

Research Article

Study on the analysis of yield and fiber quality characteristics of upland cotton (*Gossypium hirsutum* L.)

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Abstract

The present study was conducted at the Cotton Research Institute (CRI) in Tandojam during the kharif season of 2022. The study aimed to investigate the yield and fiber characteristics of upland cotton (*Gossypium hirsutum* L.) genotypes. The plant material was grown in the field in a randomized complete block design (RCBD) with three replications and eight genotypes, including one check variety. The plant height (cm), sympodial branches per plant, bolls per plant, boll weight, and staple length showed highly significant differences at a probability level of <0.01. Monopodial branches per plant, seed cotton yield, and GOT% indicated differences at a probability level of >0.05. Among the eight genotypes, the TH-26/23 genotype had the maximum plant height, monopodial branches per plant, boll weight, seed cotton yield, while TH-23/23 had the maximum sympodial branches per plant, bolls per plant, seed cotton yield, and GOT%. According to the correlation analysis, plant height showed a significant favorable relationship with monopodial branches per plant, and a highly significant and favorable relationship with boll weight, seed cotton yield, and GOT%. Monopodial branches per plant showed a highly significant relationship with GOT%. Sympodial branches per plant showed a significant relationship with staple length. Boll weight showed a highly significant correlation with seed cotton yield.

Keywords: Cotton; Fiber quality traits; Genotypes; Stability

Introduction

The cotton crop is globally valuable, a synthetic cash crop widely popular with

highly important natural fibers that are utilized for the manufacture of textiles in the recent and past world [1]. Cotton belongs to

the family Malvaceae with the *Gossypium* genus and is known as a flowering plant. The widely cultivated genus of cotton in the world includes *Gossypium*, allotetraploid $2n=52$, *G. arboreum* diploid $2n=26$, *G. barbadense*, *G. herbaceum* [2]. Cotton is famous for its important fiber and is widely cultivated in tropical as well as subtropical areas of the world. It is a fact that Pakistan is known as the 4th largest country producing the maximum amount of cotton in the world [3]. Cotton seeds are also widely used for edible oil purposes, and their seed cakes are fed to animals as a major protein source [4]. The fiber of cotton is a well-known commodity and is utilized in the textile industry. Cottonseed is also a major source of cooking oil and feed for cattle, but due to a lack of knowledge, its importance is still hidden from farmers [5]. In recent days, the use of cottonseed cake as a protein source for non-ruminants and human consumption is increasing due to its rich protein properties and affordable prices [6]. The demand for food for humans and animals is increasing day by day, and scientists are trying to search for more sources of food rich in protein, vitamins, and minerals at reasonable prices to fulfill the demand of the ever-increasing world population. *Gossypium hirsutum* L. is the main cultivated species of cotton, accounting for 95% of the world's cotton production with maximum production capacity and the ability to adapt to extreme environmental and weather conditions in tropical as well as subtropical areas of the world [7]. Furthermore, the species has been used in China to increase production. China is the world's largest cotton producer and consumer of raw cotton, accounting for one-quarter of the world's cotton production [8]. Keeping in view the importance of cotton and its production, as well as the fiber characteristics, the present study was designed with the following methodology.

Materials and Methods

The present research was carried out during the Kharif season of 2022 at the Cotton Research Institute, Agriculture Research Center (ARC), Tandojam. Eight varieties of cotton were used in the experiment. The experiment was laid out using a Randomized Complete Block Design (RCBD) with three replications.

Genotypes

1. TH-22/23
2. TH-23/23
3. TH-24/23
4. TH-25/23
5. TH-26/23
6. TH-27/23
7. TH-28/23
8. Sindh-1

Observation recorded

Plant height cm

The data regarding each plant height was recorded in centimeter at the age of maturity from the base of ground to the upper top of plant through measuring tap.

Number of monopodial branches plant⁻¹

The monopodial branches are a stem like vegetative branches which are present in the bottom of the plant.

Number of sympodial branches plant⁻¹

The sympodial branch is a fruit bearing branch. In cotton, generally two buds grow at edge of leaf. While the upper part is known as the axillary bud whereas the lower part is known as extra axillary. The axillary bud grows into monopodial is a replica of main stem while the extra axillary bud grows into sympodial branch, which bear fruit. The data regarding number of fruiting branches counted at the time of picking from each plant.

No. of bolls plant⁻¹

The bolls which were fully opened were picked from tagged plant. The number of total bolls was recorded as the production of bolls plant⁻¹.

Boll weight g

The boll weight was recorded through dividing production of cotton seed plant-1 with number of boll plant⁻¹.

Cotton seed yield plant⁻¹

The total number of bolls collected from tagged plant and cotton seed from each plant was weighed separately through electric weighing machine.

GOT (%)

The dry and clean cotton seed plant-1 sample was weighed and ginned through electric saw ginning machine. The obtained lint from each plant index was recorded by electric weighing machine in grams. The percentage of lint was recorded using the formula:

$$\text{Lint\%} = \frac{\text{Weight of lint}}{\text{Weight of cotton seed}} \times 100$$

Length of staple

The total staple of fiber length was recorded taking five samples from each plant index and recorded the length of fiber by the help of tuft method in millimeter unit. using tuft method in millimeters.

Statistical analyses

The data regarding analysis of variance was estimated by procedure provided by Gomez and [9]. The total mean genotypes of all traits were compared through LSD least

Significant differences test at 5% level of probability. The cluster analysis was determined using the squared Euclidean distance, and PCA, was carried out using multivariate statistical package (MVSP-3) [7].

Results and Discussion

The result of analysis of variance showed that most of the parameters in cotton genotypes, such as plant height (cm), sympodial branches plant⁻¹, bolls plant⁻¹, bolls weight (g), staple length was observed highly significance at (0.05) probability level (Table 1). In our study between the several between cotton genotypes, the plant height varied between (114.67cm) and (100.20 cm). The tallest plant was indicated in TH-26/23 (114.67 cm). While minimum plant height was observed in (100.20 cm) TH-22/23 genotypes. Analysis of variance displayed variance in genotypes at (<0.01) and (>0.05) probability level such as height of plant, sympodial branches plant, bolls plant¹, boll weight, length of staple, cotton seed production and GOT percentage. Significant variance was observed among the detected characters. It was also found that the same significant results applied to all the characters [2].

Table 1. Analysis of variance of production and fiber characteristics in upland cotton genotypes

Character	Mean Square		
	Replication	Genotype	Error
	DF=2	DF=7	DF=14
Plant height (cm)	0.06	77.65**	0.57
Monopodial branches	0.12	0.57*	0.12
Sympodial branches	25.41 **	25.41 **	0.58
Bolls plant ⁻¹	1.14	14.70**	0.57
Boll weight	0.04	0.16 **	0.00
Seed cotton yield plant ⁻¹	0.10	344.79 *	1.14
GOT%	0.59	1.93*	0.81
Staple length	0.08	1.53**	0.03

** , * = Significant at 1% & 5 % probability and NS = non-significant

Mean performance

Mean performance values for all the characters are presented in (Table 2). Between the several between cotton genotypes, the plant height varied between (114.67cm) and (100.20 cm). The tallest plant was indicated in TH-26/23 (114.67 cm). While minimum plant height was observed in (100.20 cm) TH-22/23 genotypes. The results showed that the maximum number of monopodial branches per plant was observed in Sindh-1 (1.67), followed by TH-23/23 (0.87). The minimum was observed in TH-22/23 (0.53). The maximum number of sympodial branches per plant was observed in TH-23/23 (23.73) and TH-24/23 (23.13). The lowest number of sympodial branches per plant was observed in TH-26/23 (16.33). The range of bolls per plant varied from 35.67 to 43.00. The maximum bolls per plant was recorded in TH-26/23 (43.00) followed by TH-27/23 (39.33) and lowest bolls per

plant was collected in (35.67) Sindh-1. The highest boll weight was recoded in (3.40 g) TH-28/23 followed by TH-26/23 (3.30) and lowest boll weight was indicated in (2.73 g) TH-22/23. The maximum seed cotton yield was measured in TH-26/23 (142.13) followed by TH-28/23 (129.27) and minimum seed was measured in TH-24/23 (112.73 g). The GOT% was examined of all genotypes. The maximum GOT% was recorded in the Sindh-1 (37.75 %) while minimum GOT% was observed in the TH-24/23 (35.44 %) in upland cotton genotypes. The findings of our study were supported by [10, 11], who have also reported higher values for bill weight, and seed cotton production. Another study was carried out by [12], who reported less values as compared with present study, the variation among findings might be due to climatic conditions, seed dormancy, land management as well as variety.

Table 2. Mean Performance of yield and fiber traits of upland cotton genotypes

Genotypes	Plant height (cm)	Monopodial branches	Sympodial branches	Bolls plant-1	Boll weight (g)	Seed cotton yield	GOT %	Staple length (mm)
TH-22/23	100.20f	0.53b	22.67abc	41.47b	2.73e	113.30d	36.67c	29.37a
TH-23/23	106.87d	0.87b	23.73a	39.73c	3.15bc	125.00c	36.59abc	28.17c
TH-24/23	103.93e	0.60b	23.13ab	38.53cd	2.90d	112.73d	35.44bc	28.43c
TH-25/23	108.67c	1.07ab	21.67c	38.80cd	3.27ab	126.57c	36.40abc	29.30a
TH-26/23	114.67a	1.53a	16.33d	43.00a	3.30a	142.13a	36.24abc	27.50d
TH-27/23	109.67c	0.63b	22.67abc	39.33c	2.87de	113.43d	36.71ab	27.50d
TH-28/23	114.00ab	0.67b	23.00abc	38.00d	3.40a	129.27b	36.33abc	28.30c
Sindh-1	113.00b	1.67a	22.00bc	35.67a	3.10c	112.97d	37.75a	28.80b
LSD 5%	1.33	0.62	1.34	1.32	0.14	1.87	0.31	0.32

The knowledge remembers the average performance of eight genotypes indicated among cotton genotypes. Between the several cotton genotypes, the plant height varied between (114.67cm) and (100.20 cm). The tallest plant was indicated in TH-26/23 (114.67 cm). While minimum plant height was observed in (100.20 cm) TH-22/23 genotypes. The maximum number of monopodial branches (1) was observed in

Sindh-1 (1.67), followed by TH-23/23 (0.87). The minimum was observed in TH-22/23 (0.53). The maximum number of sympodial branches per plant (23.73) was observed in TH-23/23, and (23.13) was observed in TH-24/23. The lowest number of sympodial branches per plant (16.33) was observed in TH-26/23. The findings of our study were supported by [13, 14], who have also reported higher values for plant height, and seed

cotton production. Another study was carried out by [15], who reported less values as compared with present study, the variation among findings might be due to climatic conditions, seed dormancy, land management as well as variety. The maximum to minimum bolls plant⁻¹ was recorded (43.00) to (35.67). The maximum bolls per plant was recorded in TH-26/23 (43.00) followed by TH-27/23 (39.33) and lowest bolls per plant was collected in (35.67) Sindh-1 [16]. The highest boll weight was recorded in (3.40 g) TH-28/23 followed by TH-26/23(3.30) and lowest boll weight was indicated in (2.73 g) TH-22/23. The maximum seed cotton yield was measured in TH-26/23 (142.13) followed by TH-28/23 (129.27) and minimum seed was measured in TH-24/23 (112.73 g) [17]. The GOT% was examined of all genotypes. The maximum GOT% was recorded in the Sindh-1 (37.75 %) while minimum GOT % was observed in the TH-24/23 (35.44 %) in upland cotton genotypes. The staple length was measured in different upland cotton genotypes. The maximum staple length was measured in the TH-22/23 (29.37 mm) while the minimum staple was observed in the new cotton genotypes TH-27/23 (27.50 mm) [18].

Conclusion

The plant height (cm), sympodial branches plant⁻¹, bolls plant⁻¹, boll weight, staple length was showed highly significant at (<0.01) probability level. While monopodial branches plant⁻¹, Seed cotton yield and GOT% indicated at (>0.05) probability level. Among the eight genotypes the TH-26/23 genotypes have maximum plant height, monopodial branches plant⁻¹, boll weight, seed cotton yield and. The maximum TH-23/23 had maximum monopodial branches plant⁻¹, sympodial branches plant⁻¹, bolls plant⁻¹, seed cotton yield and GOT%.

Authors' contributions

Conceived and designed the experiments: N Gandahi & RA Kaleri. Performed the

experiments: RA Kaleri, N Gandahi, MZH Abbasi, SK Baloch & N Kaleri. Analysed the data: R Samoon, TH Majeedano & A Bughio, Contributed reagents/ materials/ analysis tools. N Rasid & SK Kaleri. Wrote the paper. RA Kaleri & FA Kaleri.

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