J. Appl. Environ. Biol. Sci., 6(6)8-12, 2016

ISSN: 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

Association of Quantitative Traits in Upland Cotton (*Gossypiumhirstum* L.)

Javed Hussain Sahito[1], Shibin Gao[1,*], Sajid Hussain Rao[2], Saifullah Abro[3], Siraj Ahmed Channa [4], Abdul Wahid Baloch[2], Niaz Ahmed Wahocho[5]

PhD scholar*
[1] Department Crop Genetics & Breeding, Sichuan Agriculture University, Wenjiang Chengdu Sichuan 611130, China
[2]Nuclear Institute of Agriculture (NIA) Tando Jam
[3]Department Plant Breeding & Genetics, Sindh Agriculture University Tandojam Sindh, Pakistan
[4]College of Agronomy, Northwest A&F University, Shaanxi Yangling 712100, China
[5]Department Horticulture, Sindh Agriculture University Tandojam Sindh, Pakistan
Received: March 30, 2016
Accepted: May 9, 2016

ABSTRACT

The present study was conducted in experimental field of Nuclear Institute of Agriculture, Tandojam, during kharif season 2013. The plants were grown with four replication in Randomized Complete Block Design. In order to determine the association among different yield and its components traits in cotton genotypes. The observations were recorded in plant height (cm), monopodial branches plant^{-1}, sympodial branches plant-^{1}, bolls plant^{-1}and seed cotton yield (gm) plant^{-1}. The analysis of variance depicted highly significant differences among all the genotypes for most parameters. Based on mean performance, varieties NIA-Ufaq and Chandi-95 displaced better performance in four out of five quantitative traits. While Reshmi produced tallest plants, maximum number of monopodial branches plant^{-1}. The correlation results revealed highly significant and positive associations of sympodial branches plant^{-1} and boll numbers plant^{-1} with seed cotton yield palnt^{1}.Present finding results clearly demonstrated that cotton production could be increased by increasing boll numbers plant^{-1} and sympodial branches plant^{-1}.Hence, these yield mechanism could be exploited potential material in future breeding programs to improve seed cotton yield.
KEYWORDS: Correlation coefficient analysis, Quantitative yield traits, *Gossypiumhirsutum* L.

1. INTRODUCTION

Cotton *Gossypiumhirsutum* L. is one of the most an important cash and fiber crop worldwide. Cotton crop is a major source of foreign exchange earnings and it play role of backbone in the economy of Pakistan(ADD reference here). Cotton seed cake edible oil is used for human and animal consumption whereas, approximately 70% of cotton is consumed in local industries [1, 2]. Cotton adds the 8.6% accounts value in agriculture and about 1.8% in total GDP.

The growth rate of world population is lower than the global demand of growing cotton is a rapid rate ADD reference here). The demand of good quality fiber has increased with time that's why cotton breeders are trying to improve the quality of cotton fiber to meet requirements of industry by produce ring high yielding and good fiber quality genotypes. Plant breeders and bioengineers have contributed well to achieve this goal [3]. Although today's Cotton is more genetically improved than cotton grown in ancient time. However, cotton breeders have paid more concentration to the development of genotypes that can meet the challenges of future. The main objectives of cotton breeder is to evolve high-yielding varieties. The yield of cotton crop depends on different plant characteristics such as plant height, number of sympodial branchesplant^{-1}, number of bollsplant^{-1}, boll weight, the weight of seed cotton, ginning outturn percentage (GOT%), etc. The Knowledge of association of different traits is important for cotton breeders in it facilitate in the selection of plants of desirable characteristics and to identify the extent of relationship between the different mechanism of performance has fruitfully exploited to improve cotton genotypes. The studies of [4, 5, 6] showed their main objectives in cotton breeding are maximum production of cotton yield and more lint yield with good quality of fiber.

The knowledge of correlation is very essential to determine the association of different traits with yield and yield contributing characters. The Improvement of one character may have an effect on the performance of the other characters such as the increase in the percentage of fiber can result in a reduction of the fiber length and vice versa. [7]Studies on genetic correlation and path coefficients he used the 56 families of F2 generation and its 8 parents and showed that boll plant^{-1} and lint percentage had significant and positive correlated with seed cotton yield plant^{1}, lint ratio, fiber length, weight of capsule and micronaire value. Boll weight was strong correlated with lint percentage,

***Corresponding author**: Shibin Gao, PhD scholar, Department Crop Genetics & Breeding, Sichuan Agriculture University, Wenjiang Chengdu Sichuan 611130, China. email:shibingao@163.com

micronaire and performance of plant. Staple Length and fiber fineness showed positive association with plant performance. The studies of [8] showed that the correlation between the main components of yield and plant-1 capsule, the capsule weight was positive associated with yield of raw cotton; however plant height was negatively correlated with the performance of cotton in eight cotton genotypes, which could be due to lodging. Current research is to estimate the correlation coefficient of performance and features contributing in eight genotypes of cotton.

2. MATERIAL AND METHODS

Present research was conducted to determine the association between seed cotton yield and yield contributing traits in commercial upland cotton *Gossypiumhirsutum* L. cultivars. The experimental was grown in the filed at the experimental farm of Nuclear Institute of Agriculture, Tandojam during the year 2013, in Randomized Complete Block design (RCBD) with four replications, row to row distance was kept 75 cm, plant to plant space was kept 30 cm.. The data of following genotypes FH-114, CRIS-134, NIA-Ufaq, Sohni, NIAB-777, Reshmi, Chandi-95 and Shahbaz for each varieties, All the suggested cultural practices and plant protection measures were carried out on appropriate time to obtain Healthy plants. Ten plant were randomly selected from each plot by replication and data was recorded for following plant traits; plant height (cm), number of monopodial branches plant^{-1}, number of sympodial branchesplant^{-1}, number of boll numbers plant^{-1} and seed cotton yield plant$^{-1.}$

Statistical analysis: The collected data was subjected to analysis of variance according to the procedures established by way of [9]. The association between qualitative and quantitative traits was determined according to [10].

3. RESULT AND DISCUSSION

Cotton has the most complex structure among major field crops, and its performance can be affected by multidirectional interactions of genetic and environmental factors. Study of the true relationship between the performance of cottonseed and related traits help to reveal its importance in cotton breeding programs. Seed cotton yield and yield contributing traits that are not under the direct control of a single gene. Therefore, the improved characteristics of the components lead to a corresponding improvement in performance. For understanding the mechanism of association, ie a cause-effect provides the basis for formulating selection criteria suitable in breeding programs based on yield components for the rational improvement of performance and components.

Mean squares in analysis of variance present in (Table 1)showed highly significant differences among genotypes for plant height, sympodial branches plant^{-1}, boll numbers plant^{-1}, and seed cotton yield plant^{-1}, it indicates that the genotypes are different from each other for these traits while the trait monopodial branches plant^{-1}wass non significant.

Table 1.Mean squares from analysis of variance for various seed cotton yield and other components in upland cotton (*Gossypiumhirstum*L.)

Traits	Mean squares		
	Replication D.F.=3	Varieties D.F.=7	Error D.F.=21
Plant height	331.838	619.387**	99.072
Monopodial branches plant^{-1}	0.65000	0.13143$^{n.s}$	0.06429
Sympodial branches plant^{-1}	0.25792	2.35411**	0.75125
bolls plant^{-1}	24.3083	19.5021*	7.5140
Seed cotton yield plant^{-1}	141.220	457.195**	46.825

** = Significant at 0.01% probability value; *= Significant at0.05% probability value; N.S. = Non-significant

Plant height (cm)

In cotton, the moderate height plants are more desirable for high yield because medium plants have a more production capacity to set the maximum boll numbers plant^{1}, which is the final results for desirable high yielding varieties. The data presented in Table-2 revealed that genotype Reshmi produced higher plants height (136.95cm) followed by Chandi-95 (118.1) while NIA-Ufaq plants had dwarf plant height (95.55cm) compared with the other genotypes. The research of [11] reported that the genotypes with lower plant height, short branches, changed leaves, and combinations of these mechanism grown at high plant densities and a system of narrow rows could be a good marginal to increase seed cotton yield. The results correlation coefficient for plant height indicated significant positive association with sympodial branches plant^{-1}, bolls plant^{-1} and seed cotton yield plant^{-1}revealedif plant height increase will cause corresponding increase in these associated traits (Table 3), our results are similar to those obtained by [12] who reported the association of plant height was positive with yield of cotton plant^{-1}and bolls. Other researchers

[13][14] and [15] found the plant height positive association with seed cotton yield and their further study described the characters such as plant height produced the 70% variability for seed cotton yield. Therefore, plant height is concluded that in the cotton harvest, plant height is a desirable character if there was no lodging occurred.

Monopodia branches plant -1

Cultivars have a low number of monopodial branches plant^{-1} have higher seed cotton yield plant^{1}. Therefore breeding most preferred performance should be given unless vegetative branches per plant. The average number of branches plant monopodial^{-1} resulted in Table-2 that showed the maximum (1.25) of the Monopodial branches plant^{-1} was recorded in Reshmi followed by NIA-Ufaq (1.15), whereas minimum produced NIAB-777 (0.70). These findings are similar to those of [16]. Monopodial branches are not significant with other characteristics. Our results are consistent with those of [17] who worked out the correlation analysis upland cotton and found that all parameters manifest positive correlation with the performance of cotton, except monopodial plant^{-1}.

Sympodial branches plant $^{-1}$

Maximum number of Sympodial branches is the major quantitative trait considered fruitful branches in the bolls are set cotton plant, therefore, contributes directly to the performance of cotton. Unit is believed to increase or decrease in the number of bolls affect performance cottonseed and depends largely on this important feature. Therefore, plant breeders and researchers recommended that maximum sympodial branches assist as a good criterion for selecting cotton varieties and its good performance. The average yield is shown in Table 2 indicates that for sympodial branches plant^{-1}, NIA-Ufaq showed the maximum sympodial branches plant^{-1} (21.65), while Sohni produced the minimum sympodial branches plant^{-1} (19.05). The correlation results revealed that sympodial branches plant^{-1} correlated significantly and positively with boll numbers plant^{-1} and seed cotton yield plant^{-1}. Positive association of sympodial branches plant^{-1} with bolls plant^{1} suggested that increased sympodial branches cause simultaneous increase in the number of bolls and yield of cotton present in (Table 3). Our results are consistent with those of [18,19] who resolved correlation analysis upland cotton and found that sympodial branches plant^{-1} and boll numbers plant^{-1} were positive and significant correlated with the performance of cotton.

Numbers of bollsplant^{-1}

The average yield of the bolls plant^{-1} are summarized in Table 2, which revealed that the variety NIA-Ufaq beard maximum boll numbers plant^{-1} (35.20) followed by Chandi-95 (33.7), while the lowest number of bolls plant^{-1} were obtained in nReshmi (29,60). Results of correlation present in (Table 3) indicated positive relationship of number of bolls plant^{-1} with the cotton yield. Number of bolls plant^{-1} is the main component in performance contributing and has a strong correlation with the performance of cotton. These associations indicated that the increased number of the bolls will cause a corresponding increase in the yield of cotton. The present results clearly demonstrate that cotton production could be increased by increasing the number of bolls [18, 19]reported a positive correlation of seed cotton yield with bolls plant^{-1}.

Seed cotton yield (g)

Performance is considered as the most important character who is required to drive up production performance at its peak, as it performed a major role in the strengthening of social economic conditions of farmers and ultimately the country. The average yield of seed cotton yield showed that the variety NIA-Ufaq gave higher yield of seed cotton plant^{-1} (109.12g) followed by Chandi-95 (103.02), while the variety Reshmi gave the lowest yield of cotton seed plant^{-1} (78.51 g). The relationship between some characteristics of plants and yield of seed cotton to local cotton genotypes grown in densities medium and high sowing described[20,21,10], reported that boll numbers plant^{-1} was positively correlated with the cotton yield; However, plant height was negatively correlated with the performance of cotton, which could be due to lodging.

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

Genotypes	Plant height (cm)	Monopodial branches plant^{-1}	Sympodial branches plant^{-1}	bolls plant^{-1}	Seed cotton yield plant^{-1}
FH-114	105.65	1.1	20.7	28.55	79.18
CRIS-134	107.7	0.85	19.45	30.05	87.81
NIA Ufaq	95.55	1.15	21.65	35.2	109.12
Sohni	112.3	0.95	19.05	32.2	90.93
NIAB-777	116.65	0.7	19.15	30.65	87.86
Reshmi	136.95	1.25	20.45	29.6	78.51
Chandi-95	118.1	0.95	20.55	33.7	103.02
Shahbaz	103.45	0.85	20.2	31.55	87.27
LSD 5%	14.64	0.37	1.28	4.03	10.06

Table 3.Correlation coefficient (r) between seed cotton yield and various traits in cotton genotypes

Traitsassociation	Correlation coefficient (r)
Plant height vsmonopodial branches plant^{-1}	0.2126^{ns}
Plant height vs sympodial branches plant^{-1}	0.8860**
Plant height vs boll numbers plant^{-1}	0.7099*
Plant height vs Seed cotton yield plant^{-1}	0.6012*
Monopodialbranches plant^{-1}vs boll numbers plant^{-1}	-0.0658^{ns}
Monopodialbranches plant^{-1}vs Seed cotton yield plant^{-1}	-0.3084^{ns}
Sympodial branches plant^{-1} vs bollplant^{-1}	0.9091**
Sympodial branches plant^{-1} vs Seed cotton yield plant^{-1}	0.7718*
Boll numbers plant^{-1} vs Seed cotton yield plant^{-1}	0.9289**

** = Significant at 1%probabilityvalue; * = Significant at5%probability value; N'S= Non-significant.

5. CONCLUSIONS

On the basis of our findings it is concluded that varieties Chandi-95 and NIA- Ufaq performed very well in terms of performance of seed cotton yield and bolls plant^{-1}, while NIAB-777 and CRIS-134 rankers were next good, therefore, these varieties may be preferred for breeding program to develop new high yielding varieties. The promising cotton showed the close relationship between sympodial branches plant^{1}and bolls plant^{-1}were highly significant and positive with seed cotton yield, therefore, these components can be used as performance criteria reliable improve performance selection of raw cotton. The present results clearly demonstrate that cotton production could be increased by maximum boll numbers plant^{1} and sympodial branches plant^{1}.

5. ACKNOWLEDGEMENT

We acknowledge Nuclear Institute of Agriculture (NIA), Tandojam for providing facilities to conduct research.

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