



## Genetic variability in cotton (*Gossypium barbadense*) genotypes for seed cotton yield and its yield components

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Cotton (*Gossypium barbadense* L.) is the most widely used vegetable fibre and also the most important raw material for the textile industry. Pima cotton or Egyptian cotton (*G. barbadense*) is known for its high length and better other fibre properties being cultivated in less than 2% in the world (Chen *et al.* 2007). In the recent past, there is a heavy demand for extra long staple cotton in Indian textile industry. The current production of extra long staple cotton is only 0.5 million bales, but the requirement of long and extra long staple cotton of textile mills is 0.9 million bales/annum. The balance is met through imports. Attempts have been made to identify high yielding extra long staple *G. barbadense* genotypes with desirable fibre properties.

Seed cotton yield is a complex trait governed by several

yield-contributing characters such as plant height, number of monopodia, number of sympodia, number of bolls/plant. In cotton, genotypic and phenotypic variation for different agronomic and fibre quality characters such as plant height, number of monopodia, number of sympodia, number of bolls, seed index, lint index, micronaire and seed cotton yield has been extensively studied by several workers (Ahuja and Tuteja 2000, Neelam and Potdukhe 2002, Sakthi *et al.* 2007). The genetic improvement of cotton crop is dependent upon the existence of initial genetic variability among the populations. Therefore, the initial variability and the degree and directions of correlations amongst yield attributes are the prerequisite, while aiming at a rational genetic improvement in economic yield through selection approaches

Table 1 Mean, range and genotypic, phenotypic and environmental variances for various characters in *G. barbadense* genotypes

Character	Mean	Range	Variances		
			Genotypic ( $\sigma^2_g$ )	Phenotypic ( $\sigma^2_p$ )	Environmental ( $\sigma^2_e$ )
Plant height (cm)	72.6	58.0–89.3	0.03	0.02	0.01
Days to 50% flowering	65.3	54.2–73.0	70.12**	54.80 **	3.16
Nodes/plant	6.71	4.5–71.2	30.93*	4.97	23.14
Monopodia/plant	1.2	0.6–1.8	0.16	0.23	8.92
Sympodia/plant	13.4	10.3–15.5	4.05	9.13	20.69
Bolls/plant	52.0	39.5– 73.7	17.06*	12.97*	22.70
Fruiting point/plant	54.1	46.2–69.4	119.30 **	67.96**	17.36
Seed index	5.7	3.3–7.5	0.94	1.05	8.95
Lint index	3.6	2.9–4.4	9.13	5.19	11.06
Ginning percentage	30.2	28.4–33.3	53.58**	29.54	3.33
2.5% S L (mm)	34.0	30.0–37.1	43.20**	31.85 *	7.81
Mic value (mm)	3.3	3.0–4.2	0.19	0.22	13.86
Maturity coefficient	0.6	0.2–0.8	10.02*	7.01	9.08
Bundle strength	26.3	21.0–29.0	36.04**	27.85*	10.01
Seed cotton yield (g)	33.6	29.0–37.5	38.77**	18.42*	14.52

\* $P = 0.05$ , \*\* $P = 0.01$

\*Short note

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in diversified populations. Taking this into consideration, a field experiment was conducted during 2005–06 and 2006–07 at Regional Station, Central Institute for Cotton Research,

, Coimbatore in a randomized block design with three replications. Each genotype was sown in three rows of 6 m length with spacing of 90 cm×60 cm. Recommended package of practices and plant protection measures were adapted to raise a good crop. Observations were recorded on five randomly selected plants in each plot of every replication for seed cotton yield (g/plant) and other agronomic, viz plant height (cm), number of nodes/plant, days to 50% flowering, monopodia/plant, sympodia/plant, bolls/plant, fruiting points/plant, seed index (g), lint index (g), and fibre quality characters such as ginning out turn (%), 2.5% span length (mm), bundle strength (g/tex), micronaire value (μ/inch) and maturity ratio as per the standard procedure. From the mean values of each character, variability, heritability and correlations were estimated as per the procedure outlined by Singh and Chaudhary (1977).

Analysis of variance revealed high genotypic and phenotypic coefficients of variation for days to 50% flowering (70.1 and 54.8), ginning outturn (53.5 and 29.54), 2.5% span length (43.2 and 31.8), bundle strength (36.0 and 27.8) and number of bolls/plant (17.0 and 12.9) and seed cotton yield (38.7 and 18.4) indicating ample scope for genetic improvement of these traits through selection. The observed variability (phenotypic variance) was partitioned into heritable (genotypic variance) and non-heritable (environmental variance) components (Table 1). This variation among the population reflects the diverse origin and distribution of the genotypes. Similar results were reported by Girase and Mehetre (2002) and Subba Reddy and Nadarajan (2006) for number of bolls/plant; Rao and Reddy (2001) and Neelam and Potdukhe (2002) for 50% flowering and seed cotton yield, Rao and Reddy (2001) for ginning percentage and 2.5% span length.

The genotypic, phenotypic and environmental coefficients of correlation showed that the genotypic correlations were higher than the phenotypic and environmental ones for most of the characters exhibiting high degrees of genetic association among the traits under consideration. Our results confirm the findings of Neelam and Potdukhe (2002). Their study on different genotypes of upland cotton revealed that the genotypic correlation coefficients for all the characters studied were higher than the phenotypic and environmental correlation coefficients.

High heritability coupled with high genetic advance was observed for seed cotton yield, days to flowering, number of bolls/plant indicating the possibility of improvement of these traits through selection. These results are in conformity with those of Rao and Reddy (2001) for number of sympodia and bolls/plant, Ahuja and Tuteja (2000), Subba Reddy and Nadarajan (2006) and Sakthi *et al.* (2007) for seed cotton yield. High heritability accompanied with high genetic gain indicate that these traits are under the control of additive gene action and directional selection for these traits in genetically diverse material could be effective for desired

Table 2 Genotypic and phenotypic coefficients of correlation between yield and its components of 25 *G. barbadense* genotypes

Character	Plant height (cm)	Nodes/plant	Days to 50% flowering	Monopod/plant	Sympods/plant	Bolls/plant	Seed index	Lint index	GOT (%)	2.5% SL (mm)	B S g/tex	Mic value (μ/inch)	Maturity ratio	Seed cotton yield (g)
Plant height (cm)	1	-0.3635	-0.4635	-0.2913	-0.2052	-0.2729	-0.3244*	0.0521	0.5924*	-0.0365	0.05931*	-0.8324	0.8602	-0.5126*
Nodes/plant	-0.3504	1	0.3966*	0.6936*	-0.0012	0.0419*	-0.04923	-0.0659	-0.07726	-0.25502	-0.2975	0.1013	0.5521	-0.5182
Days to 50% flowering	-0.3528	0.2840	1	0.9221*	-0.3818*	-0.1449	-0.3056*	-0.5641*	-0.3624*	0.7342*	0.2840*	-0.3412	0.6213*	0.2136
Monopodia/plant	-0.1456	0.4241*	0.5067*	1	0.1904	0.4840*	-0.4425	-0.4036*	-0.1.624	0.5123*	0.0264	-0.2434	0.4125	-0.3324
Sympodia/plant	-0.1614	-0.0219	-0.3264	-0.1741	1	0.7401*	0.8921*	0.8861*	0.3241*	0.0764	0.0316	0.1534	0.2321	0.5631*
Bolls/plant	-0.4887*	0.7401*	0.4016*	0.4288*	0.2483	1	0.3102	0.3309*	-0.0961	0.2413*	0.0934*	-0.3214*	0.3425*	0.6516*
Seed index	-0.3021	0.0298	-0.3082	0.1655*	0.7443*	0.4826*	1	0.8047*	-0.0361	0.2861*	0.3455*	0.0726	0.2113	-0.6924
Lint index	0.0679	-0.0059	-0.3887*	-0.1138*	0.7068*	0.4357	0.9024*	1	0.5211*	-0.0530	-0.1342	0.3026	0.3784	0.7154*
GOT (%)	0.5872*	-0.0938	-0.2523	0.0006	0.1881	0.0079	0.0723	0.6234	1	-0.4637*	-0.9422*	0.6124*	0.3316	0.2113*
2.5% S L (mm)	-0.5519	-0.1672*	0.3492	0.1321*	0.1755*	0.1385	0.0488*	-0.3216	-0.5006*	1	0.7691	-0.7980	-0.0064	-0.0642
B S (g/tex)	-0.5335*	0.0895	-0.2751	0.0428	0.0791	0.1183	0.0768	0.1852	0.2642*	-0.2342	1	0.5712*	0.5024	0.5342*
Mic. value (mm)	0.1018	0.3596	0.3754*	0.3675*	0.1510	0.4238*	0.1953*	0.2269	0.2534	-0.0324	-0.5261*	1	-0.2562*	0.4552*
Maturity ratio	0.3847	-0.2957	0.2191	-0.0574	0.4868*	0.2154	0.2264*	-0.1435*	-0.5216	0.5342*	-0.3221	-0.4623	1	-0.1214
Seed cotton yield (g)	-0.0396	0.3729*	0.0453*	0.2373*	0.4868*	0.1068*	0.1124*	0.5431*	0.0531	0.0822	0.1342	0.3846*	0.7215*	1

P=0.05

genetic improvement.

Seed cotton yield was positively correlated with number of bolls/plant (0.6516) and which indicated that higher mean values for these traits can increase the seed cotton yield. Positive correlation of seed cotton yield with number of sympodia (0.5631) and number of bolls/plant (0.6516) showed that these characters would increase indirectly associated with yield, whereas number of monopodia (-0.3324) and number of nodes/plant (-0.5182) may lead to have low yield (Table 2). The magnitude of genotype correlation coefficients for most of the characters was higher than the corresponding phenotypic ones. It was observed that number of bolls/plant, seed index and lint index were positively correlated with seed cotton yield/plant and they are intercorrelated with each other. Our results confirm the findings of Rao and Reddy (2001) and Subba Reddy and Nadarajan (2006). Positive and correlation of sympodial branches with boll number (0.7401), seed index (0.8921) and lint index (0.8861) was observed. Plant height had negative correlation with number of monopodia (-0.2913), number of node/plant (-0.3635). The ginning percentage exhibited negative correlation with bundle strength (-0.9422). However, fibre length showed positive and significant correlation with fibre bundle strength (0.7691) as it was reported by Rao and Reddy (2001). The magnitude of genotypic correlation coefficients for most of the character was higher than the corresponding phenotypic ones. The genetic improvement in cotton is possible through selection exercised for those characters which showed high values of GCV, PCV, heritability and genetic advance. As the seed cotton yield showed positive correlation with several yield-contributing characters such as number of fruiting points/plant and boll number/plant etc; there is an ample scope for the genetic improvement of *G. barbadense* genotypes.

#### SUMMARY

A study was carried out during rainy season 2006–07 with 25 genotypes of cotton to study the genetic variability, heritability and genetic advance for seed cotton yield and its yield attributes. High genetic differences were recorded for

nodes/plant, sympodia, bolls as well as fruiting points/plant, seed cotton yield, lint index, indicating ample scope for genetic improvement of these characters through selection. High heritability coupled with high genetic advance has also recorded for yield and most of the yield components as well as fibre quality traits. Sympodia/plant, fruiting point/plant, number of nodes/plant, number of bolls/plant, and lint index were positively correlated with seed cotton yield/plant and appeared to be interrelated with each other. It is suggested that these characters could be considered as selection criteria in improving the seed cotton yield of *G. barbadense* genotypes.

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