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Correlation Coefficients and Path Coefficient Analysis of Yield and Yield Attributing Traits in Desi Cotton (*Gossypium herbaceum*)

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ABSTRACT

Background: Cotton is globally important crop valued for its single cell trichome called fibre. Cotton fibre is popularly called as white gold or king of fibre crops. Cotton fibre or seed cotton yield per plant is the economically important traits which is dependent other yield attributing traits and also influenced by the fibre quality traits. So present study was focused on the association of yield and yield attributing and fibre quality traits.

Methods: An experiment was conducted at College of Agriculture, Vijayapur campus during late *kharif* season during 2020-21 to evaluate 145 advanced breeding lines of *desi* cotton along with checks using augmented design in 7 blocks for yield and yield attributing traits. The material used in the study was developed by College of agriculture, Dharwad at Department of Genetics and Plant Breeding. Correlation and path coefficient analysis was conducted for twelve yield and fibre quality traits.

Result: Significant positive correlation of seed cotton yield per plant with boll weight, number of bolls per plant, ginning outturn and fibre fineness was reported, whereas negative significant correlation was reported by days to 50% flowering with seed cotton yield per plant. Path analysis revealed that highest positive direct effect on seed cotton yield per plant was shown by number of bolls per plant followed by boll weight and highest negative direct effect was shown by fibre fineness. Highest indirect effect on seed cotton yield per plant was contributed by. ginning outturn. The traits that are significantly positively correlated and having positive effect on seed cotton yield play a major role in the selection of high yielding seed cotton genotypes.

Key words: Correlation, *Gossypium herbaceum,* Path analysis.

INTRODUCTION

Cotton (*Gossypium* spp.) is an important fibre crop and one of the essentials of mankind after food and fuel and its being cultivated globally. Cotton is popularly known as white gold or king of fibre. crops. Though availability of synthetic fibre is plenty, demand for the natural cotton fibre has never dropped down and has enormous demand from textile and fibre industries. Cotton fibres are single cell trichrome that are originating from the outer epidermal layer of the seed coat. About 20 to 25% of the seed epidermal cells differentiate into spinnable fibres. Out of total 50 species identified in the world, 46 species are wild species and only 4 species are being in cultivation. The first two species represent old world cottons and are also known as Asiatic cottons. The other two are the new world cotton or the tetraploid cotton (2n = 52). India is the only country where all the four species are being cultivated. The diploid cotton (*G. arboreum* and *G. herbaceum* L. 2n= 26) are indigenous to Asia and Africa and are popularly referred to as desi cotton in India.

In India cotton is being cultivated in three different zones, namely; northern zone, central zone and southern zone. Approximately 65% of the cotton is being cultivated under dryland conditions and 35% is under irrigated condition. *G. herbaceum* (L.) popularly known as *desi* cotton, Asiatic cotton or Levant cotton. *Herbaceum* is hardy cotton species and also known for the biotic and abioticstress tolerance. Therefore, the levant cotton can be recommended for adverse climatic conditions and also requires less crop management practices (Kranti, 2015). *G. hirsutum* and *G. barbadense* account for 95% or more of world cotton production. Levant cotton fibre has demand for denim and surgical cotton because of the short staple length and also high absorption capacity. Desi cotton has few advantages over the Bt. Cotton in terms of tolerating biotic and abiotic stresses without much affecting the yield. Desi cotton is deep rooted and have ability to with stand severe drought condition. Unlike the tetraploid cotton the diploid cotton contains higher gossypol which is essential for resistance to insect pests and diseases.

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The current study was conducted on one hundred forty-five advanced breeding lines of herbaceum cotton to study the correlation and path coefficient analysis of twelve yield, yield attributing and fibre quality traits to find their association with seed cotton yield and to use these traits as selection criteria for seed cotton yield improvement.

MATERIALS AND METHODS

The research was taken at College of Agriculture, Vijayapur campus during late *kharif* season during 2020-21 and the experimental material consists of the one hundred forty-five advance breeding lines along with six checks. The crop was sown in the first week of august and the first crop harvest was in the month of April. The material used in the study was developed by College of agriculture, Dharwad at Department of Genetics and Plant Breeding as a part of Bhabha Atomic Research Centre BARC adhoc project on desi cotton. These advanced breeding lines were developed using five parents of which three are varieties of *herbaceum viz.,* 9749 selected for trait boll weight, RDC-88 for fibre fineness and Jayadhar is the popular variety. Two *arboreum* varieties are MDL-2582 selected for boll number and DLSA-17 had good fibre length and fibre strength. Since Jayadhar is having high seed cotton yielding and good fiber quality properties and single crosses were subjected for gamma irradiation to enhance genetic variability. 145 advanced breeding lines were sown in augmented design along with six checks in seven blocks. All the six checks were randomised in each block. All the genotypes and six checks were sownwith spacing of 60 × 30 cm and each genotype sown in two lines of 6 m length. All the recommended package of practices was followed to raise good crop. Five plants from each genotype were selected randomly and labelled for taking observations. Observations were recorded on morpho -physiological, seed cotton yield and fibre quality traits.

Simple correlation coefficients among various traits were calculated using the formula given by Singh and Narayanan, (1993). Path coefficient analysis (Dewey and Lu, 1959) was carried out to decipher the direct and indirect effects of yield attributing and fibre quality traits on seed cotton yield. The biometrical analysis was done using a software IndoStat.

RESULTS AND DISCUSSION

Correlation analysis

Correlation studies was made for 12 parameters and the association between these parameters were enlisted in Table 1. Correlation analysis was performed to realize the degree and direction of association of various yield attributing and fibre quality traits with seed cotton yield and also among themselves. There are many traits which were associated positively or negatively with seed cotton yield per plant. Positive association of several traits with seed cotton yield aids in easy selection for such traits which can have direct effect on the yield and the traits which are associated negatively with seed cotton yield can be avoided during the selection. At phenotypic level significant and positive association of seed cotton yield with number of boll per plant (0.24), boll weight (g) (0.34), micronaire value (µg/inch) (0.08) and GOT (%) (0.44) were recorded. Non-significant positive correlation of seed cotton yield was reported with days to 50 per cent boll opening (0.01), fibre length (0.01) and uniformity index (0.09). Similar findings of significant and positive correlation of seed cotton yield with number of bolls per plant and boll weight was reported by Wadeyar *et al.* (2015); Nikil *et al.* (2018); Pooja *et al.* (2020) and Rehman *et al.* (2020). On the contrary, reports on negative association of seed cotton yield with boll weight and micronaire was given by Pujer *et al.* (2014). Negative association of seed cotton yield was reported with days to 50 per cent square initiation (-0.17), plant height (-0.30) and fibre strength (-0.25). Wadeyar *et al.* (2015) and Jarwar *et al.* (2019) found

Table 1: Phenotypic correlation of yield and fibre quality traits in advance breeding lines of desi cotton (*G. herbaceum*).

	DFSI	DFFL	DFBO	BW (cm)	NB.P	PH (cm)	GOT (%)	FL (mm)	UI (%)	FF (µg/inch)	FS (g/tex)	SCY.P (g)
DFSI	1	0.32**	0.32**	-0.09	-0.02	-0.12	-0.08	0.01	-0.03	0.02	0.03	-0.17
DFFL		1	0.56**	0.08	-0.05	0.16	0.06	0.05	0.17*	0.20*	0.09	0.00
DFBO			1	-0.01	-0.17	0.13	0.10	0.13	0.17*	0.14	0.09	0.01
BW (g)				1	0.07	0.03*	0.14	0.10	0.00	0.02	-0.09	0.37**
NB.P					1	0.20*	0.26*	-0.19*	0.16*	0.30*	0.16	0.24**
PH (cm)						1	0.13	-0.10	0.17*	0.20*	-0.08	-0.30
GOT (%)							1	0.06	0.12	0.05	-0.10	0.44*
FL (mm)								1	0.06	-0.02	0.13	0.01
UI (%)									1	0.90**	0.04	0.09
FF (µg/inch)										1	0.13	0.08*
FS (g/tex)											1	-0.25

* P≤0.05; ** P≤0.01.

DFSI: Days to 50% square initiation, DFFL: Days to 50% flowering, DFBO: Days to 50% boll opening, BW: Boll weight, NB. P: Number of bolls per plant, PH: Plant height (cm), SCY.P: Seed cotton yield per plant (g), GOT: Ginning out turn (%), FL: Fibre length (mm), UI: Uniformity index (%), FF: Fibre fineness (µg/inch), FS: Fibre strength (g/tex).

Table 2: Direct and indirecteffects of different characters on seed cotton yield at phenotypic level in advance breeding lines of desi cotton.

	DFSI	DFFL	DFBO	BW (g)	NB.P	PH (cm)	GOT (%)	FL (mm)	UI (%)	FF (µg/inch)	FS (g/tex)	SCY.P (g)
DFSI	-0.051	-0.017	-0.016	0.005	0.004	0.001	-0.030	-0.005	0.000	0.000	0.000	-0.027
DFFL	-0.020	-0.060	-0.034	-0.005	-0.001	0.004	-0.003	-0.003	-0.001	0.003	0.001	0.015
DFBO	0.007	0.013	0.025	0.000	-0.001	0.003	0.039	0.002	-0.001	0.002	0.002	0.020
BW (g)	-0.029	0.025	-0.003	0.335	0.000	0.001	0.450	-0.004	0.000	-0.001	0.012	0.507**
NB.P	-0.030	-0.008	-0.027	0.010	0.976	0.006	0.329	0.006	-0.002	0.004	-0.299	0.905**
PH (cm)	-0.025	0.034	0.028	-0.005	0.007	0.015	0.306	0.003	-0.002	0.004	0.201	0.334
GOT (%)	-0.024	0.017	0.029	0.041	0.006	0.005	0.315	0.000	-0.001	0.002	0.103	0.337*
FL (mm)	0.000	0.001	-0.004	0.002	-0.003	-0.002	0.004	-0.032	0.000	0.001	0.000	0.374
UI (%)	0.000	-0.003	0.000	0.000	0.004	0.004	0.124	-0.002	-0.007	0.016	0.001	0.128
FF (µg/inch)	-0.001	-0.014	0.011	0.002	0.004	0.004	0.097	-0.001	-0.007	-0.018	0.000	-0.100*
FS (g/tex)	-0.006	-0.017	-0.017	0.017	0.001	-0.001	-0.170	-0.007	0.000	0.001	-0.001	-0.179

Residual effect: 0.2117.

Note: DFSI: Days to 50% square initiation, DFFL: Days to 50% flowering, DFBO: Days to 50% boll opening, BW: Boll weight, NB. P: Number of bolls per plant, PH: Plant height (cm), SCY.P: Seed cotton yield per plant (g), GOT: Ginning out turn (%), FL: Fibre length (mm), UI: Uniformity index (%), FF: Fibre fineness (µg/inch), FS: Fibre strength (g/tex).

negative association between seed cotton yield with plant height and Nikil *et al.* (2018) reported negative association between seed cotton yield and fibre strength.

Path coefficient analysis

Information on direct and indirect influence of an independent variable on the dependent variable and also the relationship between two variables was given by path coefficient analysis. In a biological system, the relationships may exist in a very complex form and therefore, it is essential to study the relationships among different variables in a holistic manner to get a clear idea about the component traits to achieve desired improvement the target trait. The association between seed cotton yield and its components is theclear consequence of the direct effect of some components and indirect effects *via* other yield contributing traits. Traits which have positive and direct effect on seed cotton yield can be selected directly in any breeding programme. In present study several traits are influencing seed cotton yield, it is essential to divide the whole correlation into direct and indirect effects brought about by way of path coefficient study. Direct-indirect effects of various traits with seed cotton yield are enlisted in Table 2. Among all the twelve parameters studied highest positive direct effect on seed cotton yield was shown by the number of bolls per plant (0.976), followed by bollweight (0.335) and ginning outturn (0.315). Similar results were reported by Wadeyar *et al.* (2015) and Nikil *et al.* (2018). Highest negative direct effect on seed cotton yield was shown by micronaire value (-0.018) Ginning outturn had positive indirect effect on seed cotton yield per plant *via* boll weight.

CONCLUSION

Finally, to conclude seed cotton yield per plant showed significant positive association as well as positive direct effects on the yield contributing characters *viz.,* number of bolls per plant, boll weight and ginning outturn. These parameters should be given thrust while making selection as they were major attributes of the seed cotton yieldduring future breeding programmes.

Conflict of interest

All authors declared that there is no conflict of interest.

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