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

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ABSTRACT

The present study was conducted on correlation and path coefficient analysis for yield and yield contributing characters in upland cotton. The results of phenotypic and genotypic correlation analysis revealed that plant height, number of sympodia per plant, number of bolls per plant, boll weight and lint yield per plant were significantly and positively correlated with seed cotton yield per plant in present material. Path analysis indicated that lint yield per plant exhibited high direct positive effect on seed cotton yield per plant signifying the importance of this trait during selection for improvement of seed cotton yield of cotton.

Key words : Cotton, Correlation, Path analysis, Seed cotton yield

Yield is a complex and polygenically inherited character resulting from multiplicative interaction of its contributing characters. It is highly influenced by the environment hence selection based on yield alone may limit the progress. Whereas, the yield component characters are less complex in inheritance and are influenced by environment to a lesser extent. Both correlation and path coefficient analysis form a basis for selection and also helps in understanding those yield components affecting yield improvement through the study of their direct and indirect effects.

MATERIAL AND METHODS

Fifty four hybrids of upland cotton developed from line × tester fastions (9 lines × 6 testers) along with two standard check hybrids, were grown in randomized block design in three replications during *kharif* 2009-10 at Agricultural College Farm, Bapatla. 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 characters *viz*., plant height (cm), number of monopodia per plant, number of sympodia per plant, number of bolls per plant, boll weight (g), seed index (g), lint index (g), lint yield per plant and seed cotton yield per plant. Days to 50% flowering, ginning out-turn (%), 2.5% span length (mm), micronaire (10^{-6}g/in), bundle strength (g/tex), uniformity ratio and fibre elongation (%) were recorded on plot basis. The fibre quality characters were analyzed at CIRCOT Regional Unit Lam, Guntur. The data were statistically analyzed to estimate genotypic and phenotypic correlation coefficients (Falconer, 1964) and path coefficient analysis (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

The analysis of variance indicated significant differences among the genotypes for all characters. Genotypic correlation coefficients in general were higher than phenotypic correlation coefficients (Table 1). Plant height, number of sympodia per plant, number of bolls per plant, boll weight and lint yield per plant showed significant positive correlation with seed cotton yield per plant. Similar results were reported by Sakthi *et al.* (2007) and Vijayalaxmi *et al.* (2008).

Path coefficient analysis revealed that lint yield per plant exerted highest positive direct effect on seed cotton yield per plant followed by 2.5% span length, plant height, bundle strength, seed index, number of monopodia per plant, micronaire value, uniformity ratio, boll weight, number of bolls per plant and days to 50% flowering. These results are in accordance with the reports of Vijayalaxmi *et al.* (2008), Kale *et al.* (2007), Sakthi *et al.* (2007), Kaushik and Kapoor (2006) and Tuteja *et al.* (2006).

From the correlation and path coefficient analysis study it was inferred that lint yield per plant had significant association and also positive high positive direct effects on seed cotton yield per plant. Hence, in the improvement programmes due importance may be given for this trait to improve genetic yield potential in cotton.

LITERATURE CITED

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlations of 16 characters in 56 hybrids of cotton (*Gossypium hirsutum* L.)

Character	Plant height (cm)	Days to 50% flowering	Number of monopodia plant^{-1}	Number of sympodia plant^{-1}	Number of bolls plant^{-1}	Boll weight (g)	Ginning out turn (%)	Seed index(g)	Lint index (g)	2.5% span length (mm)	Micronaire (10^{-6} g / inch)	Bundle strength (g / tex)	Uniformity ratio (%)	Fibre elongation (%)	Lint yield plant^{-1} (g)	Seed cotton yield plant^{-1} (g)
Plant height (cm)	—	-0.1408	0.1008	0.4195**	0.2870**	-0.0097	0.0794	0.2734**	0.2791**	0.0312	-0.1162	0.0563	-0.1284	-0.1161	0.2721**	0.2802**
Days to 50% flowering	-0.1767*	—	-0.2230	-0.1391	0.0078	-0.1552*	-0.1252	-0.1163	-0.1376	-0.0934	0.1243	-0.0799	0.0143	0.0602	-0.0733	-0.0550
Number of monopodia plant^{-1}	0.1659*	-0.2737*	—	0.1594*	0.0946	-0.0992	0.1636*	0.0060	0.1697*	-0.1416	0.1037	-0.0224	0.1102	-0.0573	0.1213	0.0716
Number of sympodia plant^{-1}	0.5938**	-0.1487	0.2686**	—	0.2918**	-0.1720*	-0.0349	0.1528*	0.0428	-0.0913	-0.0639	0.2388**	0.0577	0.0072	0.1597*	0.1634*
Number of bolls plant^{-1}	0.4533**	0.0503	0.2177**	0.4062**	—	-0.2931**	-0.0916	-0.1338	-0.1008	-0.0659	-0.0431	0.0268	0.0032	-0.0826	0.5255**	0.5602**
Boll weight (g)	-0.0247	-0.1762*	-0.1228	-0.2591**	-0.4614**	—	0.1159	0.1986**	0.2416**	0.0371	-0.0508	-0.0912	0.0491	0.0678	0.2962**	0.2758**
Ginning out turn (%)	0.1262	-0.1198	0.2578**	-0.0403	-0.1752*	0.1607*	—	-0.2824**	0.4212**	-0.1403	0.0206	-0.0068	0.1060	-0.0478	0.2555**	0.0405
Seed index(g)	0.3719**	-0.1576*	-0.0283	0.1745*	-0.1748*	0.2678**	-0.3590**	—	0.3900**	0.2907**	-0.1650*	-0.1516*	-0.1661*	0.0078	-0.0705	-0.0048
Lint index (g)	0.4656**	-0.1776*	0.2347**	0.0550	-0.0851	0.3478**	0.5614**	0.4333**	—	0.1048	0.0186	-0.1142	-0.1808*	-0.0062	0.2288**	0.1282
2.5% span length (mm)	0.1068	-0.1102	-0.2926**	-0.1301	-0.1108	0.0949	-0.2788**	0.4136**	0.1474	—	-0.3303**	0.1638*	-0.4534**	0.2405**	-0.1127	-0.0617
Micronaire (10^{-6} g / inch)	-0.4205**	0.3045**	0.4046**	-0.2487**	-0.1193	-0.1774*	0.0763	-0.2784**	0.0015	-0.6859**	—	-0.1430	0.2331**	-0.0584	-0.1438	-0.1527*
Bundle strength (g / tex)	0.0523	-0.1199	-0.1022	0.2932**	0.0317	-0.1159	-0.0536	-0.1936*	-0.1372	0.2509**	-0.2265**	—	-0.1637*	0.2567*	-0.0064	0.0062
Uniformity ratio (%)	-0.3142**	0.0683	0.5288**	0.0379	-0.1160	0.0599	0.1842*	-0.2850**	-0.2570**	-0.9962**	0.6693**	-0.3820**	—	0.0556	0.0257	-0.0009
Fibre elongation (%)	-0.0952	0.1219	-0.2016**	0.0372	-0.2185**	0.2757**	0.0038	0.1155	0.0091	0.1792*	-0.1760*	0.4954**	-0.0110	—	-0.0151	-0.0228
Lint yield plant^{-1} (g)	0.5339**	-0.1240	0.1702*	0.2535**	0.7811**	0.3779**	0.2564**	-0.1096	0.2862**	-0.1808*	-0.1753*	-0.0740	0.0245	-0.1020	—	0.9617**
Seed cotton yield plant^{-1} (g)	0.5032**	-0.1055	0.1171	0.2614**	0.8669**	0.3512**	0.0093	-0.0246	0.1409	-0.0891	-0.2166**	-0.0631	-0.0320	-0.0838	0.9685**	—

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

Table 2. Direct and indirect effects (phenotypic) of 15 traits on seed cotton yield per plant in 56 hybrids of cotton (*Gossypium hirsutum* L.)

Character	Plant height (cm)	Days to 50% flower-ing	Number of monopo-dia plant^{-1}	Number of sympodia plant^{-1}	Num-ber of bolls plant^{-1}	Boll weight (g)	Ginning out turn (%)	Seed index(g)	Lint index (g)	2.5% span length (mm)	Micronaire (10^{-6} g / inch)	Bundle strength (g / tex)	Uniformity ratio (%)	Fibre elonga-tion (%)	Lint yield plant^{-1} (g)
Plant height (cm)	**0.0306**	-0.0043	0.0031	0.0129	0.0088	-0.0003	0.0024	0.0084	0.0086	0.0010	-0.0036	0.0017	-0.0039	-0.0036	0.0083
Days to 50% flowering	0.0000	**0.0001**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Number of monopodia plant^{-1}	0.0014	-0.0031	**0.0140**	0.0033	0.0019	-0.0013	0.0024	-0.0002	0.0028	-0.0028	0.0022	-0.0004	0.0050	-0.0011	0.0017
Number of sympodia plant^{-1}	-0.0101	0.0034	-0.0056	**-0.0241**	-0.0070	0.0042	0.0008	-0.0037	-0.0010	0.0022	0.0015	-0.0058	-0.0014	-0.0002	-0.0039
Number of bolls plant^{-1}	0.0002	0.0000	0.0001	0.0002	**0.0007**	-0.0002	-0.0001	-0.0001	-0.0001	0.0000	0.0000	0.0000	0.0000	-0.0001	0.0004
Boll weight (g)	0.0000	-0.0004	-0.0003	-0.0005	-0.0008	**0.0027**	0.0003	0.0005	0.0006	0.0001	-0.0001	-0.0002	0.0001	0.0002	0.0008
Ginning out turn (%)	-0.0161	0.0254	-0.0351	0.0071	0.0186	-0.0235	**-0.2032**	0.0574	-0.0856	0.0285	-0.0042	0.0014	-0.0215	0.0097	-0.0519
Seed index(g)	0.0043	-0.0018	-0.0002	0.0024	-0.0021	0.0031	-0.0045	**0.0158**	0.0062	0.0046	-0.0026	-0.0024	-0.0026	0.0001	-0.0011
Lint index (g)	-0.0105	0.0052	-0.0076	-0.0016	0.0038	-0.0091	-0.0158	-0.0147	**-0.0376**	-0.0039	-0.0007	0.0043	0.0068	0.0002	-0.0086
2.5% span length (mm)	0.0011	-0.0032	-0.0067	-0.0031	-0.0023	0.0013	-0.0048	0.0099	0.0036	**0.0341**	-0.0113	0.0056	-0.0155	0.0082	-0.0038
Micronaire (10^{-6} g / inch)	-0.0014	0.0015	0.0019	-0.0008	-0.0005	-0.0006	0.0002	-0.0020	0.0002	-0.0040	**0.0121**	-0.0017	0.0028	-0.0007	-0.0017
Bundle strength (g / tex)	0.0010	-0.0014	-0.0005	0.0043	0.0005	-0.0016	-0.0001	-0.0027	-0.0020	0.0029	-0.0025	**0.0178**	-0.0029	0.0046	-0.0001
Uniformity ratio (%)	-0.0010	0.0001	0.0026	0.0004	0.0000	0.0004	0.0008	-0.0012	-0.0013	-0.0034	0.0017	-0.0012	**0.0074**	0.0004	0.0002
Fibre elongation (%)	0.0029	-0.0015	0.0020	-0.0002	0.0021	-0.0017	0.0012	-0.0002	0.0002	-0.0060	0.0015	-0.0064	-0.0014	**-0.0251**	0.0004
Lint yield plant^{-1} (g)	0.2778	-0.0748	0.1238	0.1631	0.5365	0.3024	0.2609	-0.0720	0.2336	-0.1150	-0.1468	-0.0065	0.0262	-0.0154	**1.0210**
Correlation with seed cotton yield plant^{-1} (g)	**0.2802****	**-0.0550**	**0.0915**	**0.1634***	**0.5602****	**0.2758****	**0.0405**	**-0.0048**	**0.1282**	**-0.0617**	**-0.1528**	**0.0062**	**-0.0009**	**-0.0228**	**0.9617****

* = Significant at 5% level **=Significant at 1% level, Bold & diagonal values indicate direct effects, Residual effect = 0.1667

Table 3. Direct and indirect effects (genotypic) of 15 traits on seed cotton yield per plant in 56 hybrids of cotton (Gossypium hirsutum

Character	Plant height (cm)	Days to 50% flower-ing	Number of monopo-dia plant^{-1}	Number of sympodia plant^{-1}	Num-ber of bolls plant^{-1}	Boll weight (g)	Ginning out turn (%)	Seed index(g)	Lint index (g)	2.5% span length (mm)	Micronaire (10^{-6} g / inch)	Bundle strength (g / tex)	Uniformity ratio (%)	Fibre elonga-tion (%)	Lint yield plant^{-1} (g)
Plant height (cm)	**-0.1997**	0.0353	-0.0331	-0.1184	-0.0905	0.0049	-0.0252	-0.0742	-0.0930	-0.0213	0.0840	-0.0104	0.0627	0.0190	-0.1066
Days to 50% flowering	-0.0317	**0.1797**	-0.0492	-0.0267	0.0090	-0.0317	-0.0215	-0.0283	-0.0319	-0.0198	0.0547	-0.0215	0.0123	0.0219	-0.0223
Number of monopodia plant^{-1}	0.0405	-0.0669	**0.2443**	0.0656	0.0532	-0.0300	0.0630	-0.0069	0.0574	-0.0715	0.0989	-0.0250	0.1292	-0.0492	0.0416
Number of sympodia plant^{-1}	-0.1333	0.0334	-0.0604	**-0.2249**	-0.0914	0.0583	0.0091	-0.0392	-0.0124	0.0293	0.0559	-0.0659	-0.0085	-0.0084	-0.0570
Number of bolls plant^{-1}	0.0635	0.0070	0.0305	0.0569	**0.1401**	-0.0646	-0.0245	-0.0245	-0.0119	-0.0155	-0.0167	0.0044	-0.0162	-0.0306	0.1094
Boll weight (g)	-0.0005	-0.0038	-0.0026	-0.0055	-0.0098	**0.0213**	0.0034	0.0057	0.0074	0.0020	-0.0038	-0.0025	0.0013	0.0059	0.0080
Ginning out turn (%)	-0.1501	0.1426	-0.3068	0.0479	0.2084	-0.1913	**-1.1900**	0.4272	-0.6681	0.3318	-0.0908	0.0638	-0.2192	-0.0045	-0.3052
Seed index(g)	-0.2581	0.1094	0.0197	-0.1211	0.1213	-0.1859	0.2492	**-0.6942**	-0.3008	-0.2871	0.1932	0.1344	0.1979	-0.0802	0.0761
Lint index (g)	0.5572	-0.2125	0.2809	0.0658	-0.1018	0.4161	0.6718	0.5184	**1.1966**	0.1764	0.0018	-0.1642	-0.3076	0.0108	0.3424
2.5% span length (mm)	-0.0579	0.0597	0.1586	0.0705	0.0600	-0.0514	0.1511	-0.2241	-0.0799	**-0.5419**	0.3716	-0.1359	0.5398	-0.0971	0.0980
Micronaire (10^{-6} g / inch)	0.4398	-0.3185	-0.4233	0.2602	0.1248	0.1856	-0.0798	0.2912	-0.0016	0.7175	**-1.0461**	0.2370	-0.7002	0.1841	0.1834
Bundle strength (g / tex)	0.0054	-0.0123	-0.0105	0.0300	0.0032	-0.0119	-0.0055	-0.0198	-0.0140	0.0257	-0.0232	**0.1024**	-0.0391	0.0507	-0.0076
Uniformity ratio (%)	-0.0944	0.0205	0.1589	0.0114	-0.0348	0.0180	0.0554	-0.0856	-0.0772	-0.2993	0.2011	-0.1148	**0.3005**	-0.0033	0.0074
Fibre elongation (%)	0.0040	-0.0051	0.0085	-0.0016	0.0092	-0.0116	-0.0002	-0.0049	-0.0004	-0.0075	0.0074	-0.0208	0.0005	**-0.0420**	0.0043
Lint yield plant^{-1} (g)	0.3185	-0.0740	0.1016	0.1513	0.4660	0.2254	0.1530	-0.0654	0.1707	-0.1079	-0.1046	-0.0441	0.0146	-0.0609	**0.5966**
Correlation with seed cotton yield plant^{-1} (g)	**0.5032****	**-0.1055**	**0.1171**	**0.2614****	**0.8669****	**0.3512****	**0.0093**	**-0.0246**	**0.1409**	**-0.0891**	**-0.2166****	**-0.0631**	**-0.0320**	**-0.0838**	**0.9685****

* = Significant at 5% level **=Significant at 1% level, Bold & diagonal values indicate direct effects, Residual effect = 0.0767

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