



Research Note

Variability and association studies for yield and yield components in upland cotton (*Gossypium hirsutum* L.) under red chalka soils

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Abstract

Studies conducted with 60 cotton genotypes for yield components and fibre quality traits under red chalka soil revealed high genotypic coefficient of variation and genetic gain for number of bolls, boll weight, ginning out turn, lint yield and seed cotton yield and these traits could be improved by simple selection. Correlation and path analysis studies revealed that seed cotton yield is highly influenced by lint yield. Significant positive association exists between number of bolls per plant, boll weight, ginning out turn, bundle strength, lint yield and seed cotton yield. Lint yield registered high order positive direct effect on seed yield. The present study signified the importance of number of bolls per plant, boll weight along with lint yield for overall improvement of seed cotton yield.

Key words:

Cotton, correlation coefficient, path analysis, fibre quality

Cotton is one of the most important cash crops in India. The cotton production of the country is high but the productivity is still lower than that of other countries. Cotton is predominantly grown in black soils, but in peninsular India, especially in Andhra Pradesh, other crops being not equally remunerative to that of cotton, cotton is grown in considerable area in red Chalka soils also. These soils have low water holding capacity, in seasons of low precipitation, cotton crop is exposed to frequent droughts and thus low yields are being realised. Keeping in view, the ample scope to sustain productivity in this cropping pattern, the present investigation has been undertaken with 60 genotypes of *Gossypium hirsutum* in red chalka soil to assess and to understand the degree and direction of association of various traits with seed cotton yield and to study the direct and indirect contribution of different traits to seed cotton yield.

The experimental material consists of 60 genotypes received under All India Coordinated Research Improvement Project in Cotton. The experiment was conducted in Randomized Block Design with three replications at Gorrekunta Farm, Regional Agricultural Research Station, Warangal during *khariif* 2010. The inter and intra row spacing adopted was 90 x 60 cm. Each plot consisted of one row of 6 meter length. Recommended package of practices and plant protection measures were adopted to raise a good crop. Observations were recorded on five randomly selected plants from each genotype per replication for Number of bolls per plant, Boll weight (g), Lint yield per plant (g) and Seed cotton yield per plant (g), where as 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 analysed at CIRCOT, Regional Unit, Lam, Guntur.

The mean value of all the biometrical traits were taken for statistical analysis. From mean values. Variability parameters were computed using standard statistical procedures as per Johnson *et al.* (1955). Genotypic and phenotypic correlation coefficients were estimated as per Falconer (1964) and path coefficient analysis was also done (Dewey and Lu, 1959).

Genetic variability: The variability available in breeding material is the prime requirement for improvement and selection of elite genotypes. In the present study, high phenotypic and genotypic coefficient of variation estimates were recorded for number of bolls per plant, boll weight, lint yield and seed cotton yield per plant (Table 1), while remaining traits recorded low coefficient of variation at both levels. High heritability values were recorded for all the traits, where as high genetic advance has been observed for number of bolls per plant, boll weight, ginning out turn, lint yield per plant and seed cotton yield per plant. High heritability coupled with high genetic advance were observed for the traits *viz.*, number of bolls, boll weight, ginning out turn, lint yield per plant and seed cotton yield per plant which revealed predominance of additive gene action indicating scope for selection for the improvement through these characters. High heritability with moderate genetic advance was observed for span length, micronaire value, bundle strength and fibre elongation indicating the predominance of both additive and non additive genes. High heritability and low genetic advance was observed for the trait uniformity ratio revealing little scope for improvement through selection for this traits.



Correlation studies: Correlation coefficient studies revealed that genotypic correlation coefficient values in general were higher than phenotypic values. Genotypic correlation coefficients are given in Table 2. Number of bolls per plant, boll weight, ginning out turn, bundle strength and lint yield per plant showed significant positive correlation with seed cotton yield. Similar results were reported by Tuteja *et al.*, (2006), Leela Pratap *et al.*, (2007), Vijayalaxmi *et al.*, (2008) and Srinivasulu *et al.*, (2010). The association between span length, micronaire uniformity ratio, fibre elongation and seed cotton yield was non significant. Number of bolls per plant had positive association with lint yield per plant (Dedaniya and Pethani, 1994). Boll weight showed significant positive association with lint yield and micronaire. Similar observations were reported by Murthy *et al.*, (2006). 2.5% span length showed significant positive association with bundle strength and micronaire. Micronaire value showed positive significant association with uniformity ratio and lint yield. These findings are in accordance with that of Padmavathi (2008). The correlation analysis revealed that the number of bolls, boll weight and lint yield should be given due weightage in selection process for seed cotton yield improvement.

Path analysis: Path coefficient analysis (Table 3& 4) revealed that lint yield per plant recorded high order positive direct effect on seed cotton yield followed by boll weight and number of bolls per plant. Similar results were reported by Leela Pratap *et al.*, (2007). Moderate positive direct effects on seed cotton yield was expressed by ginning out turn, span length and micronaire. Whereas characters *viz.*, bundle strength, uniformity ratio and fibre elongation registered negative direct effect on seed cotton yield. Similar results were reported by Padmavathi (2008) for ginning out turn and fibre elongation.

In the present study, the association and path coefficients revealed that major emphasis should be given to yield traits such as number of bolls per plant and boll weight along with lint yield

balancing with other quality traits for overall improvement of seed cotton yield.

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Table 1. Estimates of variability parameters in *G. hirsutum* for yield and quality traits

Character	Variance		Coefficient of Variation		Heritability (Broad sense)	Genetic advance (% of mean)
	PV	GV	PCV	GCV		
Number of bolls per plant	45.22	41.82	36.25	34.86	92.48	69.05
Boll weight (g)	0.72	0.68	27.37	26.60	94.44	53.21
Ginning out turn (%)	21.00	18.00	14.34	13.27	85.71	25.40
2.5% Span length (mm)	6.05	5.82	10.01	9.82	96.19	19.84
Micronaire value (10^{-6} g/in)	0.18	0.14	8.72	7.69	77.77	14.15
Bundle strength (g/tex)	3.88	3.81	9.79	9.71	98.19	19.86
Uniformity ratio (%)	4.88	4.20	4.56	4.23	86.06	8.09
Fibre elongation (%)	0.22	0.14	10.30	8.22	63.63	13.51
Lint yield per plant (g)	16.81	16.11	23.63	23.13	95.83	46.65
Seed cotton yield per plant (g)	109.42	98.85	23.46	22.30	90.33	43.66

PV-Phenotypic variance: GV-Genotypic variance: PCV-Phenotypic coefficient of variation: GCV-Genotypic coefficient of variation.

Table 2. Genotypic correlation coefficient for different character pairs of *Gossypium hirsutum* genotypes

Character	BW	GOT	2.5%SL	Micronaire	BS	UR	FE	LYP	SCYP
NBPP	-0.15	0.10	0.20	0.19	0.26	-0.20	-0.08	0.28**	0.292**
BW		-0.26**	0.02	0.36**	-0.16	0.10	-0.07	0.28**	0.802**
GOT			-0.04	0.18	-0.11	0.05	0.08	0.43**	0.425**
2.5%SL				0.32**	0.39**	0.03	-0.12	0.14	0.066
Micronaire					-0.16	0.32**	0.15	0.18*	0.185
BS						-0.19**	-0.20**	0.35**	0.328**
UR							0.71**	0.12	0.181
FE								0.07	0.044
LYP									0.922**

NBPP- Number of bolls per plant; BW-Boll weight (g); GOT-Ginning out turn (%); SL-2.5% Span length (mm); BS-Bundle strength (g/tex); UR-Uniformity ratio (%); FE-Fibre elongation (%); LYP-Lint yield per plant (g); SCYP-Seed cotton yield per plant (g)

*,** significant at 5% and 1% respectively



Table 3. Phenotypic path coefficients of various traits influencing seed cotton yield

Character	NBPP	BW	GOT	2.5%SL	Micronaire	BS	UR	FE	LYP	rp SCYP
NBPP	0.105	-0.001	-0.022	0.001	0.000	0.001	0.000	0.001	0.582	0.223**
BW	0.001	0.125	-0.016	0.000	0.001	0.000	0.000	0.000	0.249	0.647**
GOT	0.009	-0.023	0.015	-0.002	0.000	0.001	0.001	0.001	0.025	0.409**
2.5%SL	0.000	0.003	0.085	0.015	0.000	-0.001	-0.005	-0.001	0.034	0.078
Micronaire	0.002	0.002	0.030	-0.032	0.001	0.001	0.002	0.000	0.282	0.159
BS	0.000	0.002	0.020	0.001	0.000	-0.007	-0.002	-0.003	-0.081	0.258**
UR	0.003	0.003	-0.024	-0.003	0.001	0.001	0.003	0.001	0.072	0.125
FE	-0.001	0.000	0.003	0.001	-0.001	-0.004	-0.001	-0.005	0.126	0.101
LYP	0.004	0.003	-0.006	0.000	0.000	0.001	0.001	0.001	0.825	0.909**

NBPP- Number of bolls per plant; BW-Boll weight (g); GOT-Ginning out turn (%); SL-2.5% Span length (mm); BS-Bundle strength (g/tex); UR-Uniformity ratio (%); Fe-Fibre elongation (%); LYP-Lint yield per plant (g); SCYP-Seed cotton yield per plant (g)

*,** significant at 5% and 1% respectively

Table 4. Genotypic path coefficients of various traits influencing seed cotton yield

Character	NBPP	BW	GOT	2.5%SL	Micronaire	BS	UR	FE	LYP	rg SCYP
NBPP	0.325	-0.014	-0.016	0.006	0.020	-0.012	0.001	0.014	0.549	0.292**
BW	-0.022	0.429	-0.028	0.002	0.009	0.008	0.002	0.001	0.252	0.802**
GOT	-0.031	-0.041	0.056	-0.003	0.008	-0.003	0.000	0.005	-0.027	0.425**
2.5%SL	0.012	0.012	-0.042	0.045	-0.031	0.019	-0.003	-0.001	0.002	0.066
Micronaire	0.112	0.042	0.029	-0.031	0.040	-0.012	0.002	0.010	0.250	0.185
BS	-0.072	0.043	-0.010	0.014	-0.018	-0.029	-0.001	-0.042	-0.102	0.328**
UR	0.017	0.008	0.032	-0.031	0.038	0.016	0.009	0.015	0.087	0.181
FE	-0.001	-0.006	-0.010	0.006	-0.004	0.044	-0.002	-0.028	0.142	0.044
LYP	0.312	0.080	-0.019	0.001	0.022	-0.002	0.000	0.018	0.669	0.922**

NBPP- Number of bolls per plant; BW-Boll weight (g); GOT-Ginning out turn (%); SL-2.5% Span length (mm); BS-Bundle strength (g/tex); UR-Uniformity ratio (%); Fe-Fibre elongation (%); LYP-Lint yield per plant (g); SCYP-Seed cotton yield per plant (g); rg-genotypic correlation

Diagonal values are direct effects, other values are indirect effects: Residual effect=0.285

*,** significant at 5% and 1% respectively