0.0088	0.0160
Boll weight (g)	-0.0004	0.0001	0.0002	-0.0001	-0.0001	**-0.0017**	-0.0002
Ginning outturn (%)	0.0044	0.0254	-0.0215	-0.0148	-0.0239	-0.0253	**-0.1867**
Seed index (g)	0.0033	0.0033	0.0014	0.0020	-0.0010	-0.0018	-0.0090
Lint index (g)	0.0185	0.0002	-0.0030	0.0042	-0.0008	0.0052	0.0326
2.5%spanlength (mm)	-0.0075	-0.0029	0.0022	0.0005	-0.0005	0.0017	0.0028
Micronaire (10^{-6} g/in)	-0.0185	0.0098	-0.0012	-0.0212	-0.0189	-0.0081	-0.0115
Bundle strength (g/tex)	-0.0001	0.0005	-0.0005	-0.0006	0.0004	0.0000	-0.0018
Uniformity ratio (%)	-0.0019	0.0022	0.0019	0.0037	-0.0010	0.0036	-0.0014
Elongation (%)	0.0003	-0.0022	-0.0013	-0.0022	0.0014	0.0000	0.0000
Lint yield/plant (g)	0.1550	-0.0394	-0.0728	0.1331	0.3128	0.1786	0.1628
Correlation with Seed coton yield	0.1929**	-0.0003	-0.0758	0.1365	0.3926**	0.1608*	0.0066

Seed index(g)	Lint index (g)	2.5% Span.length (mm)	Micro.naire (10^{-6} g/in)	Bundle strength (g/tex)	Unifor.mity ratio (%)	Elonga.tion (%)	Lint yield /plant (g)
0.0032	0.0033	0.0027	0.0039	0.0002	-0.0016	-0.0003	0.0038
0.0007	0.0000	0.0002	-0.0004	-0.0003	0.0004	0.0005	-0.0002
0.0022	-0.0009	-0.0013	0.0004	0.0021	0.0027	0.0024	-0.0029
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-0.0055	-0.0008	0.0010	0.0232	-0.0059	-0.0050	-0.0097	0.0447
0.0001	-0.0001	0.0000	-0.0001	0.0000	-0.0002	0.0000	-0.0003
0.0768	-0.0502	0.0088	-0.0210	-0.0432	0.0107	0.0004	-0.0347
0.0219	0.0099	0.0042	0.0065	-0.0027	-0.0011	0.0012	0.0003
0.0548	**0.1210**	0.0118	0.0413	-0.0041	-0.0073	0.0100	0.0091
-0.0115	-0.0058	**-0.0600**	0.0069	-0.0095	0.0198	0.0083	0.0015
-0.0301	-0.0348	0.0117	**-0.1021**	0.0219	-0.0069	-0.0104	-0.0330
0.0010	0.0003	-0.0013	0.0017	**-0.0079**	0.0010	-0.0004	0.0001
-0.0012	-0.0015	-0.0080	0.0016	-0.0030	**0.0243**	-0.0019	0.0032
-0.0010	-0.0015	0.0026	-0.0019	-0.0010	0.0015	**-0.0186**	-0.0020
0.0115	0.0661	-0.0214	0.2825	-0.0086	0.1145	0.0919	**0.8752**
0.1230	0.1050	-0.0489	0.2423**	-0.0619	0.1527*	0.0734	0.8647**

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

Number of bolls per plant, boll weight and lint yield per plant had strong association with seed cotton yield per plant, hence maximum emphasis should be given for these characters to increase seed cotton yield per plant. Seed index, lint index, ginning out-turn, 2.5% span length, micronaire, elongation, were interrelated among themselves and would bring in simultaneous improvement in addition to seed cotton yield. Lint yield per plant had significant and positive association with number of sympodia per plant, ginning out-turn, number of bolls per plant, boll weight, micronaire, uniformity ratio and fibre elongation as earlier reported by Leela Pratap *et al*. (2007) and Vijayalaxmi (2008).

Association of various characters with traits of major interest and economic importance like seed cotton yield is the consequence of their direct effect and indirect effects. It becomes, therefore, essential to partition such association into direct and indirect effects of component characters through path analysis. The path analysis (Table 2) showed the number bolls per plant, plant height, days to 50% flowering, number of monopodia per plant, seed index, lint index, uniformity ratio, and lint yield per plant exhibited the positive direct effect on seed cotton yield per plant as reported by Muthu *et al.* (2004) and Leela Pratap (2007) and for these traits direct selection can be made to improve the yield.

Number of bolls per plant had positive and greater indirect effect on yield via, plant height, number of sympodia per plant, bundle strength, fibre elongation and lint yield per plant. Hence, selection through these characters may bring about seed cotton yield. The findings are in agreement with Neelima *et al.* (2005), Leela Pratap (2007) and Vijayalaxmi (2008).

Seed index exhibited positive indirect effect on yield through the number of monopodia per plant, plant height, boll weight, days to 50% flowering, lint index, ginning out-turn, bundle strength and lint yield per plant. The results are similar to Karunakar Raju (2005), Leela Pratap (2007) and Vijayalaxmi (2008).

Lint yield per plant had positive indirect effect on yield via, plant height, number of sympodia per plant, ginning out-turn, number of bolls per plant, seed index, lint index, bundle strength, 2.5% span length and uniformity ratio in complete accordance with Muthu *et al.* (2004) and Leela Pratap (2007). The trait, fibre elongation had positive indirect effect through days to 50% flowering, number of monopodia per plant, number of sympodia per plant, boll weight, ginning out-turn, seed index, lint index and 2.5% span length and lint yield per plant as reported by Muraleedhar (2005) and Vijayalaxmi (2008).

Selection for high seed cotton yield seemed to be positive through number of bolls per plant, seed index, lint index, uniformity ratio and lint yield per plant as they exerted positive and significant association with seed cotton yield. Hence, simultaneous selection based on number of bolls per plant, seed index, lint index, uniformity ratio and lint yield per plant seems to be promising in improving the seed cotton yield.

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