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RESEARCH ARTICLE

Co-relation studies in *desi* cotton genotypes (*Gossypium arboreum* L.)

■ **S. B. Borgaonkar, M. B. Patil, A. B. Jadhav and G. S. Pawar**

SUMMARY

The present investigation entitled "Correlation studies in*desi* cotton genotypes (*Gossypium arboreum* L.)" was carried out to evaluate promising cotton genotypes yield and yield contributing traits at Cotton Research Station, Mahboob baugh farm, VNMKV, Parbhani, during *Kharif* season-2022. The present experiment conducted on fifteen promising genotypes of cotton (*Gossypium arboreum* L.) including two checks. The genotypes tested were PA-904, PA-906, PA-907, PA-927, PA-929, PA-932, PA-936, PA-941, PA-942, PA-945, PA-947, PA-948, PA-950 along with two checks PA-742 (C) and NH-615 (C). The results revealed that the characters vizsympodia per plant, number of bolls per plant, 10-boll weight, seed index, and ginning out turn were significantly and positively correlated with the seed cotton yield. Whereas, days to first flower initiation, days to 50% flowering and days to first boll development had negative and significant correlation with the seed cotton yield.

Key Words : Seed index, Ginning outturn, Sympodia

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Cotton is popularly known as "White gold", is one of the most important fibre as well as cash crop. At global level, USA, China, India, Pakistan, Uzbekistan, Turkey, Brazil, Greece, Argentina and Egypt are the major cotton producing countries which contribute about 85% of the world's cotton production. Globally, cotton was grown on an area of 33.19 million hectares with production of 25.73 million tonnes (Anonymous, 2023). It has a pivotal role in strengthening Indian economy and farming community by contributing in national and international trade, industrial activities, earning foreign exchange and generating employment directly or in directly for 60 million people in our country (Saritha and Patil, 2020). In India, during 2021-2022 a production of 340 lakh bales was recorded from an area

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
S.B. Boragaonkar, Cotton Research Station, Vasantrao Naik Marathwada Krishi Vidyapeeth, **Parbhani (M.S.) India**

Address of the Co-authors:
M.B. Patil, A.B. Jadhav and G.S. Pawar, Cotton Research Station, Vasantrao Naik Marathwada Krishi Vidyapeeth, **Parbhani (M.S.) India**

of 123 lakh hectares with a productivity of 469 kg/ha (Cotton Corporation of India, 2023). Cotton is mainly cultivated for fibre yield, moreover, it is also a source of textile raw materials, seed yields, seed oil and protein. Major four cultivated species of cotton are categorized in to two sub-species *i.e.,* diploid species (2n=2x=26) popularly known a sold world cotton (*Gossypium arboreum* and *G. herbaceum*) and tetraploid species (2n=2x=52) com monly known as new world cotton (*G. hirsutum* and *G. barbadense*). India is the only country whereall the four cultivated species are grown. The yield potential of *G. arboreum* has not beenfully realized as the crop is cultivated under poor crop management conditions (Jogender *et al*., 2023). Development of cotton varieties and hybrids having greater yield potential with acceptable fibre characteristics is the main objective of cotton breeders. Breeders are always aimed to maximize the yield but it is a complex polygenic trait which is governed by interaction among number of quantitative traits. Hence direct selection based on *per se* yield may be misleading therefore breeders need to know more aboutinter-relationship among different traits for effective selection. Knowledge of association among traits and direct and indirect effects of each trait on main yield is an additional advantage which aids the selection process (Sharma *et al*., 2023). Correlation co-efficient analysis measures the magnitude of association among various plant traits and also determines the component traits on which selection depend for improvement of seed cotton yield and fibre quality. It furnishes the in formation about the nature of association which is often incomplete, additional influences from other traits mayskew the results in either direction which is not takencare off in correlation analysis. Under such situation, path co-efficient analysis is an efficient statistical tool to quantify the inter-relationship among different component trait and their direct and indirect effects on yield. Therefore, path co-efficient analysis may offer alot of realistic images of the interrelation, because it partitions the correlation co-efficient in to direct and indirect effects of variables (Sainath *et al.,* 2022). Ultimately, this kind of analysis could help the cotton breeder to design the selection strategies to improve seed cotton yield. Hence, the present experiment was conducted to find the nature of genetic association among various traits and their direct and indirect effect on seed cotton yield of (*Gossypium arboreum* L).

MATERIAL AND METHODS

The present investigation entitled "Correlation studies in *desi* cotton genotypes (*Gossypium arboreum* L.)" was carried out at the experiment farm of Cotton Research Station, Mahboob baugh farm, VNMKV, Parbhani, during *Kharif* season-2022. The objective of the research wasto study correlation for seed cotton yield with yield and yield contributing traits. The present experim ent conducted on fifteen promising genotypes of cotton (*Gossypium arboreum* L.) including two checks 927, PA-929, PA-932, PA-936, PA-941, PA-942, PA-945, PA-947, PA-948, PA-950 along with two checks viz; PA-742 (C) and NH-615 (C). Observations recorded were seed emergence percentage at 5th day after sowing, plant stand at 10th day after sowing, number of days require to 1st flower initiation, 50% flowering and first boll development. Plant height, leaf area, leaf area index, specific leaf weight, no. of monopodia and sympodia at harvesting, absolute growth rate, relative growth rate and net assimilation rate at various growth stages were recorded. The characters *viz.,* number of bolls per plant, boll weight, ginning outturn, seed index and seed cotton yield per plot was recorded as yield contributing traits.

Statistical analysis :

Fischer's method of analysis of variance was applied for the analysis of data and interpretation of the results as suggested by Panse and Sukhatme (1967). Correlation analysis was carried out to study the nature and degree of relationship between morphological, physiological, growth parameters, yield and yield components following the method of Karl Pearson (1896).

RESULTS AND DISCUSSION

The analysis of variance for all the fifteen characters studied is presented in Table 1. The analysis of variance revealed that mean square due to genotypes were highly significant for all the 21 characters indicating the presence of sufficient amount of variability in the experimental materials used. Whereas, the correlation co-efficients are presented in Table 2.

Number of days require to 1st flower initiation, number of days require to 50% flowering and number of days required for 1st boll development showed negative but significant correlation with the seed cotton yield *i.e.* (r =-0.760**), (r =-0.719**) and (r =-0.728**), respectively. The results obtained are in confirmation with the result reported by Saeed *et al*. (2008) and Sarwar *et*

Table 1: Analysis of variance for various characters in *desi* cotton genotypes

Source of variation	Degrees of freedom	Seed emergence (%)	Plant stand (%)	Plant height (cm)	Leaf area (cm^2)	Leaf area index	Number of monopodia	Number of sympodia	Absolute growth rate (g/day)	Relative growth rate (g/g/day)	Net assimilation rate (g dm^{-2} day^{-1})	Specific leaf weight (mg/cm^2)	SPAD reading
Replication	1	13.25	11.69	9.41	75950.92	0.07	0.03	0.01	0.02	1.6-06	9.6E-05	0.16	15.11
Treatment	14	28.54 *	27.09 *	174.54 **	197723.33 **	0.35 **	0.38 **	3.27 **	0.09 **	4.8-06 **	9.2E-05 *	0.01 **	13.09 *
Error	14	10.79	9.80	23.97	38501.97	0.04	0.10	0.39	0.02	7.9-07	3.5E-05	0.03	5.25

Table 1 : Contd…………

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Source of Variation	Degrees of freedom	Relative water content (%)	Specific leaf weight (mg/cm^2)	Days to 1st flower initiation	Days to 50% Flowering	Days to 1st boll development	Number of bolls per plant	10 Bolls weight(g)	Yield per plot(g)	GOT (%)	Seed index
Replication	1	1.39	0.16	22.53	0.30	17.63	0.07	5.63	770.13	0.36	0.62
Treatment	14	35.55*	0.01**	44.91**	49.26**	60.18**	13.13**	13.73**	38082.68**	9.50**	0.22**
Error	14	12.94	0.03	6.39	5.30	13.78	0.10	4.92	4751.28	3.83	0.09

al. (2021). Number of days for 1st flower initiation also showed positive but significant correlation with number of days require to 50% flowering (r = 0.945**), days required for 1st boll development (r = 0.917**) and plant height (r = 0.763**), respectively. It showed negative but significant correlation with number of bolls per plant (r = -0.622*), 10 boll weight (r = -0.745**) and seed index (r = -0.560*).

Number of days require to 50% flowering showed positive and significant correlation with number of days require to 1st flower initiation (r = 0.945**) and number of days required for 1st boll development (r = 0.945**). It showed negative and significant correlation with number of bolls per plant (r = -0.641*), 10 boll weight (r = -0.728**), seed index (r = -0.529*) and ginning out turn percentage (-0.589*). Similar findings were reported by Srinivas *et al*. (2015), Aishwarya *et al*. (2022) and Satish *et al*. (2020). Days to 50% flowering showed significant negative association with boll weight, seed index and lint index both at phenotypic and genotypic levels. This was also in accordance with the research findings of An *et al*. (2008), Kumar *et al*. (2010), Aishwarya *et al*. (2022) and Sirisha *et al*. (2016).

Number of days required for 1st boll development showed positive and significant correlation with number of days require to 1st flower initiation (r = 0.917**) and number of days require to 50% flowering (r = 0.968**). Whereas, It showed negative and significant correlation with number of bolls per plant (r = -0.702*), 10 boll weight (r = 761**), seed index (r = -0.545*) and ginning out turn percentage (-0.596*).The result obtained is similar with the results reported by Saeed *et al*. (2008) and Pooja *et al*. (2020).

Plant height found to have strong positive significant correlation with the leaf area index (LAI) *i.e.* (r = 717**). The result obtained was similar with the findings of Dube *et al*. (2019). The trait plant height had recorded significant negative correlation with the seed cotton yield (r= -0.571*). Similar findings were reported by Wei *et al*. (2019).

Both the leaf area and leaf area index data were found non-significantly correlated with the seed cotton yield *i.e.* (r=0.319 ^{ns}) and (r=-0.392^{ns}), respectively. Leaf area and leaf area index were positively correlated with each other (r=0.534*). Leaf area showed negative significant correlation with NAR (Net assimilation rate) that is (r= -0.774**). LAI (Leaf area index) showed negative but significant correlation with number of bolls per plant (r=-0.648**) and 10 boll weight (-0.569*) of the cotton genotypes.

The correlation between AGR (Absolute growth rate), RGR (Relative growth rate), NAR (Net assimilation rate) and SLW (Specific leaf weight) was found non-significant with the seed cotton yield *i.e.* (r=0.427), (r= -0.510) and (r= -0.081), respectively. These results were not in accordance with the results of Makhdum *et al*. (2007) and Ali *et al*. (2009).

SLW (Specific leaf weight) was found significantly correlated with absolute growth rate (r=0.522*), SCMR values (r=0.528*) and number of sympodiumbranches

Table 2 : Correlation analysis of yield and yield contributing characters in *desi* cotton genotypes

	1st F	50% F	1stB	PH	LA	LAI	SLW	AGR	RGR	NAR	SCMR	MP	SYP	NB	10BW	SI	GOT	YPP
1stF	1	0.945**	0.917**	0.763**	-0.245 NS	0.496 NS	-0.147 NS	-0.469 NS	0.427 NS	-0.052 NS	0.210 NS	-0.005 NS	-0.166 NS	-0.622*	-0.745**	-0.560*	-0.472 NS	-0.760**
50% F		1	0.968**	0.790**	-0.152 NS	0.552*	0.042 NS	-0.359 NS	0.327 NS	-0.056 NS	0.400 NS	-0.028 NS	-0.036 NS	-0.641*	-0.728**	-0.529*	-0.589*	-0.719**
1stB			1	0.845**	-0.253 NS	0.509 NS	0.044 NS	-0.323 NS	0.278 NS	0.070 NS	0.443 NS	0.107 NS	-0.142 NS	-0.702**	-0.761**	-0.545*	-0.596*	-0.728**
PH				1	-0.157 NS	0.717**	0.283 NS	-0.184 NS	0.304 NS	0.081 NS	0.509 NS	0.375 NS	-0.007 NS	-0.927**	-0.737**	-0.304 NS	-0.453 NS	-0.571*
LA					1	0.534*	0.406 NS	0.293 NS	-0.507 NS	-0.774**	0.203 NS	-0.083 NS	0.378 NS	0.248 NS	0.239 NS	0.156 NS	0.437 NS	0.319 NS
LAI						1	0.410 NS	-0.029 NS	0.031 NS	-0.488 NS	0.505 NS	0.223 NS	0.138 NS	-0.648**	-0.569*	-0.282 NS	-0.099 NS	-0.392 NS
SLW							1	0.522*	-0.193 NS	-0.007 NS	0.528*	0.120 NS	0.699**	-0.328 NS	0.068 NS	0.321 NS	0.155 NS	0.307 NS
AGR								1	-0.356 NS	0.366 NS	0.351 NS	-0.114 NS	0.389 NS	0.117 NS	0.367 NS	0.352 NS	0.361 NS	0.427 NS
RGR									1	0.285 NS	-0.116 NS	0.064 NS	-0.179 NS	-0.453 NS	-0.503 NS	-0.314 NS	-0.394 NS	-0.510 NS
NAR										1	0.124 NS	0.025 NS	-0.112 NS	-0.228 NS	-0.058 NS	0.030 NS	-0.215 NS	-0.081 NS
SCMR											1	0.020 NS	0.208 NS	-0.468 NS	-0.367 NS	-0.207 NS	-0.184 NS	-0.271 NS
MP												1	0.026 NS	-0.380 NS	-0.092 NS	0.204 NS	0.060 NS	0.104 NS
SYP													1	0.062 NS	0.457 NS	0.637*	0.315 NS	0.561*
NB														1	0.792**	0.357 NS	0.409 NS	0.610*
10BW															1	0.838**	0.531*	0.945**
SI																1	0.383 NS	0.913**
GOT																	1	0.528*
YPP																		1

Note :- * and ** indicate significance of values at P=0.05 and 0.01, respectively. 1stF:- Days to 1st flower formation LAI:- Leaf area
NAR :- Net assimilation rate SCMR:- SPAD chlorophyll meter readings GOT :- Ginning out turn
50%F :- Days to 50% flowering LAI :- Leaf area index SLW :- Specific leaf weight NB:- No. of bolls YPP :- Yield per plot
1stB:- Days to 1st boll development AGR :- Actual growth rate MP:- No. of monopodium10BW :- 10 Ball weight
PH :- Plant height RGR :- Relative growth rateSYP :- No. of sympodiumSI :- Seed index

per plant (r= 0.699**). SLW (Specific leaf weight) was found significantly correlated with absolute growth rate (r=0.522*) and SCMR values (r=0.528*). The results are in confirmation with the findings of Kerby*et al.* (1980).

Number of monopodia per plant showed non-significant correlation with seed cotton yield (r = 0.104^{NS}). The result obtained was similar with the result obtained by Shazia *et al.* (2010). Number of sympodia per plant showed positive and significant correlation with seed cotton yield (r =0.561*). The result obtained is similar with the result of Reddy *et al.* (2015), Ameer *et al.* (2019) and Kumar *et al.* (2020). Number of sympodia per plant also showed positive and significant correlation with seed index (r =0.637*). The findings are in agreement with the reports of Shruti *et al.* (2020) and Reddy *et al.* (2015).

Number of bolls and 10 boll weight showed strong, positive and significant correlation with seed cotton yield *i.e.* (r = 0.610*) and (r = 945**), respectively. The result obtained is similar with the findings of Reddy *et al*. (2015), Ameer *et al*. (2019), Nikhil *et al*. (2018), Erande *et al*. (2014) and Kumar *et al*. (2010).

Number of bolls and 10 boll weight showed strong positive and significant correlation with each other (r = 792**). The result is in agreement with the result of Erande *et al*. (2014), Iqbal *et al*. (2018), Nikhil *et al*. (2018) and Ameer *et al*. (2019). 10 boll weight showed strong, positive and significant correlation with seed index (r = 838**) and ginning out turn (r = 531*). The result is in agreement with the result of Iqbal *et al*. (2018), Nikhil *et al*. (2018) and Ameer *et al*. (2019).

Ginning out turn and seed index showed highly significant and positive correlation with seed cotton yield *i.e.* (r = 0.913**) and (r = 528*), respectively. These result are in agreement with the results reported by Iqbal *et al*. (2018), Nikhil *et al*. (2018) and Ameer *et al*. (2019).

Conclusion :

Yield contributing traits like number of sympodia per plant, number of bolls per plant, 10-boll weight, seed index, and ginning out turn were significantly and positively correlated with the seed cotton yield. Height and all the phenological characters *i.e*., days to first flower initiation, days to 50% flowering and days to first boll development had negative and significant correlation with the seed cotton yield. Hence, breeder should consider these parameters towards genetic improvement for seed cotton yield.

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