

## **Character association and path analysis of seed cotton yield and its component characters in cotton (*Gossypium* spp.)**

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**ABSTRACT :** Eighty one cotton genotypes were evaluated to investigate the association of different characters and their contribution to kapas yield. Character association studies indicated significant positive association of characters *viz.*, bolls/plant, boll weight, harvest index and micronaire with seed cotton yield. Hence selection of these characters would be possible to improvement in the *kapas* yield in development of high yielding genotypes in cotton. Studies of path analysis indicated that characters *viz.*, monopodia/plant, sympodia/plant, bolls/plant, boll weight, harvest index, lint index, bundle strength, micronaire and uniformity ratio had direct contribution towards seed cotton yield. Study of correlations in combination with path analysis provides better understanding of characters contribution and their association in prediction of higher yields in cotton are the main criteria for selection programme.

**Key words:** Cotton, correlations, path analysis

The lint bearing species of the genus *Gossypium*, the true cottons, are four, out of which the diploid ( $2n = 26$ ) species *G. arboreum* and *G. herbaceum* are indigenous in Asia and Africa. The history of introduction into India of the new world cottons (tetraploid species of *G. hirsutum* and *G. barbadense* with  $2n = 52$ ) dates back to the 18<sup>th</sup> century AD. India had gained a pride place in the global cotton statistics with the largest cropped area of 12.19 million ha in 2011-2012, growing the most diverse cultivars in terms of botanical species and composition, producing the widest range of cotton fiber quality suitable for spinning 6's to 120's counts yarn, and supporting the largest agro based national industry of the country. Cotton (*Gossypium hirsutum* L.) is one of the important commercial crops of the world and among the fibre crops it is considered as the king. India is the second largest producer in the world with 371 lakh bales and productivity of 481 kg lint/ha and forms the backbone of Indian Textile Industry. In Andhra Pradesh cotton is being grown in an area of 18.54 lakh hectares with a production and productivity of 54.50 lakh bales and 499.7 kg lint/ha, respectively.

Knowledge on the association between

seed cotton yield and its component traits are essential in crop improvement programme for efficient selection. Seed cotton yield is a complex character controlled by several component characters and is highly influenced by the environment. Hence selection based on yield alone may limit the improvement where as the yield component characters are complex in inheritance and influenced by the environment. Correlations in combination with path analysis would give a better insight into cause and effect relationship between different pairs of characters.

### **MATERIALS AND METHODS**

The experiment was conducted at Regional Agricultural Research Station Lam, Guntur, Andhra Pradesh located at an altitude of 31.5m above MSL. Geographically this location is at latitude of 16°2'N and longitude of 80°3'E. The soils are black cotton type with clay texture. Five diverse cotton genotypes of *G. hirsutum*. *viz.*, 241-4-2, G Cot 100, RFS 3438, 65-2(s)-3, Hysp 152

(*G.hirsutum*) and one of *G.barbadense* Suvin were selected as basic material for the study. During *kharif*, 2009, a total of 15 single cross hybrids were produced by crossing six parents in a half diallel fashion. The seed of fifteen half diallel single cross hybrids were sown along with six parents during *kharif* 2010 and sixty three way cross hybrids were obtained by using 15 single crosses as females and six parents as males. Six parents, fifteen single crosses and sixty three-way crosses were utilized for the present investigation which were evaluated during *kharif*, 2011. Observations were recorded on five representative plants on characters *viz.*, monopodia/plant, sympodia/plant, bolls/plant, boll weight (g), ginning percentage (%), seed index (g), lint index (g), 2.5 per cent span length (mm), micronaire ( $10^{-6}$ g/inch), bundle strength (g/tex), uniformity ratio, seed cotton yield per plant (g) and harvest index (%).

## RESULTS AND DISCUSSIONS

The data collected from the experimental material have been analyzed for variance studies.

It was found that considerable level of genetic variability among the genotypes for most of the characters studied. The ANOVA revealed that most of the characters were statistically significant (Table 1).

Character association (genotypic) studies indicated that significant positive association of characters *viz.*, bolls/plant, boll weight, harvest index lint index, ginning outturn and uniformity ratio with seed cotton yield (Table 2). Whereas bolls/plant, boll weight, harvest index and micronaire recorded significant positive correlations (phenotypic) with seed cotton yield (Table 3). On study of correlation coefficients revealed that the values of genotypic correlation coefficients were higher than phenotypic correlation coefficients for characters like bolls/plant, boll weight, lint index and ginning outturn indicating that these characters were free from environmental influence and most reliable. These results are in confirmatory with earlier findings of Sambamurthy *et al.*, (2006), Eswar (2008), Shazia Salahuddin *et al.*, (2010). Hence selection of these characters would be more effective to achieve improvement in seed cotton

**Table 1.** Analysis of variance of RBD for yield and yield attributing characters among six parents, 15 single crosses and 60 three way crosses

S. No	Character	Replications d.f =2 (Mean squares)	Treatments d.f = 80 (Mean squares)	Error d.f. = 160	CD (p=0.05%)	CD (p=0.01%)	CV(%)
1	Monopodia/plant	0.302 <sup>NS</sup>	0.3198 <sup>NS</sup>	0.1648	0.72	0.96	20.06
2	Sympodia/plant	110.929 <sup>NS</sup>	4.4738 <sup>NS</sup>	4.3934	-	-	9.10
3	Bolls/plant	1845.81 <sup>**</sup>	187.375 <sup>**</sup>	48.00	11.98	16.03	13.56
4	Boll weight(g)	1.554 <sup>**</sup>	1.244 <sup>**</sup>	0.393	0.75	1.01	11.55
5	Seed cotton yield/plant(g)	41026.9 <sup>**</sup>	4832.9 <sup>**</sup>	1495.40	59.07	79.04	17.04
6	Harvest index	0.8409 <sup>**</sup>	0.1158 <sup>**</sup>	0.5498	0.03	0.05	6.86
7	Seed index (g)	0.1251 <sup>NS</sup>	4.316 <sup>**</sup>	0.1380	0.71	0.96	4.02
8	Lint index (g)	0.1411 <sup>NS</sup>	1.1305 <sup>**</sup>	0.3999	0.28	0.38	3.31
9	Ginning outturn	0.5424 <sup>NS</sup>	7.6752 <sup>**</sup>	1.3634	1.70	2.28	3.15
10	2.5 per cent Span length (mm)	3.3612 <sup>NS</sup>	31.5031 <sup>**</sup>	4.6309	3.49	4.68	6.87
11	Bundle strength (g/tex)	31.0127 <sup>**</sup>	14.8015 <sup>**</sup>	3.2326	2.81	3.76	6.94
12	Micronaire ( $10^{-6}$ g/inch)	0.8992 <sup>NS</sup>	0.5084 <sup>NS</sup>	0.4988	-	-	6.84
13	Uniformity ratio	3.7528 <sup>NS</sup>	7.2725 <sup>**</sup>	3.6955	3.24	4.34	4.06

Significant at 5 per cent level, Significant at 1 per cent level

**Table 2.** Genotypic correlation coefficients among thirteen characters in 81 genotypes of cotton

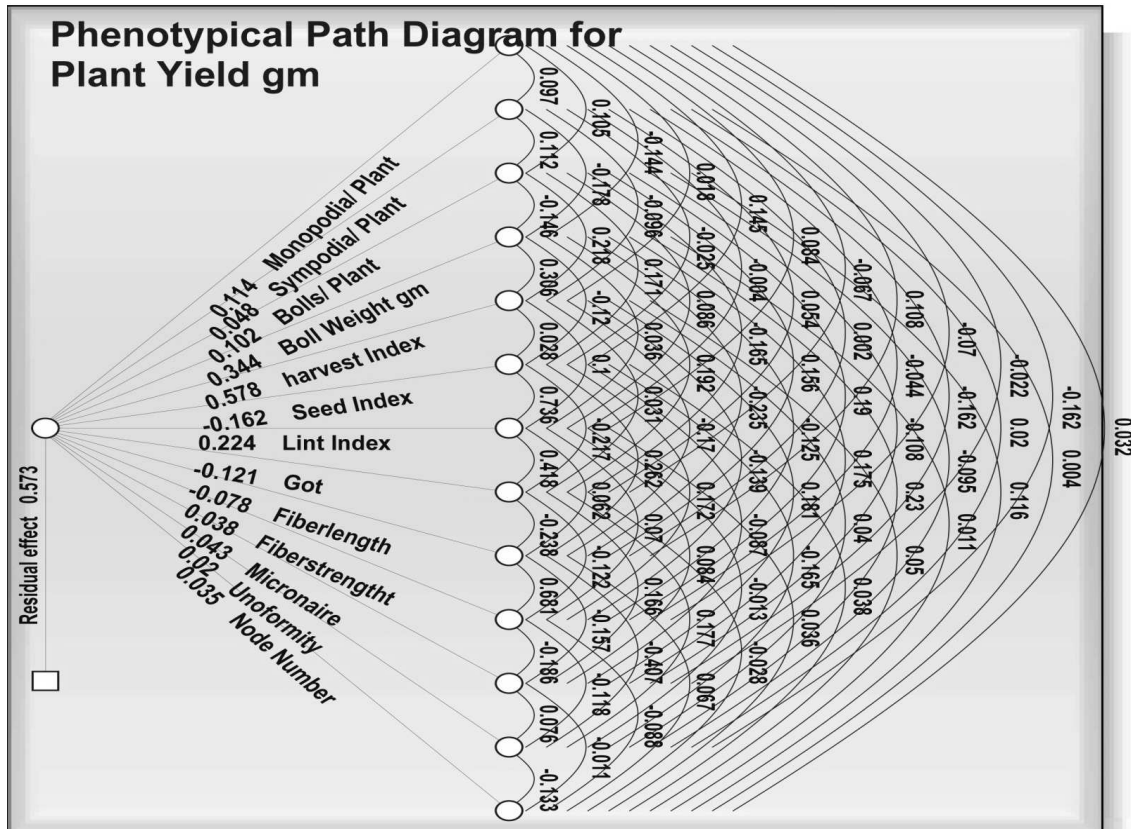
Characters	Mono- podia/ plant	Sym- podia/ plant	Bolls/ plant	Boll weight (g)	Harvest boll	Seed index (g)	Lint index (g)	GOT	2.5 per cent span length (mm)	Bundle strength (g/tex)	Micronaire (10 <sup>-6</sup> g/ inch)	Uni- formity ratio	Seed cotton yield/ plant
Monopodia/plant	1.0000	0.1054	0.5652**	-0.6312**	-0.4910**	0.4269**	0.2368**	-0.3208**	0.1677*	-0.10879	0.0542	-0.5043**	-0.2500**
Sympodia/plant	1.0000	1.0000	-0.3111**	-0.1764	0.0791	0.0160	0.0867	0.0289	0.0111	0.2240**	0.7479**	0.1352	-0.2085**
Bolls/plant	1.0000	1.0000	1.0000	-0.5783**	0.5785**	0.3334**	0.2083**	-0.2581**	0.3394**	0.1293	-0.3819**	-0.4354**	0.5453**
Boll weight (g)	1.0000	1.0000	1.0000	1.0000	0.6206**	-0.1929**	0.1497*	0.5427**	-0.6159**	-0.3675**	-0.0683	0.7224**	0.9258**
Harvest index	1.0000	1.0000	1.0000	1.0000	1.0000	0.0532	0.2855**	0.4498**	-0.6150**	-0.3991**	-0.1047**	0.2310**	0.6605**
Seed index (g)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.7964**	-0.1784*	0.3787**	0.2917**	0.3166**	-0.3232**	0.0158
Lint index (g)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.4250**	-0.1064	0.0988	-0.0840	-0.0156	0.2754**
2.5 per cent span length (mm)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.3478**	-0.3456**	0.4980**	0.4292**
Bundle strength (g/tex)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.1000	0.7111**	-0.5267**	-0.4485**
Micronaire(10 <sup>-6</sup> g/inch)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9571**	0.9009**	-0.8069**	-0.5778**
Uniformity	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-1.0052**	-1.6121**
												1.0000	0.3955**

\* Significant at 5 per cent level, \*\*Significant at 1 per cent level

**Table 3.** Phenotypic correlations of yield and yield attributing characters in 81 genotypes of cotton

Characters	Mono- podia/ plant	Sym- podia/ plant	Bolls/ plant	Boll weight (g)	Harvest boll	Seed index (g)	Lint index (g)	GOT	2.5 per cent span length (mm)	Bundle strength (g/tex)	Micronaire (10 <sup>-6</sup> g/ inch)	Uni- formity ratio	Seed cotton yield/ plant
Monopodia/plant	1.0000	0.0967	0.1045	-0.1441*	0.0184	0.1450*	0.0839	-0.0674	0.1083	-0.0704	-0.0224	-0.1624*	0.0799
Sympodia/plant	1.0000	1.0000	0.1121	-0.1782*	-0.0958	-0.0255	-0.0036	0.0536	0.0017	-0.0441	-0.1621	0.0200	-0.0579
Bolls/plant	1.0000	1.0000	1.0000	-0.1458*	0.2177**	0.1712*	0.0858	-0.1654*	0.1562*	0.1896**	-0.1079	-0.0974	0.1994**
Boll weight(g)	1.0000	1.0000	1.0000	1.0000	0.3064**	-0.1201	0.0359	0.1921**	-0.2346**	-0.1254	0.1747*	0.2297**	0.5112**
Harvest index	1.0000	1.0000	1.0000	1.0000	1.0000	0.0280	0.1000	0.0314	-0.1704*	-0.1387*	0.1813**	0.0401	0.7356**
Seed index (g)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.7361**	-0.2173**	0.2616**	0.1725*	-0.0868	-0.1648*	0.0176
Lint index (g)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.4176**	0.0623	0.0705	0.0840	-0.0132	0.1454
GOT	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	-0.2375**	-0.1220	0.1661*	0.1770*	0.0938
2.5 per cent Span length(mm)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.6808**	-0.1569*	-0.4069**	-2151**
Bundle strength(g/tex)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.1000	-0.1862**	-0.1184	-0.1398*
Micronaire(10 <sup>-6</sup> g/inch)	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0759	0.2053**
Uniformity ratio	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.1232

\* Significant at 5% level, \*\* Significant at 1% level



**Fig.1.** Phenotypic path diagram for seed cotton yield

yield in development of high yielding varieties/ hybrids in cotton. Whereas characters, monopodia/plant, seed index, lint index, ginning outturn and uniformity ratio had shown positive correlations with seed cotton yield/plant which are in confirmation with earlier results of Karunakar Raju (2005), Eswar (2008) and Vijayalaxmi *et al.*, (2008),

Partitioning the phenotypic correlation coefficients into direct and indirect effects on seed cotton yield and its component traits per plant were estimated through path analysis at phenotypic level presented in Tables 3 and the phenotypic path diagrams are given in Fig 1. The results revealed that characters monopodia/plant, sympodia/plant, bolls/plant, boll weight, harvest index, lint index, bundle strength, micronaire and uniform ratio had direct positive effects on seed cotton yield/plant. Direct selection of these

characters would be most effective for the improvement of seed cotton yield per plant. These results are in confirmation with earlier findings of Neelima *et al.*, (2005), Kaushik and Kapoor (2006), Vijayalaxmi *et al.* (2008), Ashokkumar and Ravikesavan (2010), Kaliyaperumal Ashok Kumar (2010), Shazia Salahuddin *et al.*, (2010) and Srinivasulu *et al.*, (2010). Hence these studies would be utilized for understanding dependence of various characters and their contribution towards production of higher seed cotton yield in development of commercial varieties or hybrids.

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**Table 4.** Direct and indirect effects (phenotypic) of yield attributing traits on seed cotton yield per plant in 81 genotypes of cotton

Characters	Mono- podia/ plant	Sym- podia/ plant	Bolls/ Plant	Boll weight (g)	Harvest Boll	Seed index (g)	Lint index (g)	2.5 per cent span length (mm)	Bundle strength (g/tex)	Micronaire (10 <sup>-6</sup> g/ inch)	Uni- formity ratio	Seed cotton yield/ plant
Monopodia/plant	<b>0.1143</b>	0.0111	0.0120	-0.0165	0.0021	0.0166	0.0096	-0.0077	0.0124	-0.0080	-0.0026	-0.0186
Sympodia/plant	0.0046	<b>0.0476</b>	0.0053	-0.0085	-0.0046	-0.0012	-0.0002	0.0026	0.0001	-0.0021	-0.0077	0.0010
Bolls/plant	0.0107	0.0115	<b>0.1023</b>	-0.0149	0.0223	0.0175	0.0088	-0.0169	0.0160	0.0194	-0.0110	-0.0097
Boll weight (g)	-0.0495	-0.0612	-0.0501	<b>0.3436</b>	0.1053	-0.0413	0.0123	0.0660	-0.0806	-0.0431	0.0000	0.0789
Harvestindex	0.0106	-0.0545	0.1259	0.1771	<b>0.5781</b>	0.0162	0.0578	0.0182	-0.0985	-0.0802	0.1048	0.0232
Seed index (g)	-0.0234	0.0041	-0.0277	0.0194	-0.0045	<b>-0.1617</b>	-0.1190	0.0351	-0.0423	-0.0279	0.0140	0.0266
Lint index (g)	0.0188	-0.0008	0.0192	0.0081	0.0224	0.1648	<b>0.2240</b>	0.0935	0.0140	0.0158	0.0188	-0.0029
Ginning outturn	0.0081	-0.0065	0.0199	-0.0231	-0.0038	0.0242	-0.0503	<b>-0.1205</b>	0.0286	0.0147	-0.0200	-0.0213
2.5 per cent spanlength (mm)	-0.0085	-0.0001	-0.0122	0.0184	0.0134	-0.0205	-0.0049	0.0186	<b>-0.0784</b>	-0.0534	0.0123	0.0319
Bundle strength(g/tex)	-0.0027	-0.0017	0.0073	-0.0048	-0.0053	0.0066	0.0027	-0.0047	0.0261	<b>0.0384</b>	-0.0072	-0.0045
Micronaire(10 <sup>-6</sup> g/inch)	-0.0010	-0.0069	-0.0046	0.0075	0.0077	-0.0037	0.0036	0.0071	-0.0067	-0.0079	<b>0.0427</b>	0.0032
Uniformity	-0.0033	0.0004	-0.0019	0.0046	0.0008	-0.0033	-0.0003	0.0036	-0.0082	-0.0024	0.0015	<b>0.0201</b>
Seed cotton yield(g)	0.0799	-0.0579	0.1994	0.5112	0.7356	0.0176	0.1454	0.0938	-0.2151	-0.1398	0.2053	0.1232
PartielR <sup>2</sup>	0.0091	-0.0028	0.0204	0.1756	0.4252	-0.0029	0.0326	-0.0113	0.0169	-0.0054	0.0088	0.0025

R square = 0.6714, Residual effect = 0.5732

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