Genetic Variability and Correlation Analysis of Some Upland Cotton *(Gossypium hirsutum L.) Accessions.*

Muhammad Zahir Ahsan*, Muhammad Saffar Majidano, Hadayatullah Bhutto, Abdul Razzaque Channa, Karim Bakhsh Sial, Allah Dino kalhoro

Abstract--To determine the variation and correlation of different traits with seed cotton yield per plant in *Gossypium hirsutum* accessions, the experiment was conducted at central cotton research Institute Sakrand, PAKISTAN during 2014. It is clear from the analysis of variance that accessions were highly significant for all the recorded traits. It was clear from the analysis that seed cotton yield was positive correlate with the most of the traits under observation. Beside lint percentage, seed cotton yield is the ultimate objective of the growing cotton. Highest seed cotton yield per plant (125.42g) was observed in CRIS-667 followed by CRIS-665 i.e. 120g. This type of correlation is rarely found and ultra desirable by the cotton breeders.

Key words: Variability, Correlation, Accessions, Upland Cotton, *Gossypium hirsutum*

1. INTRODUCTION

Cotton fiber is used for clothing and cotton seed is the source of vegetable oil production [27]. In Pakistan, cotton having a share of 1.4% in GDP and 6.7% in agriculture value addition and a source of raw material for the textile industry and about 50-62 percent of total domestic edible oil production [5].

The development of varieties having tolerance to CLCuV, possessing better fiber quality and greater yield potential are the primary objectives of a cotton breeder. Seed cotton yield is influenced by both genetic and environmental factors. Interaction between these two factors makes the selection difficult. Knowledge about the relationship between yield and its components facilitate the breeders in the selection of desirable genotypes.

Vast information about the genetic potential of genotypes, genotypic and phenotypic correlation between different plant characters is available in literature. The observation on correlation by the Khan [14] stated that the seed cotton yield was positively correlated with bolls per plant and bolls weight. Further studies in this respect also indicated that seed and lint indices were positively associated with seed cotton yield. Genetic variability and positive correlation were observed for yield traits in *G. hirsutum* [8,13,29]. The principle objectives in the cotton breeding are higher production of seed cotton and lint yields with better fiber quality, early maturity and resistance to diseases and insect pests [15,16,18]. In light of the above, a research plan was outlined to study the genetic capability of different genotypes and correlation studies of different cotton yield traits under climatic conditions of Sakrand, Benzirabad, Pakistan.

Corresponding Author: Muhammad Zahir Ahsan, ahsanzahir@gmail.com
Central Cotton Research Institute Sakrand, Benzirabad (Nawabshah), Sindh Pakistan

2. MATERIALS AND METHODS:

2.1. Genetic material and field procedure:

The experimental work to study the genetic ability of genotypes and association of seed cotton yield with yield contributing traits in *Gossypium hirsutum* was carried out during 2014 at Central Cotton Research Institute Sakrand, Pakistan. The breeding materials comprised of eight upland cotton accessions i.e., CRIS-664, CRIS-665, CRIS-666, CRIS-667, CRIS-668, CRIS-669, CRIS-670 and CRIS-342, Accessions were sown on beds with Row × Row distance 75cm and plant × plant distance 30cm in RCB design with three replications on May 8, 2014. Each replication has 4 rows. Thinning was done to maintain the proper plant population. All recommended cultural practices were done uniformly for each replication and treatments and picking was done during the month of October and November 2014.

2.2. Traits measurement:

At maturity from central two rows ten plants were randomly selected. The data were recorded for Plant Height (cm), bolls per plant, boll weight (gm), seeds per locule, seed per boll, , lint per boll, seed index, lint per seed and seed cotton yield per plant (g). For seeds per boll, 20 bolls were separated and after counting the number of seeds in each boll, the average number of seeds per boll was calculated or each accession. The seeds per locule were counted in each locule for the 10 bolls per plant to have average seeds per locule. For seed index after ginning the hundred cotton seeds were weighed and hundred seed weight in grams (g) was treated as seed index. Lint index means the weight of lint obtained from one hundred gram seeds in grams; however lint index was calculated by the formula given below.

$$Lint\ Index = \frac{\text{Seed Index} \times \text{Lint\%}}{100 - \text{Lint\%}}$$

$$Lint\%\ (GOT\%) = \frac{\text{Weight of Lint in a Sample}}{\text{Weight of Seed cotton sample}} \times 100$$

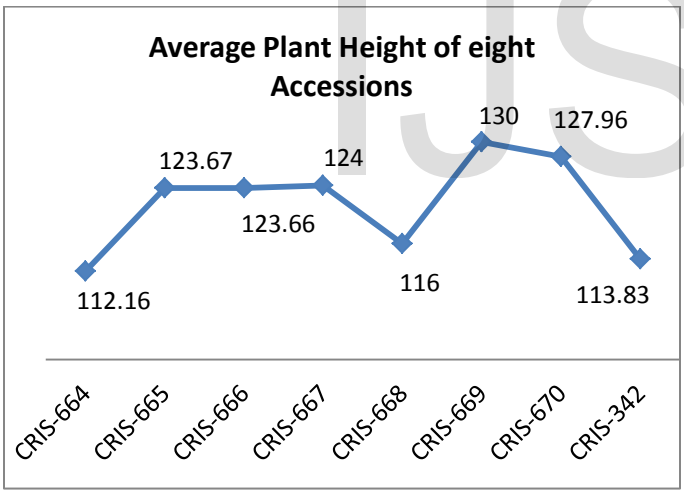
2.3. Statistical Analysis:

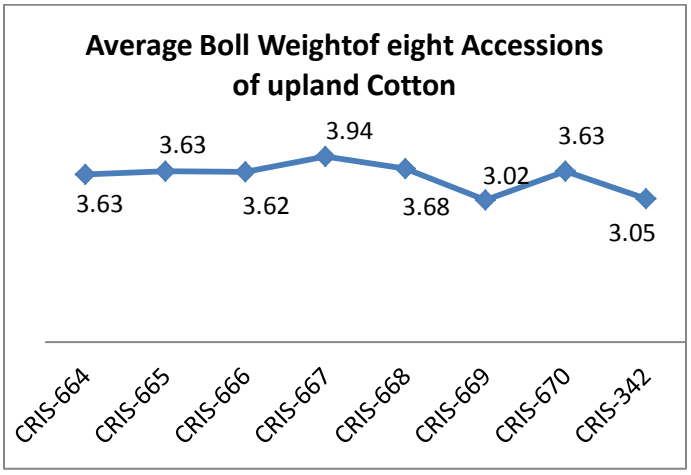
Analysis of variance of the recorded data was calculated according to the method of Steel and Torrie [28] to compare the mean differences among cotton genotypes for seed cotton yield per plant and its other components.

3. Results and Discussion

Plant Height (cm)

Plant height varies from 112.16cm (CRIS-664) to 130cm (CRIS-669). Analysis of variance showed that the variation among accessions is significant for plant height. It is also observed that non significant positive correlation (0.004) was present among the plant height and seed cotton yield per plant but Cotton Breeders are mostly concerned with short statue plant because lodging reduces the crop yield adversely. It is also observed that short stature crop easy to pick mechanically or with machines. Khan [14] and Khan *et. al.,* [16] and Batool *et. al.,* [8] reported that plant height had positive correlation with seed cotton yield and number of bolls per plant. Toahua and Haipeng [30], Khan [14] also reported the genetic variability among different cotton accession for plant height and stated that if lodging did not occur plant height had positive correlation with seed cotton yield per plant. So it is concluded that plant height is favorable character if lodging does not occur.





Boll Weight (g)

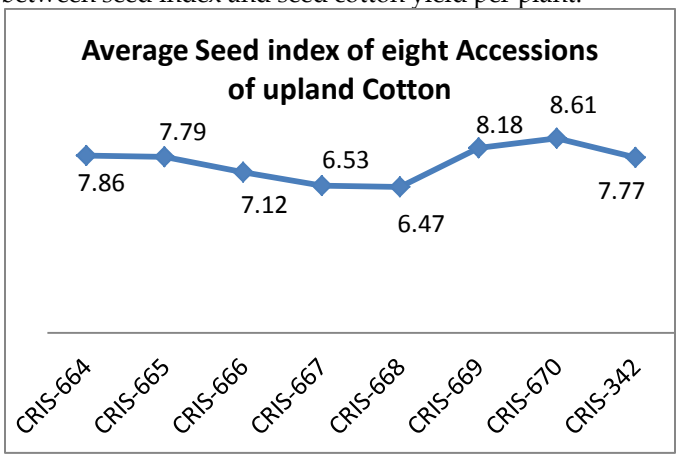
A significant variation found in boll weight among the eight accessions and below graph show that maximum boll weight observes in CRIS- 667 (3.94g) and minimum boll weight was found in CRIS CRIS-669 (3.02g). It is also observed that seed cotton yield per plant significantly influenced by boll weight. As the boll weight increases the cotton yield of a plant also increases. Ivanova and Stovanova [12], Terziev *et. al.,* [31] Abouzaid *et. al.,* [1] also recorded similar type of observations in upland cotton for boll weight. Boll weight has a greater contribution in enhancing the total crop yield. Khan [14] and Copur [10] also made this clear through their experiment that boll weight had significant variation for different cultivars and had positive effect on seed cotton yield per plant. Taohua and Haiping [30] and Meena *et. al.,* [23] had also made this clear that boll weight should be kept in mind while breeding for seed cotton yield they also confirmed that boll weight had significant effect on seed cotton yield per plant.

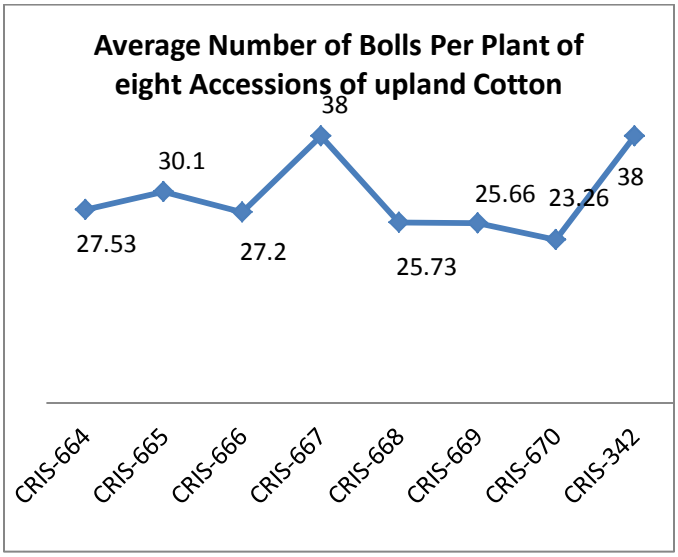
Number of Bolls per Plant

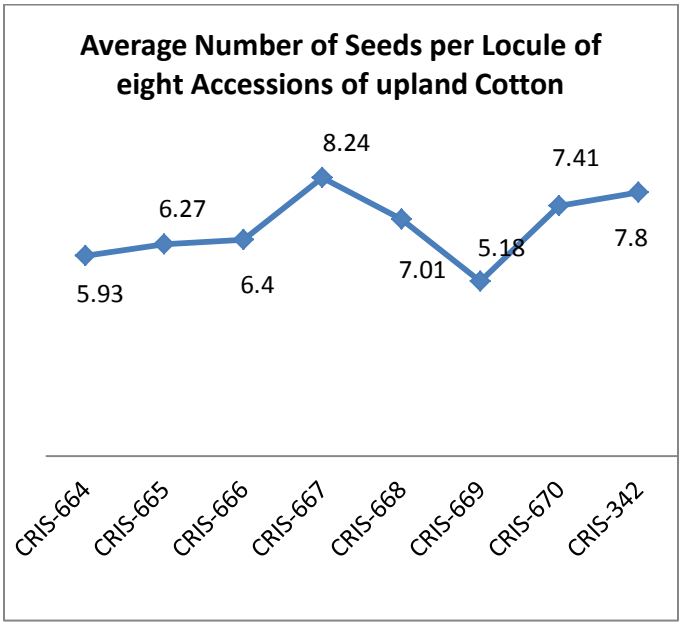
Number of bolls per plant is varied from 23.26 (CRIS-670) to 38 (CRIS-667 and CRIS-342). Analysis of variance showed that significant variation among the accessions present (Table 1). A highly significant positive correlation (0.862) with the seed cotton yield per plant also observed. Seed cotton yield was directly associated with number of bolls per plant selection for higher number of bolls per plant will surely increase the seed cotton yield. It is noticed by the different scientists that cotton cultivars differ in boll production (Cook & El-Zik [9] and Khan [14].

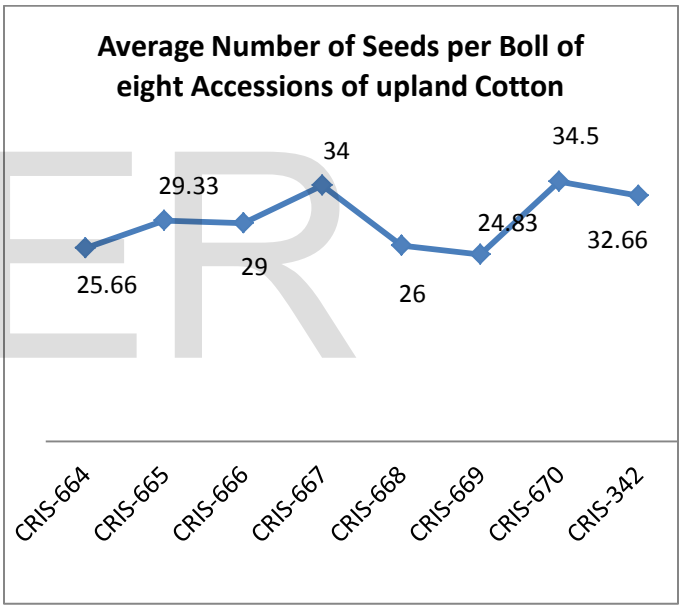
Seed Index (g)

Maximum seed index is found in CRIS-670 (861) and lowest seed index is observed in CRIS-668 (6.47). It is clear from the table 1 that significant variation present for seed index but it is also clear that it have minor effect on seed cotton yield per plant.. Khan *et. al.,* [18] observed significant differences among different upland cotton genotypes for seed index they also observed that positive correlation was present between seed index and seed cotton yield per plant. Echekwu [11] also observed moderate positive correlation between seed index and seed cotton yield per plant.









Number of Seeds per Boll

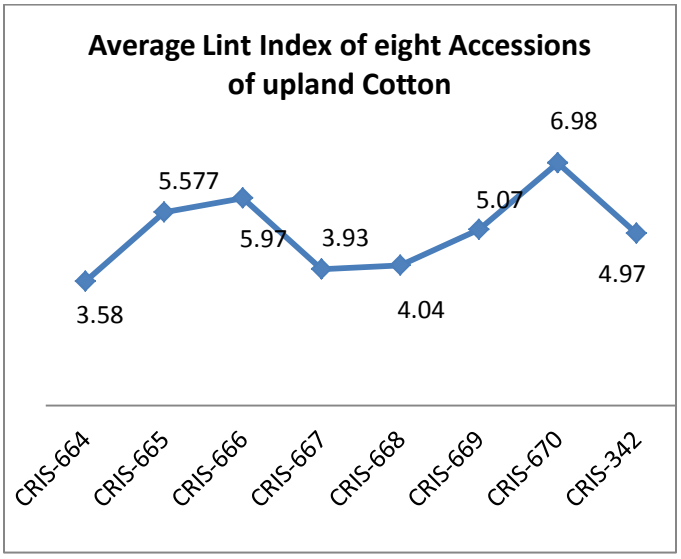
Number of seeds per boll in an important yield component and manage boll weight and seed cotton yield. Seed cotton yield per plant influenced by the number of seed per boll because they directly increases the boll weight so variety having higher number of seeds will have more seed cotton yield as compared to the variety having less number of seeds. Maximum number of seeds per boll is observed in CRIS-670 (34.5) followed by CRIS-667 (34) and minimum number of seeds per boll is CRIS-669 (24.83). Analysis off variance clear that these variations among the accessions are highly significant (Table 1) also highly significant correlation between the number of seeds per boll and seed cotton yield were observed. Iqbal *et al.,* [14] and Wang *et al.,* [29] derived information on genetic variability and positive correlation between seeds per bolls and seed cotton yield including other yield characters in *G. hirsutum*.

Number of Seeds per Locule

Maximum number of seeds per locule is found in CRIS-667 (8.24) followed by the CRIS-342 (7.8) and minimum number of bolls per locule exhibited by the CRIS-669 (5.18). From analysis of variance it is clear that the accessions are significantly different from each other for number of seeds per locule (Table 1). Number of seeds per locule has highly significant positive correlation with the seed yield per plant. Makhdoom *et. al.,* [22], Khan [14] and Khan *et al.,* [18] also noted that seventy percent variability in the seed cotton yield per plant was attributed by the number of seeds per locule. Murthy [24] and Wang *et al.,* [29] derived information on genetic variability and observed positive yield correlations with number of seeds per locule.

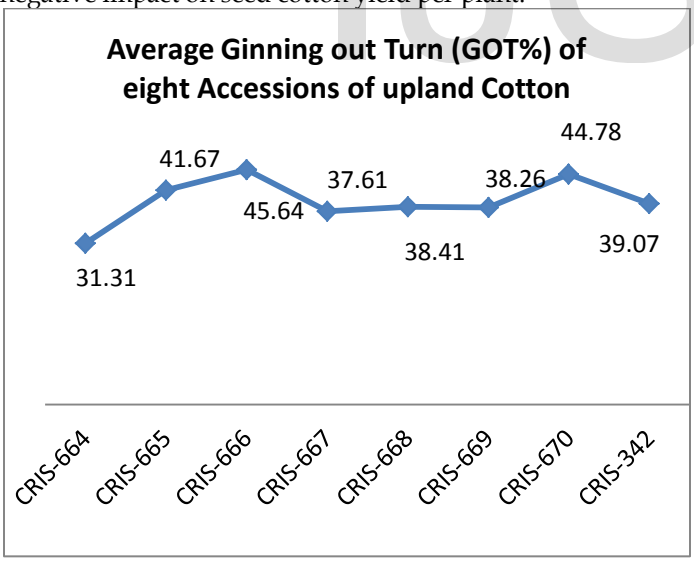
Lint Index

Highest lint index 6.98 observed in CRIS-670 followed by the 5.97 in CRIS-666 and lowest exhibited by the CRIS-664 i.e. 3.58. Table 1 indicated that significant variation present among the accessions so this character should also consider during selection process. Table also showed that Lint index had significant positive correlation with the seed cotton yield per plant. Asad *et. al.,* 2002 observed that lint index had significant influence on seed cotton yield per plant. The confirmation the results were made by the studies of the Kalpande *et al.* [20] Rao and Gopinath [25].



Ginning out Turn (GOT %)

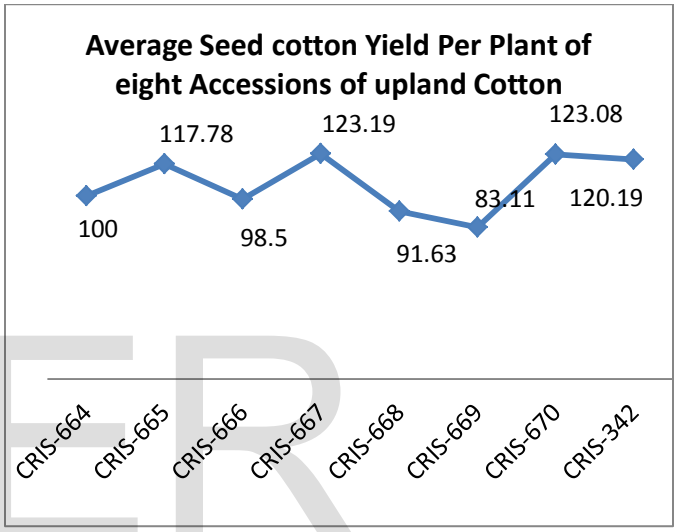
Highest ginning outturn (GOT %) is found in the accession CRIS-666 (45.64) followed by the CRIS-670 (44.78) and lowest GOT% is observed in the CRIS-664 (31.31). From the analysis of variance it is clear that accessions are significantly different from each other for ginning out turn (table 1) but table 2 also showed that ginning out turn has no significant effect on total seed cotton yield of the plant. Amudha *et. al.*, [21] Ahuja *et. al.*, [4 also confirmed through experiments that ginning out turn had non significant negative impact on seed cotton yield per plant.



Seed Cotton Yield per Plant

Seed cotton yield per plant is the main objective of the cotton breeder besides lint percentage. Highest seed cotton yield per plant is obtained from CRIS-667 (123.19g) followed by the CRIS-670 (123.08g) and lowest seed cotton yield is obtained from CRIS-669 (83.11g). Highly significant variability among the accessions has been observed for seed cotton yield per plant (Table 1). The yield also manifested strong positive correlation with number of bolls per plant, boll weight and seed index. There is a great opportunity in the said accessions for further yield enhancement because most the traits have significant positive correlation with the seed cotton yield per plant. Khan[14] and Ahmed *et. al.*, [3] also noticed that significant variation among different cultivars of upland cotton for seed cotton yield which indicated that seed cotton yield can be improved by improving s

eed traits. Afiah and Ghoneim [2], Badr [7], Khan *et. al.*, [17,18] and Soomro et. al., [26] also observed that seed cotton yield had strong positive correlation with the said seed traits.



4. Conclusion

Genetic potential of genotypes and correlation of different yield traits revealed that the cultivars showed highly significant differences for most of the traits. The promising accessions CRIS-665, CRIS-667, CRIS-670 and CRIS-342 with high genetic potential for majority of the traits can safely be used in future cotton breeding for further exploitation of their genetic variability.

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Table: 1 Analysis of Variance and CV% of various traits of upland cotton (*G. hirsutum*)

Characters	Mean Sum of Squares	CV %
Plant Height	131.05**	5.2
Boll Weight	0.303**	8.7
Number of Bolls per Plant	79.63**	16.3
Seed Index	1.76**	9.7
Number of Seeds per boll	44.69**	12.9
Number of Seeds per Locule	3.13**	14.4
Lint Index	3.98**	22.1
Ginning out turn GOT%	61.61**	11.0
Seed cotton Yield Per Plant	753.34**	14.2

Table: 2 Correlation of various traits with the seed cotton yield per plant and Standard Error

Characters	Correlation with Seed cotton Yield per Plant	Standard Error
Plant Height	0.004	1.30
Boll Weight	0.329**	0.062
Number of Bolls per Plant	0.862**	1.022
Seed Index	0.113	0.149
Number of Seeds per boll	0.882**	0.77
Number of Seeds per Locule	0.760**	0.199
Lint Index	0.297*	0.23
Ginning out turn GOT%	0.266*	0.89