J. Cotton Res. Dev. **36**(1), 54-58 (January, 2022) **ISSN No. 0972-8619**

Genotypic and phenotypic correlation analysis among seed cotton yield and fibre quality traits in cotton (*Gossypium hirsutum* L.)

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Abstract : The study was undertaken to find out the association between seed cotton yield, its component traits and fibre quality characters in upland cotton (*Gossypium hirsutum* L.). Fifty genotypes of upland cotton were sown in a randomized block design with three replications at the Research Area of Cotton Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar during *kharif*, 2020. Seed cotton yield exhibited a highly significant positive correlation at genotypic level with number of monopods (0.674), number of bolls (0.937), boll weight (0.533), seed index (0.725), ginning outturn (0.422 and 0.326), fibre length (0.587), fibre uniformity (0.560) and fibre strength (0.380). It showed non significant correlation with days to 50 per cent flowering and fibre fineness. There was a strong association of fibre length with fibre uniformity (1.007) and fibre strength (0.686) at both genotypic and phenotypic level. However, it had non significant correlation with fibre fineness at both the levels.

Keywords : Correlation, fibre, quality, seed cotton, traits, yield

Cotton is one of the most important and extensively grown cash crops in the world. It is also known as “King of Fibres” or “White Gold” which plays a dominant role in the industrial and agricultural economy of the country (Ranganatha *et al.*, 2013). Cotton provides employment and sustenance to a population of nearly 60 million people, who are involved directly or indirectly in cotton production, processing, textiles and related activities. The genus *Gossypium* consists of 50 species. Out of these four species *viz.*, *Gossypium arboreum*, *G. herbaceum*, *G. hirsutum* and *G. barbadense* are cultivated in India. The *G. hirsutum* also known as upland cotton has long staple cotton, it has occupied nearly 95 per cent of the global land area of cotton production because of its wider adaptability and high lint yield. (Sun *et al.*, 2019)

Improvement in the yield is the prime objective of plant breeding in any crop improvement programme and this can be targeted through gaining the knowledge of component traits that are linked with yield. Seed cotton yield itself being a complex trait; polygenic in inheritance, more prone to environmental fluctuations than other characters. Seed cotton yield also depends upon the component traits like bolls, boll weight, monopodia, sympodia etc. These characters exhibit various types of correlation to each other. Therefore, direct selection for seed cotton yield itself may not be effective in improving the production and productivity without improving its component traits. Information of association of seed cotton yields with its component traits is essential for improvement in seed cotton yield. Correlation at phenotypic level indicates the extent of the visual observation having relation between two characters while genotypic correlation provides an estimate of genetic association between the genes controlling any two characters (Pujer *et al.*, 2014; Nikhil *et al.*, 2018). Development of cotton varieties with high yield and superior fibre quality is a fundamental objective of many cotton improvement programmes. Hence, the objective of the present study was to find out the association between various yield and fibre quality traits to facilitate indirect selection in cotton (Angadi *et al.*, 2016).

MATERIALS AND METHODS

The investigation was carried out at the Research Area of Cotton Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar during *kharif* 2020. The study was planned with fifty diverse genotypes of upland cotton. The experiment was laid out in randomized block design (RBD) with three replications. Observations were recorded on three randomly selected plants from each line in each replication for 14 characters *viz.*, days to first flower, days to 50 per cent flowering, plant height (cm), monopods, bolls and seeds/boll, boll weight (g), seed cotton yield/plant (g), ginning outturn (%), seed index (g), fibre length (mm), fibre strength (g/tex), fibre uniformity index (%) and fibre fineness (mic). Genotypic and phenotypic correlation coefficients were calculated from the genotypic and phenotypic variance and covariance as suggested by Johnson *et al.*, (1955).

RESULTS AND DISCUSSION

The analysis of variance revealed that the mean sum of squares due to genotypes were highly significant for all the characters (Table 1). This indicated that the genetic material selected for the present study was appropriate and a lot of genetic diversity was present among the genotypes under study. Similar findings were also reported by Kaushik and Kapoor (2006); Sakthi *et al.*, (2007), Rasheed *et al.*, (2009); Soomro *et al.*, (2010); Kumar *et al.*, (2019) and Reddy *et al.*, (2019). It was observed that genotypic correlation coefficients among the various characters were greater than phenotypic correlation coefficients indicating a strong inherent association between the various traits studied. The phenotypic expression of correlation was lessened under the influence of environment. Association analysis was done for seed cotton yield with its components traits and fibre quality traits.

Results obtained from this study indicated that seed cotton yield/plant had highly significant positive correlation with monopods (0.674 and 0.600), bolls (0.937 and 0.797), boll weight (0.533 and 0.435), seed index (0.725 and 0.615) and ginning outturn (0.422 and 0.326) at both the genotypic and phenotypic level, respectively. However, it showed non significant correlation with days to 50 pre cent flowering (Table 2). Plant height also exhibited significant positive correlation with seed cotton yield/plant. Monopods had highly significant and positive association with bolls/plant (0.596 and 0.552), seed index (0.413 and 0.352), boll weight (0.378

Table 1. Analysis of variance for various morphological characters and fibre quality traits

	1	2	3	4	5	6	7	
Source of variation	D.F	PH cm	DFF	FPF	NMP	NBP	BW (g)	SCYP (g)
Replication	2	239.76	0.83	23.33	0.121	19.127	0.193	30.77
Treatment	49	485.17**	9.246*	6.0**	2.158**	308.774**	0.308**	3567.39**
Error	98	112.93	0.813	1.15	0.069	11.86	0.037	204.642

PH- plant height, DFF- days to first flower, FPF- fifty percent flowering, NMP- number of monopods, NBP- number of bolls, BW- boll weight, SCYP- seed cotton yield per plant

		8	9	10	11	12	13	14
Source of variation	D.F	SI(g)	NSB	GOT(%)	FL(mm)	UI (%)	FS(g/tex)	FF(µg/inch)
Replication	2	0.029	0.021	1.005	0.028	0.694	0.057	0.016
Treatment	49	1.305**	19.3*	12.5**	3.749**	1.674**	3.911**	0.24**
Error	98	0.06	0.1	1.744	0.147	0.225	0.014	0.01

SI- seed index, NSB- number of seeds per boll, GOT- ginning out turn, FL- fibre length, UI- uniformity index, FS- fibre strength, FF- fibre fineness

Table 2: Genotypic (above diagonal) and phenotypic (below diagonal) correlations of seed cotton yield and its component traits

Characters	Plant height	Days to 50 per cent flowering	Monopods	Bolls	Boll weight	Seed cotton yield	Seed index	Ginning outturn
Plant height	1.000	-0.029NS	0.775**	0.638**	0.559**	0.784**	0.658**	0.455**
Days to 50 pre cent Flowering	-0.040NS	1.000	0.105NS	0.040NS	0.083NS	0.024NS	-0.166*	0.275**
Monopods	0.553**	0.060NS	1.000	0.596**	0.378**	0.674**	0.413**	0.315**
Bolls	0.457**	0.025NS	0.552**	1.000	0.081NS	0.937**	0.627**	0.384**
Boll weight	0.360**	0.031NS	0.299**	0.062NS	1.000	0.533**	0.382**	0.354**
Seed cotton yield	0.584**	0.035NS	0.600**	0.797**	0.435**	1.000	0.725**	0.422**
Seed index	0.456**	-0.104NS	0.352**	0.565**	0.326**	0.615**	1.000	0.101NS
Ginning outturn	0.270**	0.185*	0.259**	0.295**	0.202*	0.326**	0.053NS	1.000

** Highly significant positive correlation, * Significant positive correlation

Table 3: Genotypic (above diagonal) and phenotypic correlations (below diagonal) for fibre quality characters

Characters	Fibre length	Fibre uniformity	Fibre strength	Fibre fineness	Seed cotton yield/plant
Fibre length	1.0	1.007**	0.686**	-0.064NS	0.587**
Fibre uniformity	0.809**	1.0	0.662**	-0.019NS	0.560**
Fibre strength	0.645**	0.546**	1.0	0.341**	0.380**
Fibre fineness	-0.045NS	-0.036NS	0.318**	1.0	0.062NS
Seed cotton yield/plant	0.476**	0.436**	0.344**	0.056NS	1.0

** Highly significant positive correlation, * Significant positive correlation

and 0.299) and ginning outturn (0.315 and 0.259) at both genotypic and phenotypic levels, respectively. It was also reported that ginning outturn (GOT) had a significant and positive correlation with seed cotton yield (0.422 and 0.326), bolls/plant (0.384 and 0.295), boll weight (0.354 and 0.202) and days to 50 per cent flowering (0.275 and 0.185) at both genotypic and phenotypic level, respectively. The results obtained from this study confirmed the findings of Kowsalya and Raveendran (1996); Sambamurthy (1999); Neelam and Potdukhe (2002); Muthuswamy and Vivekanandan (2004); Rajamani *et al.*, (2013); Pujer *et al.*, (2014); Asha *et al.* (2015); Reddy *et al.*, (2019) and Sahar *et al.*, (2021).

Correlation studies for fibre quality parameters showed that, seed cotton yield/plant was positively and significantly associated with fibre length (0.587 and 0.476), fibre uniformity (0.560 and 0.436) and fibre strength (0.380 and 0.344) both at the genotypic and phenotypic level, respectively. However, it showed non significant correlation with fibre fineness (Table 3). There was a strong association of fibre length with fibre uniformity (1.007 and 0.809) and fibre strength (0.686 and 0.645) at both genotypic and phenotypic level, respectively. However, it had non significant correlation with fibre fineness at both the levels. These results were in agreement with the findings of Chaudhari *et al.*, (2017). They also reported significant positive correlation of seed cotton yields with fibre lenth, fibre uniformity and fibre strength. Similar observations of correlation between seed cotton yield and upper half of mean length was made by Sahar *et al.*, (2021). However, Rao and Gopinath (2013) and Pujer *et al.*, (2014) found negative association of seed cotton yield with fibre length.

Fibre strength had highly significant positive correlation with seed cotton yield, fibre length and fibre uniformity. Pujer *et al.*, (2014) also reported the positive correlation of fibre strength with seed cotton yield. Fibre uniformity had strong significant positive correlation with seed cotton yield/plant, fibre length and fibre strength. However, there was non significant correlation with fibre fineness. Chaudhari *et al.*, (2017) observed that span length had positive and highly significant association with fibre strength, while span length and fibre strength negatively

correlated with fibre fineness. Similar observations were reported by the Thiyagu *et al.*, (2010).

CONCLUSION

According to the association analysis it had been concluded that seed cotton yield had highly significant positive correlation with monopods and bolls/plant, boll weight, ginning outturn and fibre length. Therefore, these characters are the most essential component for improving seed cotton yield. Hence, selection for these traits would be quite effective in improving the seed cotton yield in upland cotton.

REFERENCES

Angadi, C, Manjula, S. M., Patil, S. S., Madhura, C., Basavaradder, A. B. and Santosh, H. B. 2016. Correlation and path coefficient analysis of yield component and fibre quality traits of upland cotton (*Gossypium hirsutum* L.). *Int. J Agric. Sci. Res.*, **6** : 171-76.

Asha, R., Ahamed, M. L., Babu, D. R. and Kumar, P. A. 2015. Character association and path coefficient analysis for yield and component traits in upland cotton. *J. Cotton Res. Dev.*, **29** : 31-35.

Chaudhari, M. N., Faldu, G. O., and Ramani, H. R. 2017. Genetic variability, correlation and pathcoefficient analysis in cotton (*Gossypium hirsutum* L.). *Adv. Biores.*, **8** : 226-33.

Johanson, H. W., Robinson, H. and Comstock, R. E. 1955. Genetic and phenotypic correlations in soybean and their implications in selection. *Agron. J.*, **47**: 477 – 83.

Kaushik, S. K. and Kapoor, C. J. 2006. Genetic variability and association study for yield and its component traits in upland cotton (*Gossypium hirsutum* L.). *J. Cotton Res. Dev.*, **20** : 185-90.

Kowsalya, R. and Raveendran, T. S. 1996. Correlation and path coefficient analysis in cotton. *Madras Agri. J.*, **83**: 705-06.

Kumar, C. P. S., Raju, S., Rajan, R. E. B., Muraleedharan, A. and Suji, D. B. 2019. Studies on genetic variability, heritability and genetic advance in cotton (*Gossypium hirsutum* L.). *Plant Arch.*, **19** : 618-20.

Muthuswamy, A. and Vivekanandan, P. 2004. Correlation studies on seed cotton yield and its components in *hirsutum* cotton (*Gossypium hirsutum* L.). *J. Ind. Soc. Cotton Imp.*, **29** : 7-9.

Neelam, G. D. and Potdukhe, N. R. 2002. Studies on variability and correlations in upland cotton for yield and its components. *J. Ind. Soc. Cotton Imp.*, **27** : 148-52.

Nikhil, P. G., Nidagundi, J. M. and Anusha, H. A. 2018. Correlation and path analysis studies of yield and fibre quality traits in cotton (*Gossypium hirsutum* L.). *J. Pharmaco. Phytochem.*, **7** : 2596-99.

Pujer, S., Siwach, S. S., Deshmukh, J., Sangwan, R. S. and Sangwan, O. 2014. Genetic variability, correlation and path analysis in upland cotton (*Gossypium hirsutum* L.). *Elect. J. Plant Breed.*, **5** : 284-89.

Ranganatha, H. M., Patil, S. S., Manjula, S. M. and Arvindkumar, B. N. 2013. Genetic variability studies in segregating generation of upland cotton (G. *hirsutum* L.). *Mol. Plant Breed.*, **4**: 84-88.

Rao, P. J. M. and Gopinath, M. 2013. Association

analysis of yield and fibre quality characters in upland cotton (*Gossypium hirsutum* L.). *Aust J. Basic Appl. Sci.*, **7**: 787-90.

Rasheed, A., Malik, W., Khan, A. A., Murtaza, N., Qayyum, A. and Noor, E. 2009. Genetic evaluation of fiber yield and yield components in fifteen cotton (*Gossypium hirsutum*) genotypes. *Int. J. Agri. Biol.*, **11**: 581-85.

Reddy, B., Nimbal, S., Sangwan, R. S. Kumar, P., S. and Jangid, K. 2019. Genetic parameters, correlation and path analysis of agro morphological traits in elite genotypes of upland cotton (*Gossypium hirsutum* L.). *Int. J. Chem. Std.*, **7** : 1885-89.

Sahar, A., Zafar, M. M., Razzaq, A., Manan, A., Haroon, M., Sajid, S. and Youlu, Y. U. A. N. 2021. Genetic variability for yield and fiber related traits in genetically modified cotton. *J. Cotton Res.*, **4** : 1-10.

Sakthi, A. R., Kumar, M. and Ravikesavan, R. 2007. Variability and association analysis using morphological and quality traits in cotton (*Gossupium hirsutum* L.). *J. Cotton Res. Dev.*, **21** : 148-52.

Sambamurthy, J. S. V. 1999. Character association and component analysis in upland cotton. *Madras Agri. J.*, **86**: 39-42.

Soomro, Z. A., Kumbhar, M. B., Larik, A. S., Imran, M. and Brohi, S. A. 2010. Heritability and selection response in segregating generations of upland cotton. *Pak. J. Agri. Res.*, **23** : 25-30.

Sun. Z., Xingfen, W., Zhengwen, L.I.U., Qishen, G.U., Yan, Z., Zhikun, L.I., Huifeng, K.E., Jun, Y., Jinhua, W.U., Liqiang, W.U., Guiyin, Z. and Zhiying, M.A. 2019. Evaluation of the genetic diversity of fibre quality traits in upland cotton (G*ossypium hirsutum* L.) inferred from phenotypic variations. *J. Cotton. Res.*, **2** : 1-8.

Thiyagu, K., Nadarajan, N., Rajarathinam, S., Sudhakar, D., and Rajendran, K. 2010. Association and path analysis for seed cotton yield improvement in interspecific crosses of cotton (*Gossypium* spp). *Elect. J. Plant Breed.*, **1** : 1001-05.

Received for publication : October 19, 2021
Accepted for publication : December 5, 2021