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Study of correlation analysis of seed cotton yield with yield attributing traits in upland cotton

HIMANSHI SARASWAT, SONIKA* AND OMENDER SANGWAN

Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar- 125004

**Email : Sonikabhankhar@gmail.com*

Abstract : Assessment of available germplasms is the most vital step in developing a crop variety or improving an existing one for a particular character. In the current study, 50 upland cotton genotypes were evaluated for analysis of correlation coefficient. When the correlation between two characters is positive and significant in nature, then improvement of one trait leads to the significant improvement of another trait. It was found that seed cotton yield exhibited positive association with traits *viz.*, plant growth habit, weight of seed, bolls/plant, lint index, monopods/plant, plant height, ginning per cent, days to 1st flower, gossypol (%), protein (%) and sugar (%) and negative association with number of seed/locule and Tannin (%). Convincingly, correlation of different traits with one another can be utilized in cotton breeding programs for further improvement of seed cotton yield.

Keywords: Cotton, genotypes, seed cotton yield, upland cotton

Cotton (White Gold) has been established as the most significant cash crop and the backbone of the global textile industry (Zafar *et al.*, 2022).Cotton crop has boosted Indian economy by providing raw material for manufacturing sector and generating employment directly or indirectly for 60 million people (Saritha and Patil, 2020). In cotton, four cultivated species are present and India is the only country where all these four species are being cultivated. Cotton is sensitive to biotic, a biotic stresses and environment fluctuations. In India cotton crop productivity is low as compared to other countries which mainly due to lack of irrigation facilities at critical stages, poor plant stand, injudicious input use, outbreak of insect pests, lack of good quality seed, non-availability of superior hybrids/varieties, adverse weather conditions and most important, lack of real time information technologies (Sangwan *et al.*, 2022). The success in any breeding programme depends upon the nature and magnitude of genetic variability which provides better chances of selecting desired plant types. The knowledge of interrelationships between different traits is important in breeding for direct and indirect selection of characters that are not easily measured and has low heritability. Some of the characters are highly associated among themselves and with seed yield. The analysis of the relationships among these characters and their associations with seed yield is essential to establish selection criteria. Cotton seed yield depends on contributing traits and better understanding aids to researchers to minimize the yield penalty factors. So the present investigation was conducted to investigate the extent of genetic variability and association of seed yield with other component characters. Correlation analysis determine the association between yield and its components traits thus help in selection of traits that are positively associated with yield.

The present investigation consisting of fifty elite lines of upland cotton (Table 1.) (*Gossypium hirsutum* L.) was conducted at Research Area of Cotton Section, Department of Genetics and Plant Breeding CCS HAU, Hisar, Haryana during *kharif* 2021. The experimental material was sown in a randomized block design with three

replications by maintaining distance of 67.5 cm between rows and of 30 cm between plants. Standard package of practices and plant protection measures were taken to raise a good crop stand. Observations were recorded on five randomly selected plants for each genotype/replication for the traits *viz.*, Plant height (cm), seed cotton yield/plant (g), weight of seed cotton/boll (g), ginning outturn (%), seed index (g), bolls/plant, locules/boll, seeds/locule, lint index (g), Days to first flower and monopods/plants. Along with that biochemical parameter namely, gossypol content (%), phenol content (%), sugar content (%), tannin content (%) and protein content (%) were recorded. Correlation coefficients at both genotypic and phenotypic levels were computed as per the standard statistical method suggested by Al-Jibouri *et al.*, (1958).

Correlation analysis measures the degree and direction of relationship between the traits which helps in understanding the nature and magnitude of association among yield and its component traits. In the present study, genotypic correlations reflects (Table 2.) higher magnitude than their corresponding phenotypic correlations indicating the highly heritable nature of traits and might be due to favourable environmental influence on the genotypic expression. This may be due to the relative stability of genotypes as majority of them were subjected to certain amount of selection (Johnson *et al.*, 1955).

Computation of correlation between yield and its attributing traits is of considerable importance in plant selection. Seed cotton yield exhibited positive and highly significant association at genotypic as well as phenotypic level with plant growth habit (0.248 and 0.235), weight of seed cotton (0.379 and 0.372), number of bolls/plant (0.915 and 0.913), lint index (0.261 and 0.226) and monopods/plant (0.310 and 0.279) concluded in accordance with the study conducted by Neelima *et al.*, 2008, Preetha and Raveendran 2007, Manonmani *et al.*, 2019. but positive and significant association with seed index (0.183 and 0.179) and positive association with traits *viz.*, Plant height (0.092 and 0.089), ginning per cent (0.145 and 0.11), days to first flower (0.053 and 0.049), Gossypol (%) (0.095 and 0.093), Protein % (0.054 and 0.048), and sugar % (0.054 and 0.044), similar conclusion were recorded by Kaushik and Kapoor (2006).

Seed cotton yield exhibited negative and highly significant association with number of locule/ball at genotypic level but negative and significant association at phenotypic level and with trait Tannin % (-0.204 and -0.199) negative and significant at both genotypic and phenotypic level. Traits *viz.*, seed/locule (-0.049 and -0.032), and phenol % (-0.005 and -0.051) exhibited negative and significant association with seed

Table 1. List of elite genotypes of upland cotton

S. No.	GENOTYPE	S. No.	GENOTYPE	S. No.	GENOTYPE	S. No.	GENOTYPE
1	Acala 1517	14	AR 37	27	Gregg male sterile	40	N 46
2	Atlas	15	H 1316	28	H 1353	41	REBA B 50
3	Auburn	16	Badnawar	29	216 F	42	Russian hirsutum
4	GTSV 337	17	C 2-3	30	H 655 C	43	SV 7 A
5	AR 27	18	Coker 413-68	31	HG 1-P 625	44	SA 439
6	CSH 1071	19	Combed seed	32	H 1465	45	SA 136-1
7	RS2098	20	Coker	33	IAN 9332	46	S 344
8	CNH 36	21	Deltapine 66	34	IAN 40-10-385	47	Tex Maroon 2-7
9	PIL 8-5	22	Dunn	35	ISC 67	48	Tx ORH 14-1-7850
10	PIL8-7	23	EL 505	36	ISC 6-1-2		
11	AR40	24	RS 2141	37	Locket 4785 cream	49	Tx ORSC 78
12	PKV Rajat	25	DUNN 119	38	GTSV 337	50	Tidewater IC 342
13	Surbhi	26	Gregg 25	39	CA 9941		

Table 2. Correlation analysis of seed cotton yield and attributing traits

	Plant height	Plant growth habit	Seed cotton yield/ plant	seed cotton/ boll	Seed index	Ginning (%)	Bolls/ plant	Locules/ boll	Seed/ locule	Lint index	Days to 1st flower	Monopods/ plant	Gossypol (%)	Protein (%)	Sugar (%)	Phenol (%)	Tannin (%)
Plant height	1	-0.165*	0.089	0.027	0.059	0.152	0.072	0.134	0.281**	0.145	-0.046	-0.133	0.093	-0.02	0.122	-0.389**	0.052
Plant growth habit	-0.180*	1	0.235**	0.121	0.09	0.094	0.212**	-0.138	-0.141	0.124	0.021	0.029	0.039	-0.086	-0.006	-0.125	-0.046
Seed cotton yield/plant	0.092	0.248**	1	0.372**	0.179*	0.11	0.913**	-0.197*	-0.032	0.226**	0.049	0.279**	0.093	0.054	0.044	-0.051	-0.199*
Seed cotton/boll	0.035	0.122	0.379**	1	-0.048	0.064	-0.018	-0.045	0.209*	0.016	-0.195*	-0.011	-0.224**	-0.256**	-0.063	-0.005	-0.116
Seed index	0.062	0.084	0.183*	-0.059	1	0.001	0.211**	0.112	-0.200*	0.730**	-0.046	0.341**	-0.09	0.042	0.108	0.024	0.276**
Ginning (%)	0.16	0.099	0.145	0.077	0.013	1	0.091	0.166*	0.082	0.674**	0.174*	-0.352**	0.122	-0.216**	-0.061	-0.282**	-0.092
Bolls/plant	0.072	0.224**	0.915**	-0.016	0.221**	0.136	1	-0.196*	-0.13	0.233**	0.107	0.288**	0.199*	0.180*	0.078	-0.047	-0.168*
Locules/boll	0.208*	-0.163*	-0.254**	-0.003	0.142	0.316**	-0.265**	1	0.182*	0.171*	0.1	-0.155	0.042	-0.178*	-0.099	-0.024	-0.112
Seed/locule	0.386**	-0.151	-0.049	0.248**	-0.237**	0.12	-0.170*	0.379**	1	-0.074	0.032	-0.086	0.089	-0.188*	-0.133	-0.133	-0.099
Lint index	0.148	0.12	0.261**	0.014	0.789**	0.618**	0.281**	0.285**	-0.079	1	0.067	0.029	0.01	-0.128	0.036	-0.179*	0.151
Days to 1st Flower	-0.048	0.014	0.053	-0.212**	-0.047	0.227**	0.116	0.151	0.058	0.085	1	-0.033	0.143	0.165*	-0.026	0.025	-0.154
Monopods/Plant	-0.159	0.021	0.310**	-0.02	0.396**	-0.421**	0.328**	-0.159	-0.084	0.069	-0.035	1	-0.187*	0.163*	0.095	0.117	0.178*
Gossypol (%)	0.102	0.046	0.095	-0.231**	-0.088	0.164*	0.207*	0.03	0.11	0.023	0.147	-0.217**	1	0.04	0.06	-0.075	-0.188*
Protein (%)	-0.034	-0.094	0.048	-0.269**	0.041	-0.268**	0.180*	-0.259**	-0.223**	-0.15	0.181*	0.217**	0.047	1	0.136	0.098	0.024
Sugar (%)	0.131	0.005	0.054	-0.061	0.118	-0.082	0.09	-0.138	-0.141	0.038	-0.025	0.116	0.063	0.14	1	0.088	0.275**
Phenol (%)	-0.413**	-0.133	-0.057	-0.005	0.021	-0.351**	-0.055	-0.034	-0.172*	-0.207*	0.023	0.137	-0.079	0.105	0.087	1	0.231**
Tannin (%)	0.053	-0.049	-0.204*	-0.119	0.280**	-0.111	-0.173*	-0.144	-0.123	0.162*	-0.159	0.203*	-0.192*	0.025	0.281**	0.232**	1

cotton yield. It means with the increase in seed/locule and phenol (%) lead to significant decrease in seed cotton yield/plant. The information available on association of seed cotton yield with other component characters will provide additional assistance to plant breeders in deciding the selection criteria and developing effective breeding programmes for evolving high yielding varieties.

Plant height exhibited positive and highly significant association with seed/locule (0.386,0.281) and negative and highly significant association with phenol content (0.412,-0.389) which indicates increase in plant height leads to increase in seeds/locule and will lead to decrease in phenol content. Bolls/plant associated positive and highly significant relation with plant growth (0.224,0.212), lint index (0.281,0.233), monopods/plant (0.328,0.288) at both genotypic as well as phenotypic level and positive and significant association with gossypol content at both genotypic level and phenotypic level. Weight of seed cotton/boll indicates positive and highly significant association with number of seed/ locule (0.248, 0.209) which means increase in weight of seed cotton/ball leads to increase in seeds/locule.

CONCLUSION

In order to initiate an effective breeding programme, correlation studies of upland cotton were taken into account, wherein indirect selection of seed cotton yield takes place based on the component traits. Correlation analysis helps in examining the possibilities of improving seed cotton yield through indirect selection of highly correlated component traits. Seed cotton yield had significant and positive correlation with plant growth habit, weight of seed cotton/boll, bolls/plant, lint index and monopods/plant, seed index, plant height, Ginning (%), days to first flower, Gossypol (%) Protein (%) and sugar (%) indicating the improvement in seed cotton yield is due to improvement in one or more of the above component traits. Therefore, selection based on these traits will be rewarding in increasing the seed cotton yield.

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