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Response of newly developed cotton strains for quantitative traits of upland cotton

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ABSTRACT

The study was conducted to assess the twenty-eight advance strains for yield and fiber traits. Significant difference was observed in all the genotypes for yield and fiber traits. On the basis of yield and its components, the advance strains CRIS-753, CRIS-797 and CRIS-697 found best for higher number of bolls and also given maximum seed cotton yield. Whereas there fiber traits results are low, therefore, it is suggested that such varieties could be tested at different zones for the study and improvement in fiber traits. For the character staple length only two advance strains CRIS-795 and CRIS-753 could produce acceptable staple length above from the standard. The correlation results suggested that boll weight has positive association with seed cotton yield and ginning outturn, if boll weight will be increased ultimately yield and GOT in term of lint % in boll will be increased. Positive association of bolls plant^{-1} was noted with seed cotton yield, if the number of bolls will be increased or decreased, similarly seed cotton yield will also be increased or decreased. Regarding the fiber traits, staple length shown positive association with fiber strength and micronaire and fiber strength also shown positive association of micronaire value, it suggests that due to increase or decrease of one trait could affect on other trait.

Keywords: Seed cotton yield, fiber traits, correlation, quantitative traits.

INTRODUCTION: The cotton is an important cash and fiber crop of Pakistan; it is placed as key role in textile as well as oil industries by earning foreign exchanges, throughout export in the form of raw cotton, cotton yarn, prey clothes, garments, and other cotton products. Globally Pakistan is 4th largest cotton producing country, while 3rd in consumption during last five years from 2014-15 to 2018-19. County economic development depends upon the production of cotton because the nation mainly dependent on industry of cotton and related to its textile sector. That's why the principal status has been given to the cotton crop. The area under cotton cultivation in Pakistan during year 2019-20 was 2.895 million hectares and production was 12.72 million bales, as regards the provincial status, Punjab contributed 2.145 million hectares with production 7.90 million bales and Sindh was on 0.640 million hectares and 4.60 million bales production. Kakar *et al.* (2012) observed significant differences in yield, ginning out turn, micronaire and staple length for different cultivars. While selecting a cultivar, different agronomic traits like yield potential, growth period and quality should be considered (Nichols *et al.*, 2004). Breeding efforts for improving *Gossypium hirsutum* L. were initiated since its introduction in this region. Many high yielding and good quality varieties developed and successfully cultivated in this region. But cotton production in Pakistan faces the threats of both biotic and abiotic stresses. Afzal *et al.* (2002) reported significant differences in yield, boll weight and number of bolls plant-1 due to difference in genotypes. Sezener *et al.* (2006) also found significant variation in seed cotton yield due to genotypes. Different cotton genotypes behave differently for seed cotton yield (Iqbal and Khan, 2010). Correlation analysis also determines the correlation of one character with another, thus predicting the proportionate change in on character and its effects on the counterpart trait. The correlation between different yield contributing traits may be useful to enhance the yield of seed cotton. The correlation estimates show the specific trait response with its related traits, and it also provides the estimate that what extent of change may occur in one trait due to the change in another trait. Keeping in view the importance of cotton crop and significant response of different cotton varieties, the present study was conducted to identify the highest yielding advance line of cotton for the environmental condition of Sindh.

OBJECTIVE: The objective of this study was intended to identify advanced cotton line for quantitative traits of cotton at the environmental conditions of Sakrand and estimation of association (simple correlation) between the traits.

MATERIAL AND METHODS: The research trial was conducted at experimental farm of Central Cotton Research Institute Sakrand during the year 2020 to assess the efficacy of newly developed cotton strains for various quantitative traits of upland cotton. The experiment was conducted in randomized complete block design (RCBD) with three replications. The sowing was done in the last week of April, the row-to-row distance was kept 2.5 feet and plant to plant distance was maintained 12 inches after thinning. All the agronomic practices and fertilizer applications were adopted normal and uniform. Plant protection measures were applied as per need whenever required. 10 plants were tagged from each replication to record the data of boll weight (g), bolls plant-1, seed cotton yield (kg ha^{-1}), ginning outturn%, staple length (mm), fiber strength (g tex^{-1}) and micronaire value (µg inch^{-1}). Data collected on different parameters were analyzed statistically by using statistics software Statistix-8.1. For analysis of variance and means were separated using Fisher's protected least significant difference (LSD) and the comparison of means were tested by Duncan Multiple Range Test (DRMT) at 5% and 1% probability test (Steel, 1997).

RESULT AND DISCUSSION: The mean square values from analysis of variance (ANOVA) table 1 shown that all the quantitative traits viz. boll weight, bolls plant^{-1}, seed cotton yield, ginning outturn, staple length, fiber strength and micronaire value was significant different, which suggested genetic diversity among the varieties. The results are in accordance with Riaz *et al.* (2013) who found significant difference for bolls plant^{-1}, staple length and micronaire value. Rahman *et al.* (2013) documented significant difference for ginning outturn. HANDI and Katageri (2016) also reported significant difference for boll weight, bolls plant^{-1}, ginning outturn and seed cotton yield. The mean performance of 07 characters was recorded from twenty-eight advance strains and 02 standard check genotypes presented in table 2. All the genotypes differ significantly for boll weight. The maximum boll weight was recorded in genotype CRIS-692 (3.3 g), while minimum boll weight was given by CRIS-751 (2.2 g). The significant difference in cultivars for boll weight had also been reported by Hofs *et al.* (2006) and Ehsan *et al.* (2008). The bolls plant^{-1} is an important character and directly effect on seed cotton yield, because variety possesses maximum bolls, ultimately produce more yield as compared to other genotypes. There was significant difference among the advance strains for the trait bolls plant^{-1}. The maximum number of bolls plant^{-1} was produced by CRIS-797 (51.7) followed by CRIS-796 (48.7). However, the lowest boll was given by check variety CRIS-585. Anwar *et al.* (2002) and Copur (2006) also reported significant difference in cotton varieties for bolls plant^{-1}.

Seed cotton yield is an important character and place a unique position with special consideration as compared to other traits. But seed cotton yield is not independent character, it is result of joint effect of boll weight and bolls plant^{-1}. The results indicated that all the varieties performed in different way for the trait seed cotton yield, there was significant difference found in all the advance strains (table 2).

Table 1: Analysis of variance mean square values of quantitative traits.

SV	DF	Boll Weight (g)	Boll Plant^{-1}	Seed Cotton Yield (kg ha^{-1})	Ginning Outturn %	Staple Length (mm)	Fiber Strength (g tex^{-1})	Micronaire Value (µg inch^{-1})
Replications	02	0.0164	99.90	19582	1.7284	0.012	1.051	0.0018
Varieties	29	0.1678**	112.79**	233632**	26.211**	71.05**	75.94**	3.165**
Error	58	0.0238	23.94	33687	0.639	0.19	1.469	0.054

Table 2: Mean performance of quantitative traits of upland cotton.

Varieties	Boll Weight (g)	Boll Plant^{-1}	Seed Cotton Yield (kg ha^{-1})	Ginning Outturn %	Staple Length (mm)	Fiber Strength (g tex^{-1})	Micronaire Value (µg inch^{-1})
CRIS-748	2.6^{e-j}	32.0^{jk}	2045^{ghi}	35.0^{o}	25.1^{lm}	26.3^{c-h}	3.7^{l}
CRIS-749	2.7^{c-h}	35.3^{e-j}	2390^{bcd}	39.0^{klm}	27.5^{bc}	27.6^{a-e}	5.5^{b}
CRIS-750	2.2^{lm}	38.3^{d-j}	2275^{d-h}	33.7^{op}	25.1^{lm}	26.0^{c-i}	4.9^{e-h}
CRIS-751	2.2^{m}	40.6^{c-g}	2390^{bcd}	40.2^{f-k}	26.4^{f-i}	26.0^{c-i}	5.3^{bcd}
CRIS-753	2.7^{d-i}	46.8^{ab}	2849^{a}	34.1^{op}	28.1^{ab}	29.0^{a}	4.6^{ghi}
CRIS-754	2.5^{g-k}	35.7^{e-j}	2275^{d-h}	36.6^{n}	26.8^{c-f}	26.8^{b-f}	5.2^{b-e}
Cyto-124 (std.)	2.4^{i-m}	33.3^{g-k}	2045^{ghi}	41.1^{e-h}	26.1^{f-k}	24.6^{g-j}	5.9^{a}
CRIS-692	3.3^{a}	26.7^{k}	1980^{hi}	41.3^{def}	26.2^{f-j}	21.9^{k}	6.0^{a}
CRIS-693	2.5^{g-k}	40.0^{c-i}	2664^{ab}	42.5^{bcd}	25.7^{h-l}	25.1^{f-j}	5.0^{d-g}
CRIS-694	2.8^{b-e}	30.7^{jk}	2090^{e-i}	43.2^{bc}	26.1^{f-k}	26.8^{b-f}	5.2^{b-e}
CRIS-695	2.3^{c-g}	32.7^{h-k}	2193^{d-i}	40.3^{f-k}	28.7^{a}	29.3^{a}	4.6^{hi}
CRIS-696	2.6^{f-j}	32.0^{jk}	1991^{ghi}	41.1^{efg}	27.1^{cd}	27.9^{abc}	4.7^{f-i}
CRIS-697	2.4^{h-l}	32.3^{ijk}	1950^{ij}	44.1^{a}	25.6^{i-m}	24.9^{f-j}	5.2^{b-e}
CRIS-698	2.9^{bcd}	30.7^{jk}	2178^{d-i}	42.0^{cde}	26.3^{f-i}	26.4^{b-h}	4.7^{f-i}
CRIS-585 (std.)	3.2^{ab}	26.7^{k}	1674^{j}	39.8^{h-l}	26.0^{g-k}	25.6^{e-i}	4.9^{e-h}
CRIS-783	2.7^{c-h}	36.3^{d-j}	2054^{f-i}	40.1^{f-l}	26.1^{f-k}	25.0^{f-j}	5.3^{bcd}
CRIS-784	2.3^{klm}	36.3^{d-j}	2168^{d-i}	40.8^{e-i}	24.9^{m}	24.8^{f-j}	5.1^{c-f}
CRIS-785	2.7^{c-g}	42.0^{b-f}	2280^{d-g}	40.1^{f-l}	25.5^{j-m}	24.3^{ij}	5.2^{b-e}
CRIS-786	2.6^{e-i}	42.7^{b-e}	2123^{d-i}	40.3^{f-k}	25.2^{lm}	28.3^{ab}	5.4^{bc}
CRIS-787	2.6^{e-j}	47.0^{abc}	2396^{bcd}	40.3^{f-j}	25.7^{h-l}	23.6^{jk}	5.4^{bc}
CRIS-788	2.7^{c-h}	43.7^{bcd}	2593^{abc}	39.7^{i-l}	27.8^{abc}	28.9^{a}	4.5^{ij}
CRIS-789	2.9^{bc}	34.3^{f-k}	2590^{abc}	38.8^{lm}	26.7^{d-g}	26.3^{c-h}	4.5^{ij}
CRIS-790	2.9^{bc}	32.3^{ijk}	2054^{f-i}	39.4^{j-m}	26.1^{f-k}	26.0^{c-i}	5.0^{d-g}
CRIS-791	2.3^{j-m}	42.6^{b-e}	2121^{d-i}	33.1^{p}	25.5^{j-m}	25.8^{d-i}	4.4^{ij}
CRIS-792	2.7^{c-g}	36.3^{d-j}	2345^{c-f}	40.5^{f-j}	26.5^{efg}	27.7^{a-d}	4.8^{f-i}
CRIS-793	3.1^{ab}	40.6^{c-g}	2375^{b-e}	40.0^{g-l}	26.8^{c-f}	27.6^{a-e}	4.2^{j}
CRIS-794	2.6^{e-j}	37.7^{d-j}	2150^{d-i}	40.1^{f-l}	27.3^{cd}	27.5^{a-e}	4.4^{ij}
CRIS-795	2.8^{c-f}	42.3 $^{b-e}$	2388^{b-e}	38.3^{m}	25.4^{klm}	24.2^{ij}	5.2^{b-e}
CRIS-796	2.8^{c-f}	48.7^{ab}	2762^{a}	43.6^{b}	26.1^{f-k}	26.5^{b-g}	5.2^{b-e}
CRIS-797	2.6^{e-j}	51.7^{a}	2831^{a}	42.6^{bcd}	26.4^{e-h}	24.5^{hij}	5.2^{b-e}
CD 5%	**0.25**	**7.99**	**299.9**	**1.31**	**0.71**	**1.98**	**0.38**
CD 1%	**0.34**	**10.64**	**399.8**	**1.74**	**0.95**	**2.64**	**0.51**
CV %	**5.80**	**13.08**	**8.07**	**2.01**	**1.72**	**4.81**	**4.92**

The highest seed cotton yield was obtained by advance strain CRIS-753 (2849 kg ha^{-1}) followed by CRIS-797 (2831 kg ha^{-1}) and CRIS-697 (2762 kg ha^{-1}). It was noted that the advance strains that given higher seed cotton yield also obtained higher number

of bolls plant^{-1} and acceptable boll weight. Similar results with significant difference among varieties for seed cotton yield is obtained by Ehsan *et al.* (2008) and Khan *et al.* (2008). The comparison between treatment means for the trait ginning outturn indicated that cultivars significantly differ from each other. The maximum GOT% ginned by stain CRIS-697 (44.1%) followed by CRIS-796 (43.6%). While minimum GOT% was given by CRIS-791 (33.1%) which is lowest from standard set. The result is supported with Ehsan *et al.* (2008).

The fiber traits results are presented in Table 2. It indicated that all the twenty-eight advance strains along with 02 standard check varieties were significantly differ for staple length, fiber strength and micronaire value. For the character staple length only two advance strains CRIS-795 (28.7 mm) and CRIS-753 (28.1 mm) could produce acceptable staple length above from the standard as compared with other strains as well as standard check varieties. Whereas, the lowest and short fiber obtained by strain CRIS-784 (24.9 mm) that is below from the set standard. However, for the trait fiber strength these two strains CRIS-795 (29.3 g tex^{-1}) and CRIS-753 (29.0 g tex^{-1}) also produced strongest fiber strength as compared with other genotypes. As regards the micronaire value, the fineness fiber given by CRIS-748 (3.7µg inch^{-1}) and CRIS-793 (4.2µg inch^{-1}) comparing with other advance strains and standard check varieties. Bakhsh *et al.* (2019) reported significant difference in mean values of fiber traits. Similar findings are in line with Copur (2006), Ehsan *et al.* (2008) observed significance in cotton varieties for staple length, fiber strength and micronaire value.

Correlation studies helps cotton breeders to develop high yielding cotton varieties with quality fiber traits. The results of correlation is presented in table 3, it indicated that boll weight has positive correlation with seed cotton yield. If the boll weight will be increase than ultimately seed cotton yield will be increased.

Table 3: Association (simple correlation) of quantitative traits.

Traits	Boll Weight	Boll Plant^{-1}	Seed Cotton Yield	Ginning Outturn	Staple Length	Fiber Strength
Boll Plant^{-1}	-0.470					
Seed Cotton Yield	0.916**	0.587**				
Ginning Outturn	0.859**	-0.319	-0.504			
Staple Length	0.104	-0.807	-0.520	-0.041		
Fiber Strength	-0.530	-0.613	-0.442	-0.724	0.948**	
Micronaire Value	-0.300	-0.129	-0.734	0.212	0.838**	0.724**

Whereas in case of positive association of boll weight with ginning outturn, that due to increase in boll weight the lint percent will be increase in boll, that's why both have a positive correlation with each other. The bolls plant^{-1} also shown positive association with seed cotton yield, if the number of bolls will be increased or decreased, similarly seed cotton yield will also be increased or decreased. Regarding the fiber traits, staple length shown positive association with fiber strength and micronaire and fiber strength also shown positive association of micronaire value, it suggest that due to increase or decrease of one trait could effect on other trait. Guo *et al.* (2014) reported significant positive correlation of boll weight and bolls plant^{-1} with seed cotton yield. Makhdoom *et al.* (2010) documented positive association of boll weight with seed cotton yield. (Nikhil *et al.*, 2018) stated positive association of boll weight with ginning outturn and also positive correlation of staple length with fiber strength. Ahmad *et al.* (2016) reported significant positive association between staple length and micronaire value.

CONCLUSION: Significant difference was observed in all the genotypes for yield and fiber traits. Based on yield and its components, the advance strains CRIS-753, CRIS-797 and CRIS-697 found best for higher number of bolls and given maximum seed cotton yield. Whereas their fiber traits results are low, therefore, it is suggested that such varieties could be tested at different zones for the study and improvement in fiber traits. The correlation results suggested that boll weight and boll plant^{-1} have positive association with seed cotton yield and positive correlation between staple length, fiber strength and micronaire value. Therefore, selection could be done based on correlation results.

REFERENCES: Afzal, M., M. Arshad, M. Idrees and N. Illahi, 2002. Yield response of indigineously evolved upland cotton genotypes for various traits in National Coordinated Varietal trails (ncvt) under multan conditions. Asian journal of plant sciences, 4(4)1:13.

Ahmad, S., S. Fiaz, A. Riaz, I. Bashir and A. Zeb, 2016. Correlation analysis of morphological and fiber quality traits in upland cotton (*Gossypium hirsutum* L.). International journal of biosciences, 9(4): 200-208.

Anwar, A., M. Gill, D. Muhammad and M. Afzal, 2002. Evaluation of cotton varieties at different doses of nitrogen fertilizer. Pakistan cottons, 46(1-4): 35-41.

Bakhsh, A., M. Rehman, S. Salman and R. Ullah, 2019. Evaluation of cotton genotypes for seed cotton yield and fiber quality traits under water stress and non-stress conditions. Sarhad journal of Agriculture, 35: 161-170.

Copur, O., 2006. Determination of yield and yield components of some cotton cultivars in semi-arid conditions. Pakistan journal of biological sciencs, 9(14): 2572-2578.

Ehsan, F., A. Ali, M. A. Nadeem, M. Tahir and A. Majeed, 2008. Comparative yield performance of new cultivars of cotton (*Gossypium hirsutum* L.). Pakistan journal of life sciences, 6(1): 1-3.

Guo, Z., Y. Zhao, W. Chen, Y. Li, H. Wang, H. Gong and X. Sang, 2014. Genetic diversity and association analysis of upland cotton based on ssr markers. Cotton science, 26(5): 420-430.

Handi, S. S. and I. Katageri, 2016. Genetic diversity studies for fiber quality traits in upland cotton (*G. Hirsutum* L.). Journal of farm sciences, 29(3): 322-326.

Hofs, J. L., B. Hau, D. Marais and M. Fok, 2006. Boll distribution patterns in bt and non-bt cotton cultivars: Ii. Study on small-scale farming systems in south africa. Field crops research, 98(2-3): 210-215.

Iqbal, M. and M. A. Khan, 2010. Management of cotton leaf curl virus by planting time and plant spacing. Advances in agriculture & botanics, 2(1): 25-33.

Kakar, N. U., F. C. Oad, S. Tunio, Q.-U. Chachar and M. M. Kandhro, 2012. Response of sowing time to various cotton genotypes. Sarhad journal of agriculture, 28(3): 379-385.

Khan, N., N. Muhammad and K. Noor-ul-Islam, 2008. Assessment of some novel upland cotton genotypes for yield constancy and malleability. International Journal of Agriculture and Biology, 10(1): 109-111.

Makhdoom, K., N. U. Khan, S. Batool, Z. Bibi, S. K. Farhatullah, F. Mohammad, D. Hussain, M. S. Raziuddin and N. Khan, 2010. Genetic aptitude and correlation studies in *Gossypium* hirsutum L. Pakistan journal of botany, 42(3): 2011-2017.

Nichols, S., C. Snipes and M. Jones, 2004. Cotton growth, lint yield, and fiber quality as affected by row spacing and cultivar. Journal of cotton science, 4(3): 201-207.

Nikhil, P., J. Nidagundi and H. Anusha, 2018. Correlation and path analysis studies of yield and fibre quality traits in cotton (*Gossypium hirsutum* L.). Journal of pharmacotical and phytochemical, 7(5): 2596-2599.

Rahman, S. A., M. S. Iqbal, M. Riaz, A. Mahmood, M. R. Shahid, G. Abbas and J. Farooq, 2013. Cause and effect estimates for yield contributing and morphological traits in upland cotton (*Gossypium hirsutum* L.). Journal of agriculture research, 51(4): 393-398.

Riaz, M., M. Naveed, J. Farooq, A. Farooq, A. Mahmood, C. M. Rafiq, M. Nadeem and A. Sadiq, 2013. Ammi analysis for stability, adaptability and ge interaction studies in cotton (*Gossypium hirsutum* L.). Journal of animal and plant sciences, 23(3): 865-871.

Sezener, V., T. Bozbek, A. Unay and I. Yavas, 2006. Evaluation of cotton variety yield trials under mediterranean conditions in turkey. Asian journal of plant sciences, 2(3): 11-13.

Steel, R., 1997. Analysis of variance ii: Multiway classifications. Principles and procedures of statistics: A biometrical approach: 204-252.