

Original Research Article

Genetic variability among quality traits in cotton varieties

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Abstract

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Five cotton genotypes were grown at Research Farm, Lasbela University of Agriculture, Water and Marine Sciences (LUAWMS), Uthal: Pakistan in 2008. The seed was obtained from Central Cotton Research Institute, Multan and sown in a randomized complete block design with three replications to test the adoptability, heritability (broad sense) and genetic advance values for quality traits viz. Plant height, bolls/plant, boll weight/plant, GOT (%), staple length and yield/plant. It is best of our collected data to explain that LUAWMS has been established in very remote area of Pakistan in 2005 where basic data on crops from research point of view is not up to the mark. Researchers tried to be pioneer in evaluation of cotton varieties under harsh condition of drought and rockiness of soil, however, such parameters other than quality traits were excluded during preparation of this manuscript due to lack of funding and expertise that may need to be considered in lateral projects.

Keywords: Cotton varieties, Genetic variability, Quality traits

INTRODUCTION

Cotton is warm season and a main cash crop in Pakistan that is widely used in textile industries to earn foreign exchange. However, it has been observed that though the climate of District Lasbela is suitable for cotton production but the local farmers have to face a number of problems due to lack of people interest in marketing and guidance of cotton before 2005. Establishment of The Lasbela University of Agriculture, Water and Marine Sciences in 2005 looked a promising achievement of Government to uplift not only educational level but also to diagnose problems and possible solutions in field of research for best of local community of District Lasbela specially and rest of Pakistan in general. From agricultural prospects, fiber quality is the basis for the marketing and sale of cotton throughout the world (Hake *et al.*, 1990).

However, working with new scientific organization with limited facilities, authors faced challenging environment of work in prescribed remote area of Pakistan where little or negligible work has been done so far on various major

crops of the country; cotton is one of those that was seemed to be fit in this hot climatic conditions (Pakistan, 2006). The heritable improvements in economic character need determination of genetic traits before conduction of a breeding program. Knowledge of heritability of a trait thus guides a plant breeder to predict behavior of succeeding generations and helps to predict the response to selection. High genetic advance coupled with high heritability estimates offer a most suitable condition for selection (Larik *et al.*, 1989).

A heritability analysis is considered as variation in all characteristics of a population (Turkheimer, 2000) and different methods were used to estimate heritability (Cattell, 1960; Visscher *et al.*, 2008). Temperature, humidity, and soil moisture may affect cotton yield, yield components and fiber properties. A number of factors influence its growth in a specific location, therefore estimation of genetic and environmental variability for cotton yield, yield components and lint quality traits at different environments are targeted for start of successful

breeding program. The genetic and nongenetic parameters, heritability, and direct and indirect relations between yield and yield components for yield improvement are being studied from past (Miller *et al.*, 1958; Miller *et al.*, 1959; Miller *et al.*, 1962). Different researchers have conducted a number of parameters for improvement of cotton germplasm indicating that cotton exhibit quickly fruiting cycle under suitable temperature and humidity conditions (Hau *et al.*, 2001). Heritability estimates suggest chances of improvement (Sekloka *et al.*, 2008); heritability of different traits have been worked out so far like in a study, salinity parameters were considered in estimating the heritability (Azhar and Ahmed, 2000) but our goal was to measure chances of improvements for yield related attributes in studied cotton varieties finding warm temperature of our targeted region to initiate this pilot project.

Significant differences for most of traits and broad sense heritability of seed cotton yield, yield component and lint quality traits on five introduced cotton genotypes from Azerbaijan comparing with two standard cotton varieties ranged very low to high values and higher value (91.80%) was recorded for seed cotton weight (Killi *et al.*, 2005). Therefore, availability of good knowledge of heritability and genetic advance existing in different yield parameters is a pre-requisite for effective plant improvement exercise. Keeping in view, the present study was designed for determination of genetic variability among cotton varieties in field conditions of Uthal city of District Lasbela: Pakistan where lack of researchers and research organizations to be worked on this valuable cash crop are being restricted farmers attraction.

MATERIAL AND METHODS

The seed of five cotton genotypes viz. CIM-496, CIM-499, CIM-506, CIM534 and CIM-538 (Table1) was obtained from Central Cotton Research Institute, Multan, Pakistan and sown at Research Farm, Lasbela University of Agriculture, Water and Marine Sciences, Uthal: Pakistan with three replications using randomized complete block design with 1.5ft of plant to plant distance and 2ft of row to row distance in 2008. Same agronomic practices were followed in all replications and data on different traits viz. bolls/plant, boll weight, GOT (%), staple length and yield/plant were collected on ten randomly selected plants in each row at maturity. Various methods have been practices to measure broad sense heritability coefficients (Comstock and Robinson, 1952; Agresti and Coul, 1998) but in preparation of this manuscript, we preferred to describe significance of data and heritability estimates through analysis of variance table can be ascertained after field data analysis (Steel and Torrie, 1980).

RESULTS AND DISCUSSIONS

All the genotypes exhibited significant differences for all characters to be studied (Table1). However, it is also mentioned that our data need much attention through repetition of a number of new experiments before reliability value of the genotypes due to insufficient resources of manpower and equipments but can provide a well hypothetical base line for future scientists, students and pesticides companies who are looking to work on this cash crop being suitable temperature of described remote area of Pakistan other than banana with valuable textile market (Karachi city) near to it. Among studied traits, maximum number of bolls/plant according to our studied data under stress field conditions (Table 1), were observed for CIM-496 whereas genotype CIM-499 exhibited minimum bolls/plant and heritability of this character was found higher with high value of genetic advance (Table 3). Measuring the boll weight trait, higher value was recorded for CIM-506 and lowest for CIM-496 (Table 1) while this trait showed high heritability estimate but with little value of genetic advance (Table 3). Ginning out turn (GOT) %age was higher for CIM-496 and lower for CIM-499 (Table 1) with high heritability and genetic advance values (Table 3). Staple length for CIM-499 was highest while it was lowest for CIM-506 (Table 1) with higher heritability and average genetic advance calculations (Table 3) of this trait. Last character under our studies parameter was yield/plot where CIM-496 gave highest yield of cotton and CIM538 & CIM-499 gave low yield of cotton among other genotypes (Table 1). Heritability estimated value for yield/plot was higher but genetic advance estimate was low to medium (Table 3).

All the genotypes exhibited significant differences for all characters to be studied for agronomic traits and their heritability estimates (Table 1 and Table 3). Among studied traits (Table 1), maximum number of bolls/plant according to our studied data under stress field conditions (Table 1), were observed for CIM-496 whereas genotype CIM-499 exhibited minimum bolls/plant. Measuring the boll weight trait, higher value was recorded for CIM-506 and lowest for CIM-496. Ginning out turn (GOT) %age was higher for CIM-496 and lower for CIM-499. Staple length for CIM-499 was highest while it was lowest for CIM-506. Last character under our studies parameter was yield/plot where CIM-496 gave highest yield of cotton and CIM538 & CIM-499 gave low yield of cotton among other genotypes. Heritability and genetic advance values were calculated and presented in Table 3. The heritability value of minimum bolls/plant was found higher with high value of genetic advance. Heritability and genetic advance values were calculated and presented in Table 3. Higher value of heritability for boll weight was noticed but with little value of genetic advance. Ginning out turn (GOT) %age comprised of high heritability and genetic advance values. Staple

Table 1. Average performance of cotton varieties grown in Agriculture Farm of Lasbela University during 2009

Treatment	Variety Name	Bolls/plant (150 dap)	Boll weight (g)	GOT %	Staple length mm	Seed cotton yield (Kg/plot)
V ₁	CIM- 496	27.67	2.99	35.75	25.63	2.7
V ₂	CIM-499	23.33	3.54	32.7	26	1.85
V ₃	CIM-506	25.67	3.6	35.16	23.87	2.35
V ₄	CIM-534	24.67	3.47	35.41	25.43	1.87
V ₅	CIM-538	24.0	3.02	34.42	25.43	1.84

Table 2. Analysis of variance for cotton varieties grown in Agricultural Farm of Lasbela University during 2009

Source of variation	Df	Bolls/plant	Boll weight	GOT%	Staple length	Yield/plant
Treatment	4	8.57**	0.26**	4.41**	2.016**	0.45**
Replication	2	0.27	0.006	1.04	0.24	0.004
Error	8	0.52	0.011	0.15	0.09	0.006

^{df} Degree of freedom

** Highly Significant difference

Table 3. Heritability and genetic advancement for different traits of five cotton genotype grown in Agricultural Farm of Lasbela University during 2009

Traits	Bolls/plant	Boll weight	GOT%	Staple length	Yield/plant
h ²	94.31	95.82	96.79	95.72	98.75
G.A	4.99	0.88	3.63	2.44	1.17

h² = Heritability

G.A = Genetic Advanced

length attained higher heritability estimates whereas calculated value of genetic advance was moderate for this trait and yield/plot also exhibited higher heritability estimated value but genetic advance estimate was low to medium.

Among other genotypes it is also noticeable that range of bolls/plant varies from lower to higher and higher presented value of heritability with more estimated genetic advance (Table 3) are indicating improvement of characters in lateral breeding programs in addition to improve the soil and agronomic practices to reclaim natural stressful field conditions. Comparing bolls weight among different genotypes, where range varied, there was a point of thinking that CIM-496 though was good in number of bolls/plant but its boll weight is lowest one. It is critique able that genotype CIM-496 had less boll weight but exhibited higher GOT %age due to existence of more number of bolls/plant (Table 1). The chances of improvements are comparative less in the trait of staple length due to medium genitive advance value as compared to those traits where higher genetic advance values were documented (Table 3). Yield is complex and important trait in crops for farmers and is influence by a number of factors. Among our studied parameter of yield/plot, its further improvement in breeding program seemed little due to gain of less genetic advance value.

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