

## STUDY ON HERITABILITY AND CORRELATION ANALYSIS OF PRODUCTION AND FIBER CHARACTERISTICS OF UPLAND COTTON

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### ABSTRACT

*This investigation was performed to evaluate the heritability and correlation analysis of production and fiber characteristics for upland cotton (*Gossypium Hirsutum* L.). This experiment was performed at Agriculture Research Center Tandojam in (RCBD) with three replication and eight genotypes with one check variety. In this study the parameters observed height of plant, bolls plant-1, boll weight, sympodial branches plant-1 monodial branches plant-1, staple length showed highly significant at (<0.01) probability level. While the results for cotton seed production, sympodoial branches plant-1 and monopodial branches plant-1 and GOT% indicated at (>0.05) probability level. Among the eight genotypes, the TH-26/23 genotypes have maximum height of plant, smypodial branches plant-1, monopodial branches plant-1, cotton seed production and boll weight, while TH-23/23 had maximum number of bolls plant-1, sympodial branches plant-1, GOT%, monopodial branches plant-1 and boll weight. According to correlation the plant height had showed only significant favorable relationship with the monopodial branches plant-1, and height of plant showed significantly higher and beneficial relationship among boll weight, cotton seed production and GOT%. The monopodial branches plant-1 indicated significantly higher relationship with the GOT%. The sympodial branches-1 showed significant relationship with staple length. Boll weight showed highly significant correlation with the seed cotton yield. The heritability in broad sense estimated high heritability for majority of the studied material which exhibited that characters should be improved through simple selection.*

**Keywords:** Heritability, Correlation, Yield, Fiber, Upland cotton.

### INTRODUCTION

Cotton is very important cash crop due to its natural fiber commodity and widely used in textile industry for synthesis of various materials such

thread, cloth, socks, towels etc. The information regarding as rich sources of protein from cottonseed cake as feed for animal as well as

cooking oil for human consumption still lack identified due to short concentration and studies (Huang et al., 2020). Heritability studies offer crucial genetic information to breeders for predicting gene interactions in segregating generations. It has been observed heritability and genetic progress inform us about character inheritance from parents to progenies and selection response (Degewione et al., 2017). The heritability is genetic parameter used observe the percentage of physical variation of a characteristics that is responsible for genetic variation, indicating the extent to which a trait is influenced by genetics compared to environmental factors (Memon et al., 2017). The heritability of cotton genotypes can differ depending on the specific trait under investigation. Traits like fiber length or micronaire are known to exhibit high heritability, signifying that a substantial portion of the variation in these traits stems from genetic differences among cotton genotypes (Morris et al., 2018). Knowledge regarding correlation analysis and quality traits linked with production is highly useful for recognizing the production component. The correlation is a genetic tool that play key role for analyzing the relationship in which beneficial association showed that increase in the one trait will positively increase the other traits linked with each other (Mukoyi et al., 2018). It has been reported that negative correlation indicates that increase one traits results in decrease the other trait vice versa with other linked trait. Hence, the positive results for correlation among two different traits are known as desirable and negative will be called as non-desirable traits in genetics (Robert et al., 2013).

### Material and Method

This investigation was performed in Kharif season 20222 in (CRI) Cotton Research Institute, Agriculture Research Center Tandojam, Sindh, Pakistan. Total eight varieties of cotton were used. The experiment was layout under 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

Following Parameters were used in this study:

- Height of plant
- No. of monopodial branches plant-1
- No. of sympodial branches plant-1
- Boll weight
- No. of bolls plant-1
- Cotton seed production
- GOT %
- Staple length

### Statistical Analysis

The data was collected and typed on computer to analysis the variance with formula as suggested by (Gomez & Gomez, 1984). The average genotypes mean of all characteristics were compared with LSD test at the level of 5% probability.

### Results

#### Heritability estimates in broad sense

The results for heritability ( $h^2_{b.s}$ ) estimates in broad sense showed that ( $h^2_{b.s}$ ) and phenotypic variance ( $\delta^2_p$ ), results from different varied component for different traits are showed in Table-1. The results of heritability estimates for height of plant in our study ( $\delta^2_g = 77.08$ ) showed low values for genetic variance as compared with phenotypic variance ( $\delta^2_p = 77.84$ ), that higher ranges of heritability estimates ( $h^2 = 99.02\%$ ). The results regarding cotton seed production, genetic and phenotypic variance was observed 343.62 and 345.17, respectively, in our study, that cause higher values of heritability estimates ( $h^2 = 99.60\%$ ). The results for genetic and phenotypic variance of monopodial branches plant-1 was observed 0.45 and 0.61, respectively, that indicates that ( $h^2=73.77$ ) values for heritability estimates. Sympodial branches showed the genetic variance ( $\delta^2_g$ ) of 24.83 which is also near to its phenotypic variance ( $\delta^2_p = 25.60$ ), as a consequences, high heritability estimate was achieved ( $h^2=96.99\%$ ) for sympodial branches. In case of boll plant<sup>1</sup>, the genetic variance ( $\delta^2_g =$

14.13) was so near with its phenotypic variance ( $\delta^2_p = 14.89$ ), resultant revealed high heritability estimates ( $h^2 = 94.89$ ). The results for boll weight trait genetic and phenotypic variance was recorded 0.61 and 0.21, which showed high level of heritability results for this trait (76.19). Similarly the genetic and phenotypic variance was observed for cotton seed production 343.62 and 345.17, respectively in our study, that showed higher values of heritability estimates for

mentioned trait (99.60%). Whereas the genetic and phenotypic variance for GOT percentage was observed under the moderate range 1.12 and 2.43, which indicates low level results for heritability estimates for said trait (30.36%). The results for length of staple regarding genetic and phenotypic variance was recorded 1.50 and 1.54, cause high range of heritability estimates in our study (90.90%).

**Table 1 Heritability of production and fiber characteristics of genotypes**

Characters	Genotypic variance ( $\delta^2_g$ )	Phenotypic variance ( $\delta^2_p$ )	Broad sense heritability
Plant height (cm)	77.08	77.84	99.02
Monopodial branches plant <sup>-1</sup>	0.45	0.61	73.77
Sympodial branches plant <sup>-1</sup>	24.83	25.60	96.99
Bolls plant <sup>-1</sup>	14.13	14.89	94.89
Boll weight	0.16	0.21	76.19
Seed cotton yield plant <sup>-1</sup>	343.63	345.17	99.60
GOT%	1.12	2.43	30.36
Staple length	1.50	1.54	90.90

**Correlation analysis:**

The correlation among the height of plant was found positively higher and significant (0.51\*\*) relationship among monopodial branches plant<sup>-1</sup>. The plant height was showed negative but significant association (-0.47\*) with the sympodial branches plant<sup>-1</sup>. The height of plant revealed that negative and non-significant linkage (-0.20<sup>ns</sup>) with the sympodial branches plant<sup>-1</sup>. Whereas relation of height of plant was observed highly significant and favorable relationship with boll weight. The plant height was observed significantly higher and positive relation among cotton seed production. The association plant height was showed significant and positive (0.49\*) relationship with GOT%. The plant height was shown negative but significant (-0.49\*) association with staple length. The Monopodial branches plant<sup>-1</sup> was indicated negative and significant relationship (-0.44\*) with the sympodial branches plant<sup>-1</sup>. Linkage between monopodial branches plant<sup>-1</sup> was recorded non-significant and negative association (-0.04<sup>ns</sup>) with bolls weight. The results for cotton seed production showed non-significant relation or unfavorable relationship (0.32<sup>ns</sup>) with the

monopodial branches plant<sup>-1</sup>. The results for monopodial branches plant<sup>-1</sup> revealed non-significant and positively higher association among (0.37<sup>ns</sup>) and GOT%. The relationship between the monopodial branches plant<sup>-1</sup> was recorded non significant and negative correlation (-0.08<sup>ns</sup>) among staple length. The sympodial branches plant<sup>-1</sup> was indicated significant relationship but negative (-0.51\*) with the bolls plant<sup>-1</sup>. The sympodial branches was indicated negative and non-significant relationship (-0.38<sup>ns</sup>) with the boll weight. The relationship between the sympodial branches plant<sup>-1</sup> was showed negative and highly significant (-0.69\*\*) relation in between sympodial branches and seed cotton yield plant<sup>-1</sup>. The relationship between sympodial branches plant<sup>-1</sup> and GOT% was negative and non-significant association (-0.02<sup>ns</sup>) with the GOT%. The association between the sympodial branches plant<sup>-1</sup> was indicated positive non-significant (0.37<sup>ns</sup>) association with the staple length. The correlation between the bolls plant<sup>-1</sup> and the boll weight was the negative and non-significant (-0.14<sup>ns</sup>) association between the bolls plant<sup>-1</sup> and boll weight. The relationship between bolls plant<sup>-1</sup> was indicated positive and significant

(0.48\*) association between bolls plant<sup>-1</sup> and seed cotton yield. The connection between the bolls plant<sup>-1</sup> was showed the non-significant and negative linkage (-0.34<sup>ns</sup>) with GOT%. The relationship between the bolls plant<sup>-1</sup> was showed negative and non-significant association (-0.23<sup>ns</sup>) with staple length. The correlation between boll weight was indicated highly significant and favorable relationship (0.77\*\*) with the seed cotton yield plant<sup>-1</sup>. The connection between boll weights was showed non-significant but positive

(0.24<sup>ns</sup>) relationship with the GOT%. The relation between boll weight and staple length was indicated negative and non-significant (-0.18<sup>ns</sup>) relationship between each other. The seed cotton yield correlated with staple length in a non-significant but positive (0.01<sup>ns</sup>) way. The seed cotton yield revealed a non-significant (-0.35<sup>ns</sup>) but negative relationship among staple length. The correlation of GOT% showed non-significant but negative (-0.09<sup>ns</sup>) interrelationship with the staple length.

**Table 2 The correlation of different yield and fiber trait in upland cotton genotypes**

Traits	Plant height	Monopodial branches plant <sup>-1</sup>	Sympodial branches plant <sup>-1</sup>	Boll plant <sup>-1</sup>	Boll weight	Seed cotton yield	GOT%
Monopodila branches plant <sup>-1</sup>	0.51**						
Sympodial branches plant <sup>-1</sup>	-0.47*	-0.44*					
Bolls plant <sup>-1</sup>	-0.20 <sup>ns</sup>	-0.4 <sup>ns</sup>	-0.51*				
Boll weight	0.74**	0.30 <sup>ns</sup>	-0.38 <sup>ns</sup>	-0.14 <sup>ns</sup>			
Seed cotton yield plant <sup>-1</sup>	0.57**	0.32 <sup>ns</sup>	-0.69**	0.48*	0.77**		
GOT%	0.49*	0.37 <sup>ns</sup>	-0.02 <sup>ns</sup>	-0.34 <sup>ns</sup>	0.24 <sup>ns</sup>	0.01 <sup>ns</sup>	
Staple length	-0.49*	-0.08 <sup>ns</sup>	0.37 <sup>ns</sup>	-0.23 <sup>ns</sup>	-0.18 <sup>ns</sup>	-0.35 <sup>ns</sup>	-0.09 <sup>ns</sup>

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

**Discussion**

In our study findings regarding broad sense heritability estimates, genetic and phenotypic variance showed higher values for plant height, cotton seed production, monopodial branches plant and sympodial branches plant-1. These results are supported by findings of (Memon et al., 2018), who had reported higher values for plant height, monopodial branches and sympodial branches plant. Whereas the findings of (Morris et al., 2017) were relatively low as compared with results revealed in our study. He reported low to moderate values for plant height, monopodial branches plant-1 and sympodial branches plant-1 in different check varieties of cotton grown under different agro ecological zones. Another study was carried out by (Baloch et al., 2015), whose findings are in agreement with the results of our investigation and depicted higher values of heritability estimates for plant height, monopodial branches plant-1, sympodial branches plant-1 in upland cotton grown in agro ecological region of

Tandojam, Sindh, Pakistan. The variation between the results might be due to different ecological areas such as tropical, subtropical, dry, arid as well as semi arid zones. It has also been reported that variation among the findings may be due to variety differences, their management, use of chemical fertilizers and farm management with different latest techniques. The findings of our study for heritability estimates in boll plant-1, boll weight and length of staple was observed low to moderate. Similar results were revealed by (Baloch et al.,2015), who had also reported low to moderate values for boll weight, staple length and bolls plant-1. These results showed resemblance and variation are climatic and environmental factor that influence on the ability of plant and size of data is also responsible. In our study findings regarding correlation estimates among different yield and fiber traits showed higher and positive values for plant height, cotton seed production, monopodial branches plant and sympodial branches plant-1. These results are supported by findings of (Memon et al., 2018), who had reported high and positive results for correlation estimates for plant height, monopodial

branches and sympodial branches plant. Another study was carried out by (Baloch et al., 2015), who had reported positively higher and significant values for plant height, monopodial branches and sympodial branches plant. The results of (Morris et al., 2017), were controversial with our study, who revealed negative and low to moderate results for plant height, monopodial branches and sympodial branches plant. The difference among the findings may be due to additive genetic effect and environment affect. It has also been reported that epigenetics also associated in variation between different genes showed association either positive or negative between the traits. The result of our study for correlation estimates among boll plant-1, boll weight and length of staple were observed negative and low. These values are in agreement with the results showed by (Morris et al., 2017), who had also reported low negative values for mentioned traits. The similarity and variation might be due to additive genetic effect, inbreeding and environment influences. The correlation between the bolls plant<sup>-1</sup> and the boll weight was the negative and non-significant association between the bolls plant<sup>-1</sup> and boll weight. The connection between the bolls plant<sup>-1</sup> was showed the non-significant and negative linkage with the bolls plant<sup>-1</sup> and GOT (Shibin et al., 2016). The relationship between the bolls plant<sup>-1</sup> was showed negative and non-significant association with the bolls plant<sup>-1</sup> and staple length. The correlation between boll weights was indicated highly significant and favorable relationship with the seed cotton yield plant<sup>-1</sup>. The connection between boll weights was showed non-significant but positive relationship with the GOT (Abdul et al., 2020). The relation between boll weight and staple length was indicated negative and non-significant relationship between each other. The seed cotton yield correlated with staple length in a non-significant but positive way. The seed cotton yield revealed a significant but negative relationship among staple length. The correlation of GOT% showed non-significant but negative interrelationship with the staple length.

#### **Conclusion:**

The heritability in broad sense estimated that high heritability were observed for majority of the

studied material which exhibited that characters should be improved through simple selection. According to correlation the plant had showed only significant favorable relationship with the monopodial branches plant<sup>-1</sup> and plant height showed highly significant and favorable relationship with boll weight, seed cotton yield and GOT%. The monopodial branches plant<sup>-1</sup> was indicated highly significant relationship with the GOT%. The sympodial branches plant showed significant relationship with staple length. Boll weight showed highly significant correlation with the seed cotton yield.

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