

Correlation Analysis of Yield and Fiber Traits in Upland Cotton (*Gossypium hirsutum* L.)

¹Javed Hussain Sahito, ¹Shibin Gao, ¹Zhi Nie, ²Saifullah Abro,
³Siraj Ahmed Channa and ⁴Niaz Ahmed Wahocho

¹Department Crop Genetics & Breeding, Sichuan Agriculture University,
Wenjiang Chengdu, Sichuan 611130, China

²Nuclear Institute of Agriculture (NIA) Tando Jam, Pakistan

³College of Agronomy, Northwest A&F University, Shaanxi Yangling 712100, China

⁴Department Horticulture, Sindh Agriculture University Tandojam Sindh, Pakistan

Abstract: An experiment was carried out in a Randomized Complete Block Design with four replications and eight varieties viz. FH-114, CRIS-134, NIA Ufaq, Sohni, NIAB-777, Reshmi, Chandi and Shahbaz of upland cotton at experimental field of Nuclear Institute of Agriculture, Tandojam, during the year 2013, for assessing the correlation between yield and fiber traits in upland cotton genotypes. The observations were recorded on ginning outturn (%), staple length (mm) and micronaire value ($\mu\text{g}/\text{inch}$). Significantly maximum ginning outturn (39.27), staple length (30.37) and fiber fineness (3.95) was recorded by variety Reshmi. Correlation studies were analyzed for ginning outturn (%), staple length (mm), micronaire value ($\mu\text{g}/\text{inch}$). Results revealed that staple length was positive significantly associated with plant height, monopodial, ginning outturn which indicated that these qualitative characters can be used as reliable selection criteria for improving qualitative value of cotton.

Key words: Correlation • Fiber quality • Seed cotton yield

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) belongs to family malvaceae, sub-family hibiscaceae, class dicot, order malva and genus *Gossypium*. The genus *Gossypium* comprises of 50 cultivated and wild species. Cotton successfully cultivated as annual crop in tropical and sub-tropical region of Pakistan. Cotton is the most an important fiber cash crop and also use for oilseed crop in the different countries of world and uplift the economy level of Pakistan [1] large amount of peoples grown the cotton crop and engaged their field for cotton crop. The textile exports of cotton made the different items like raw cotton, cotton yarn cotton cloths and synthetic fabric knit wear and ready mates garments and export to foreign countries that's why cotton also known as the back bone of Pakistan economy [2] the demand of farmers day by day are increasing for good quality of seed cotton yield genotypes and yield is the most complex parameter which is influenced by biotic and a biotic stress. The interaction among both factors makes the difficult procedure for

desirable cotton varieties. The knowledge of interaction between seed cotton yield and its related traits support to breeders to obtain the desirable genotypes. For obtaining desirable cotton genotypes the correlation analysis provides the good knowledge to visualize the consistent change which occurs in in one character and proportional change occurs in others parameter [3]. Regarding the correlation studies, Soomro *et al.* [4] determined that the yield had positive association with sympodial branches plant⁻¹ and boll numbers sympodia⁻¹ in cotton. Correlation mechanism determines cause and effect relation and direct and indirect effects of plant traits which provide the relative importance of each causal character to construct selection criteria to identify better early maturing combinations from segregating populations. Correlation study is an important asset to breeders which yield characters are related with each other. It is consequently, essential to investigate the association between yield and fiber traits or several factors contributing to cotton and lint yield. It correspondingly occurs that due to association of characters development

in respect of one character may have been obtained at the expense of other characters. Increase in ginning outturn percentage may result into reduction of staple length. Therefore, understanding of the mechanism of association that is, cause and effect relationship provides the foundation for formulating suitable selection criteria in breeding programmes on the basis of yield components for achieving rational improvement of yield and its components. The present study aims to investigate the correlation performance of fiber with seed cotton yield in different BT and Non-Bt cotton genotype.

MATERIALS AND METHODS

An experiment was carried-out at the Nuclear Institute of Agriculture Tandojam, during Kharif Season 2012 in order to find out the association of yield and fiber contributing traits of grown cotton genotypes cultivars. The field experiment was laid out in Randomized Complete Block Design with four replications. The experimental data were recorded of eight cotton genotypes FH-114, CRIS-134, NIA-UFAQ, SOHNI, NIAB-777, RESHMI, CHANDI-95 and SHAHBAZ. Ten plants were randomly selected from each plot of per replication and observation were recorded on following characters, ginning outturn (%), staple length (mm) and micronaire value ($\mu\text{g}/\text{inch}$). The data were subjected in analysis of variance calculated after [5], while, correlation coefficients (r) were determined according to procedure of Raghavrao [6]

RESULTS AND DISCUSSION

The analysis of variance presented in Table 1, data revealed that all genotypes were highly significant differences at ($P \leq 0.01$) for ginning outturn (%) and micronaire value ($\mu\text{g}/\text{inch}$). which indicate that the genotypes are different from each other for these traits. Whereas, the trait staple length is non-significant at ($P \leq 0.01$).

Mean Performance of Genotypes

Ginning Outturn Percentage: Mean performance for the character ginning outturn percentage is shown in Table 2 revealed that variety Reshmi ginned the highest lint (39.27%), whereas the lowest value of GOT was obtained in FH-114 (35.97%) cultivar. The correlations of lint were recorded significantly positive with staple length. This result indicated that increasing lint% will correspondingly

increase staple length. Whereas, its association with other traits positively non-significant which indicated that increase in one character will not be cause any significant differences in an-other character. Our findings results are in agreement with those obtained by Karademir *et al.* [7], who concluded that some of ginning percentages were significantly and positively correlated with fiber fineness, fiber elongation and fiber uniformity.

Staple Length (mm): Staple length has secured a unique importance among the quality parameters of cotton because it is more useful for textile mills in yarn manufacturing. Based on mean performance in Table 2, results revealed that maximum staple length was obtained from variety Reshmi (30.37mm) and the lowest from NIAB-777 (27.74mm). Our results are similar with those obtained by Copur [8] Fahad *et al.* [9], who reported the staple length could be vary variety to variety and different growing condition of cultivars. Results from correlation studies revealed that staple length was positively correlated with plant height, monopodial branches plant^{-1} and ginning outturn percentage, while its correlation with other traits was positive non-significant and negative non-significant with fiber fineness. This result determined that increase in staple length would result in marginal decrease in fiber fineness value.

Micronaire Value or Fiber Fineness ($\mu\text{g}/\text{inch}$): Fiber fineness affects the yarn appearance, its uniformity and strength. Fiber fineness is an important trait for fiber quality of cotton useful for textile industries. Mean values of varieties indicated that variety Shahbaz produced the maximum micronaire value ($4.25\mu\text{g}/\text{inch}$), but the minimum fiber fineness was observed in variety NIAB-777 and Sohani ($3.94\mu\text{g}/\text{inch}$), while the maximum fineness ($4.25\mu\text{g}/\text{inch}$) was produced by Shahbaz variety. This means that the varieties NIAB-777 and Sohani had the better fineness than other cotton varieties. Our finding results are in agreement with those obtained by Fahad *et al.* [9], who reported that fiber fineness vary from variety to variety. Results from correlation suggested that micronaire was negatively and non-significantly associated with plant height, monopodial branches plant^{-1} , sympodial branches plant^{-1} , number of bolls plant^{-1} , ginning outturn, staple length and seed cotton yield. Similar results were found by Ekinci *et al.* [10] and Killi *et al.* [11]. These results indicated that increase in fiber fineness caused corresponding decrease these traits.

Table 1: Mean squares from analysis of variance for various yield and fiber traits of upland cotton genotypes

Traits	Mean squares		
	Replication d.f=3	Varieties d.f=7	Error d.f=21
Ginning outturn	0.53536	5.60678**	0.26863
Staple length	77.0705	87.8136 ^{n.s}	78.7938
Micronaire	0.00061	0.05557**	0.00348

**= Significant at P<0.01; *= Significant at P<0.05; n.s. = Non-significant

Table 2: Mean performance for various traits of upland cotton genotypes

Genotypes	Ginning outturn (%)	Staple length (mm)	Micronaire value (µg/inch)
FH-114	35.97	28.05	4.13
CRIS-134	36.01	28.04	4.04
NIA Ufaq	38.55	28.34	3.99
Sohni	36.52	27.94	3.94
NIAB-777	37.69	27.74	3.94
Reshmi	39.27	30.37	3.95
Chandi	36.95	28.74	4.16
Shahbaz	37.29	28.13	4.25
LSD 5%	0.76	13.05	0.09

Table 3: Correlation coefficient (r) among all possible yield and fiber traits of eight upland cotton genotypes

Character association	Correlation coefficient (r)
Ginning outturn percentage vs Plant height	0.4099 ^{ns}
Ginning outturn percentage vs Number of monopodial branches plant ⁻¹	0.4523 ^{ns}
Ginning outturn percentage vs Number of sympodial branches plant ⁻¹	0.2586 ^{ns}
Ginning outturn percentage vs Number of bolls plant ⁻¹	0.2705 ^{ns}
Ginning outturn percentage vs Seed cotton yield plant ⁻¹	0.2868 ^{ns}
Staple length vs Plant height	0.7502*
Staple length vs Number of monopodial branches plant ⁻¹	0.7026*
Staple length vs Number of sympodial branches plant ⁻¹	0.5440 ^{ns}
Staple length vs Number of bolls plant ⁻¹	0.2950 ^{ns}
Staple length vs Seed cotton yield plant ⁻¹	0.0946 ^{ns}
Staple length vs Ginning outturn	0.6788*
Staple length vs Fiber fineness	-0.1646 ^{ns}
Fiber fineness vs Plant height	-0.3443 ^{ns}
Fiber fineness vs Number of monopodial branches plant ⁻¹	-0.1496 ^{ns}
Fiber fineness vs Number of sympodial branches plant ⁻¹	-0.2539 ^{ns}
Fiber fineness vs Number of bolls plant ⁻¹	-0.2196 ^{ns}
Fiber fineness vs Seed cotton yield plant ⁻¹	-0.3778 ^{ns}

** = Significant at P<0.01; * = Significant at P<0.05; n.s. = Non-significant

CONCLUSIONS

On the basis of over all results of this study, the following conclusions can be drawn:

The analysis of variance revealed significant differences among the genotypes for ginning outturn percentage and micronaire value. The promising cultivars Reshmi and NIA Ufaq performed very well in terms of lint%, staple length and fiber fineness among all genotypes. Correlation of different traits revealed that these varieties showed significant differences. Therefore, these traits may be used for hybridization programme to develop new promising cotton varieties.

ACKNOWLEDGEMENT

The author's special gratitude to Director, Nuclear institute of Agriculture, Tandojam for providing facilities to conduct the current study.

REFERENCES

1. Riaz, M., J. Farooq, G. Sakhawat, A. Mahmood, M.A. Sadiq and M. Yaseen, 2013. Genotypic variability for root/shoot parameters under water stress in some advanced lines of cotton (*Gossypium hirsutum* L.). Genetic Mol. Res., 12(1): 552-561.

2. Farooq, J., M. Anwar, M. Riaz, A. Farooq, a. Mahmood, M.T.H. Shahid, M.R. Shahid and F. Ilahi, 2014. Correlation and path coefficient analysis of earliness, fiber quality and yield contributing traits in cotton (*Gossypium hirsutum* L.). *The J. Animal & Plant Sci.*, 24(3): 781-786.
3. Ahmad, W., N.U. Khan, M.R. Khalil, A. Parveen, U. Ajmen, M. Saeed, Samiullah and S.A. Shah, 2008. Genetic variability and correlation analysis in upland cotton. *Sarhad J. Agric.*, 24: 573-580.
4. Soomro, Z.A., A.S. Larik, M.B. Kumbhar, N.U. Khan and N.A. Panhwar, 2008. Correlation and path analysis in hybrid cotton. *SABARO J. Pl. Breed. & Genet.*, 40: 49-56.
5. Gomez, K.A. and A.A. Gomez, 1984. *Statistical Procedures for Agricultural Research*. John Wiley & Sons Inc. 2nd (Ed.) New York U.S.A.
6. Raghav Rao, D., 1983. *Design of Experiments. Statistical Techniques in Agricultural and Biological Research*. Oxford and IBH Publishing Company, New Delhi.
7. Karademir, E., C. Karademir, R. Ekinci and O. Gencer. 2010. Relationship between yield, fiber length and other fiber related traits in advanced cotton strains. *Not. Bot. Hort. Agrobot. Cluj.*, 38(3): 111-116.
8. Copur, O., 2006. Determination of yield and yield components of some cotton cultivars semi-Arid condition. *Pak. J Biol. Sci.*, 9(14): 2572-2578.
9. Fahad, E., A. Ali, M.A. Nadeem, M. Tahir and A. Majeed, 2008. Comparative yield performance of new cultivars of cotton (*Gossypium hirsutum* L.) Department of Agronomy, University of Agriculture, Faisalabad-Pakistan. *Pak. J. Life Soc. Sci.*, 6(1): 1-3.
10. Ekinci, R., S. Basbag and O. Gencer, 2010. Path coefficient analysis between seed cotton yield and some characters in cotton (*Gossypium hirsutum* L.). *Journal of Environmental Biology*, 31(5): 861-864.
11. Killi, F., L. Efe and S. Mustafayev, 2005. Genetic and environmental variability in yield, yield components and lint quality traits of cotton. *International Journal of Agriculture and Biology*, 7: 1007-1010.