



## Correlation and Path Coefficient Analysis for Yield and Yield Component Traits in American Cotton (*Gossypium Hirsutum* L.)

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### ABSTRACT

Correlation and path coefficient analysis have been carried out for 15 characters in 50 genotypes of American cotton (*Gossypium hirsutum* L.) for yield and yield component traits. The character association analysis revealed that plant height, number of sympodia per plant, number of bolls per plant, boll weight, ginning out turn, seed index, lint index and lint yield per plant were found to have significant positive association with seed cotton yield per plant at both phenotypic and genotypic level suggesting that these were the major yield contributing traits. Path analysis revealed that number of bolls per plant, boll weight and seed index showed direct positive effect and significant positive correlation with seed cotton yield per plant which suggested that direct selection for these traits would be effective to improve the seed cotton yield of American cotton.

Key words: *Correlation, Gossypium hirsutum, Path analysis, Yield.*

Yield is a complex trait, polygenic in inheritance, more prone to environmental fluctuations than other characters. Therefore, selection of genotypes based on yield is not effective. 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 (Kumar *et al.*, 2014). Path coefficient analysis splits the correlation coefficients and provides precise information on the direct and indirect effects in order to perceive the most influencing characters to be utilized as selection criteria in cotton breeding programmes. 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.

### MATERIAL AND METHODS

The present study was carried out with 50 genotypes of cotton (*G. hirsutum* L.) obtained from different research centers across the country in randomized block design with three replications at Regional Agricultural Research Station, Lam Farm, Guntur during *kharif* 2015-16. The inter- and intra-row spacing adapted was 105cm 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 (g) and seed cotton yield per plant (g). Days to 50% flowering, ginning out turn (%), 2.5% span length (mm), micronaire ( $10^{-6}$  g/in) bundle strength (g/tex) and uniformity ratio were recorded on plot basis. The fiber quality characters were analyzed at CIRCOT regional unit Lam, Guntur. The data was 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 the characters. Genotypic and phenotypic correlation coefficients were presented in table 1. Seed cotton yield per plant was significantly and positively correlated with plant height, number of sympodia per plant, number of bolls per plant, boll weight, ginning out turn, seed index, lint index and lint yield per plant at both genotypic and phenotypic levels. The above results were in accordance with Tulasi *et al.* 2012 for plant height, number of

**Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlations among 15 characters in 50 cotton (*G. 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 (%)	Seed index	Lint index (g)	2.5% span-length (mm)	Micronaire (10 <sup>-6</sup> g/in)	Bundle strength (g/tex)	Uniformity ratio	Seed cotton yield / plant (g)	Lint yield /plant (g)
Plant height (cm)	—	0.1471	-0.0814	0.0773	0.1801*	0.2653**	0.1487	0.0941	0.1169	-0.1329	0.0661	0.0306	-0.0939	0.2748**	0.2640**
Days to 50% flowering	0.1819*	—	0.1682*	-0.0800	-0.0328	0.1728*	0.1836*	0.0260	0.0936	0.3308**	-0.1027	0.0302	0.1199	0.0538	0.0589
No. of monopodia /plant	-0.2069*	0.2414**	—	0.3147**	0.3463**	0.0304	0.0732	0.2424**	0.2044*	-0.0319	0.1363	0.0581	0.0427	0.3145**	0.3079**
No. of sympodia/plant	0.1610*	-0.1225	0.1046	—	0.5646**	0.3990**	0.1350	0.3271**	0.2930**	0.0348	0.0473	0.0953	0.0711	0.6989**	0.6979**
No. of bolls/plant	0.3039**	-0.0438	0.2257**	0.2123**	—	0.0312	0.0822	0.2866**	0.2472**	-0.1693*	0.1656*	-0.0335	-0.1457	0.8292**	0.8064**
Boll weight (g)	0.3059**	0.1911*	-0.1081	0.3291**	-0.2618**	—	0.2904**	0.3687**	0.3880**	0.2637**	-0.0838	0.1764*	0.1723*	0.5686**	0.5919**
Ginning out turn (%)	0.1499	0.2254**	0.0134	0.0387	-0.0659	0.2949**	—	0.5308**	0.7605**	0.2835**	-0.0552	0.0406	0.0802	0.2185**	0.2868**
Seed index (g)	0.1220	0.0303	0.1443	0.0548	0.0081	0.2892**	0.5753**	—	0.9458**	0.2087*	-0.0576	-0.0275	0.0891	0.4298**	0.4801**
Lint index (g)	0.1509	0.1088	0.1127	0.0516	-0.0208	0.3250**	0.8169**	0.9469**	—	0.2619**	-0.1987*	-0.0275	0.0900	0.4069**	0.4706**
2.5% span length (mm)	-0.1205	0.3601**	-0.0121	0.0211	-0.2971**	0.2883**	0.3476**	0.2378**	0.3048**	—	-0.1638*	0.4160**	0.6483**	-0.0094	0.0199
Micronaire (10 <sup>-6</sup> g/in)	0.0663	-0.1089	0.2277**	0.0805	0.2916**	-0.0949	-0.1028	-0.2828**	-0.2414**	-0.1627*	—	0.3565**	-0.0470	0.0889	0.0809
Bundle strength (g/tex)	0.0357	0.0250	0.0629	0.1382	-0.0603	0.1925*	0.0586	-0.0902	-0.0465	0.4585**	0.4329**	—	0.3763**	0.0714	0.0797
Uniformity ratio	-0.3185**	0.2532**	0.0534	0.2367**	-0.4485**	0.4440**	0.3208**	0.3181**	0.3562**	0.9245**	-0.0210	0.7724**	—	-0.0274	-0.0083
Seed cotton yield/plant (g)	0.4909**	0.0853	0.1049	0.4309**	0.6446**	0.5693**	0.1626**	0.2103**	0.2167**	-0.0602	0.1718*	0.1009	-0.0794	—	0.9927**
Lint yield/plant (g)	0.4764**	0.0976	0.1113	0.4471**	0.5985**	0.6076**	0.2749**	0.3034**	0.3272**	-0.0121	0.1556	0.1187	-0.0424	0.9891**	—

\* 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 50 genotypes of cotton (*G. hirsutum* L.).**

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 (%)	Seed index	Lint index (g)	2.5% span-length (mm)	Micronaire (10 <sup>-6</sup> g/in)	Bundle strength (g/tex)	Uniformity ratio	Lint yield /plant (g)
Plant height (cm)	—	0.0012	-0.0006	0.0006	0.0014	0.0021	0.0012	0.0007	0.0009	-0.0011	0.0005	0.0002	-0.0007	0.0021
Days to 50% flowering	-0.0002	—	-0.0002	0.0001	0.0000	-0.0003	-0.0003	0.0000	-0.0001	-0.0005	0.0002	0.0000	-0.0002	-0.0001
No. of monopodia /plant	-0.0011	0.0022	0.0130	0.0041	0.0045	0.0004	0.0010	0.0031	0.0027	-0.0004	0.0018	0.0008	0.0006	0.0040
No. of sympodia/plant	0.0007	-0.0007	0.0029	0.0092	0.1524	0.0037	0.0012	0.0030	0.0027	0.0003	0.0004	0.0009	0.0007	0.0064
No. of bolls/plant	0.0486	-0.0089	0.0935	0.1524	0.2699	0.0084	0.0222	0.0774	0.0667	-0.0457	0.0447	-0.0090	-0.0393	0.2177
Boll weight (g)	0.0450	0.0293	0.0052	0.0677	0.0053	0.1696	0.0492	0.0625	0.0658	0.0447	-0.0142	0.0299	0.0292	0.1004
Ginning out-turn (%)	-0.0026	-0.0032	-0.0013	-0.0023	-0.0014	-0.0050	-0.0173	-0.0092	-0.0132	-0.0049	0.0010	-0.0007	-0.0014	-0.0050
Seed index (g)	0.0014	0.0004	0.0035	0.0047	0.0041	0.0053	0.0077	0.0144	0.0137	0.0030	-0.0035	-0.0008	0.0013	0.0069
Lint index (g)	-0.0067	-0.0053	-0.0116	-0.0167	-0.0141	-0.0221	-0.0433	-0.0539	-0.0570	-0.0149	0.0113	0.0016	-0.0051	-0.0268
2.5%Span length (mm)	0.0001	-0.0004	0.0000	0.0000	0.0002	-0.0003	-0.0003	-0.0002	-0.0003	-0.0011	0.0002	-0.0005	-0.0007	0.0000
Micronaire (10 <sup>-6</sup> g/in)	-0.0006	0.0010	-0.0013	-0.0004	-0.0016	0.0008	0.0005	0.0022	0.0019	0.0015	-0.0094	-0.0033	0.0004	-0.0008
Bundle strength (g/tex)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
Uniformity ratio	0.0006	-0.0008	-0.0003	-0.0005	0.0009	-0.0011	-0.0005	-0.0006	-0.0006	-0.0041	0.0003	-0.0024	-0.0064	0.0001
Lint yield/plant (g)	0.1816	0.0405	0.2117	0.4800	0.5546	0.4070	0.1972	0.3302	0.3237	0.0137	0.0556	0.0548	-0.0057	0.6877
Correlation with seed cotton yield /plant (g)	0.2748**	0.0538	0.3145**	0.6989**	0.8292**	0.5686**	0.2185**	0.4298**	0.4069**	-0.0094	0.0889	0.0714	-0.0274	0.9927**

\* Significant at 5% level, \*\* Significant at 1% level, Residual effect = 0.0759, diagonal values indicate direct effects

Table 3. Direct and indirect effects (genotypic) of yield components on seed cotton yield per plant in 50 genotypes of cotton (*G. hirsutum* L.)

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 (%)	Seed index	Lint index (g)	2.5% span-length (mm)	Micronaire (10 <sup>-6</sup> g/in)	Bundle strength (g/tex)	Uniformity ratio	Lint yield /plant (g)
Plant height (cm)	<b>-0.453</b>	-0.0082	0.0094	-0.0073	-0.0138	-0.0138	-0.0068	-0.0055	-0.0068	0.0055	-0.0030	-0.0016	0.0144	-0.0216
Days to 50% flowering	-0.0083	<b>-0.0454</b>	-0.0110	0.0056	0.0020	-0.0087	-0.0102	-0.0014	-0.0049	-0.0163	0.0049	-0.0011	-0.0115	-0.0044
No. of monopodia /plant	-0.0056	0.0065	<b>0.0270</b>	0.0028	0.0061	-0.0029	0.0004	0.0039	0.0030	-0.0003	0.0062	0.0017	0.0014	0.0030
No. of sympodia/plant	-0.0057	0.0044	-0.0037	<b>-0.0357</b>	-0.0076	-0.0117	-0.0014	-0.0020	-0.0018	-0.0008	-0.0029	-0.0049	-0.0084	-0.0160
No. of bolls/plant	0.5111	-0.0737	0.3796	0.3571	<b>1.6820</b>	-0.4404	-0.1109	0.0136	-0.0350	-0.4997	0.4905	-0.1014	-0.7544	1.0066
Boll weight (g)	0.4977	0.3109	-0.1758	0.5354	-0.4259	<b>1.6269</b>	0.4798	0.4705	0.5287	0.4691	-0.1544	0.3132	0.7223	0.9884
Ginning out-turn (%)	0.0242	0.0363	0.0022	0.0062	-0.0106	0.0475	<b>0.1612</b>	0.0927	0.1317	0.0560	-0.0166	0.0094	0.0517	0.0443
Seed index (g)	0.0004	0.0001	0.0005	0.0002	0.0000	0.0010	0.0019	<b>0.0033</b>	0.0032	-0.0008	-0.0009	-0.0003	0.0011	0.0010
Lint index (g)	-0.0080	-0.0058	-0.0060	-0.0027	0.0011	-0.0173	-0.0435	-0.0504	<b>-0.0532</b>	-0.0162	0.0128	0.0025	-0.0189	-0.0174
2.5%Spanlength (mm)	0.0220	-0.0658	0.0022	-0.0038	0.0543	-0.0527	-0.0635	-0.0434	-0.0557	<b>-0.1827</b>	0.0297	-0.0838	-0.2314	0.0022
Micronaire (10 <sup>-6</sup> g/in)	-0.0048	0.0078	-0.0164	-0.0058	-0.0210	0.0068	0.0074	0.0204	0.0174	0.0117	<b>-0.0720</b>	-0.0312	0.0015	-0.0112
Bundle strength (g/tex)	0.0027	0.0019	0.0048	0.0105	-0.0046	0.0147	0.0045	-0.0069	-0.0035	0.0349	0.0329	<b>0.0761</b>	0.0588	0.0090
Uniformity ratio	-0.0166	0.0132	0.0028	0.0123	-0.0233	0.0231	0.0167	0.0165	0.0185	0.0659	-0.0011	0.0402	<b>0.0520</b>	-0.0022
Lint yield/plant (g)	-0.4730	-0.0969	-0.1105	-0.4438	-0.5941	-0.6031	-0.2729	-0.3012	-0.3248	0.0120	-0.1545	-0.1178	0.0421	<b>-0.9927</b>
Correlation with seed cotton yield/plant(g)	<b>0.4909**</b>	<b>0.0853</b>	<b>0.1049</b>	<b>0.4309**</b>	<b>0.6446**</b>	<b>0.5693**</b>	<b>0.1626*</b>	<b>0.2103**</b>	<b>0.2167**</b>	<b>-0.0602</b>	<b>0.1718*</b>	<b>0.1009</b>	<b>-0.0794</b>	<b>0.9891**</b>

\* = Significant at 5% level, \*\* = Significant at 1% level, diagonal values indicate direct effects

sympodia per plant, number of bolls per plant, boll weight, ginning out turn, seed index and lint index and with Reddy *et al.*, 2015 for lint yield per plant. At genotypic level, micronaire showed significant negative effect on seed cotton yield per plant.

Significant and positive correlations at both levels were also observed among the component characters themselves like that of plant height with number of bolls per plant, boll weight (Ranjan *et al.*, 2014) and lint yield; days to 50% flowering with monopodia per plant & boll weight (Ranjan *et al.*, 2014), ginning out turn and 2.5% span length; monopodia per plant with number of bolls per plant (Kumar *et al.*, 2014); number of sympodia per plant with bolls per plant, boll weight (Abbas *et al.*, 2014) and lint yield; number of bolls per plant with micronaire and lint yield; boll weight with ginning out turn, seed index, lint index, 2.5 % span length, bundle strength, uniformity ratio and lint yield; ginning out turn with seed index, lint index, 2.5 % span length and lint yield (Dahiphale *et al.*, 2014); seed index with lint index, 2.5 % span length (Kumar *et al.*, 2014) and lint yield; lint index with 2.5 % span length and lint yield (Kumar *et al.*, 2014); 2.5 % span length with bundle strength and uniformity ratio; micronaire with bundle strength (Abbas *et al.*, 2014), bundle strength with uniformity ratio.

Path coefficient analysis (Table 3) revealed that at genotypic level number of bolls per plant (1.6820) exerted highest positive direct effect on seed cotton yield per plant followed by boll weight (1.6269), ginning out turn (0.1612), bundle strength (0.0761), uniformity ratio (.0520), number of monopodia per plant (0.0270) and seed index (0.0033). These results were in accordance with the results of Asha *et al.* (2015) for number of bolls per plant, boll weight and uniformity ratio and with that of Tulasi *et al.* (2012) for ginning out turn and seed index.

At genotype level lint yield per plant, 2.5% span length, micronaire value, lint index, plant height, days to 50% flowering and number of sympodia per plant exerted negative direct effect on seed cotton yield per plant. Similar results were reported by Reddy *et al.* (2015) for lint index, plant height, days to 50% flowering and number of sympodia per plant and Vinodhana *et al.* (2013) for 2.5% span length and micronaire value.

The correlation and path coefficient analysis revealed that major emphasis should be laid on balancing between yield component traits *i.e.*, number of bolls per plant and boll weight for the improvement of seed cotton yield per plant without sacrificing desirable fiber quality traits.

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