بسم الله الرحمن الرحيم

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Variability and Heritability in Eleven Genotypes of Cotton (*Gossypium Hirsutum* L.) For some Growth and Yield Characters

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الآيـة

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قال تعالى:

(وَفِي الْأَرْضِ قِطَعٌ مُتَجَاوِرَاتٌ وَجَنَّاتٌ مِنْ أَعْنَابٍ وَزَرْعٌ وَنَخِيلٌ صِنْوَانٌ وَغَيْرُ صِنْوَانٍ يُسْقَى بِمَاءٍ وَاحِدٍ وَنُفَضِّلُ بَعْضَهَا عَلَى بَعْضٍ فِي الْأُكُلِ إِنَّ فِي ذَلِكَ لَآيَاتٍ لِقَوْمٍ يَعْقِلُونَ)

صدق الله العظيم

سورة الرعد الآية (4)

DEDICATION

To …

My mother who filling me with happiness and shinning my life..

To …..

My father the source of light….

To ….

My teachers, to my sisters and brothers….

Finally…..

To my dear friends and clleagues….

This work is dedicated……

ACKNOWLEDGEMENT

My first and last thanks to ALLAH ALKAREEM who gave me health and strength to complete this research successfully. My special thanks and respect goes to Dr. Atif Elsadig Idris and Dr. Babeker Eshag, Shambat Research Station for their valuable guidance and supervision during the preparations of this dissertation. My thanks goes to all teachers at dept. of Agronomy, College of Agricultural Studies for their sincere help. To my dear sisters, brothers, colleagues and all friends I offer this works. I am also grateful to all teaching staff and all my colleagues in the Department of agronomy and for their aid during my college life.

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ABSTRACT

The experiment was carried out in experimental farm Agricultural Research corporation, Shambat Research Station to study variability and heritability in eleven genotypes of American Cotton *(Gossypium hirsutum* L.*)* for some growth and yield characters, during season (2015-2016). The design of the experiment was a randomized complete block (RCBD) with three replications. Eight growth and yield characters were measured included Plant height(cm) , Number bolls, Number of fruit branches, Number of vegetative branches, stem diameter(cm), 100-Seed weight(g), Seed cotton yield(k/ha) and Lint seed cotton yield(t/h). The genotypic and phenotypic variances and heritability for different characters were estimated. The results revealed that there were significant differences for all studied characters except Plant height and Number of vegetative branches. The highest and the lowest values of genotypic and phenotypic variances were obtained by Seed cotton yield and 100-seed weight respectively. The highest and the lowest values of heritability were obtained by Seed cotton yield and 100-Seed weight respectively. The genotype (L.5) scored the highest value (323.5) of Lint seed cotton yield.

الخلاصة

أجريت هذه التجربة بهيئة مزرعة البحوث الزراعية محطة أبحاث شمبات بهدف دراسة التباين ودجة التوريث بين إحدى عشر طراز وراثي من القطن قصير التيلة لبعض صفات الانتاجية والنمو في موسم(2015-6 201) وتم استخدام تصميم القطاعات العشوائية الكاملة في ثلاث مكررات وتم قياس ثمانية صفات وهي طول النبات وعدد اللوز وعدد الافرع الثمرية وعدد الافرع الخضرية وقطر الساق ووزن المائة حبة والقطن البزرة والقطن الشعرة، كما تم تقدير التباينات الوراثية والمظهرية ودرجة التوريث بالنسبة للصفات المختلفة وأظهرت النتائج فروقات معنوية لكل الصفات تحت الدراسة ماعدا طول النبات وعدد الفروع الخضرية .وأظهرت النتائج ان أعلى قيمة للتباينات الوراثية والمظهرية كانت لصفات القطن البزرة ،كما أظهرت النتائج ان أعلى وأقل قيمة لدرجة التوريث كانت لصفات القطن البزرة ووزن المائة البزرة على التوالي ،الصنف (L.5) أحرز أعلى قيمة لوزن القضن الشعرة وكانت (323.53)

CHAPTER ONE

INTRODUCTION

Cotton(*Gossypium spp)* belongs to the order Marvels, family Malvaceae and genus Gossypium,whih includes about 45 diploid (2n=2x=26) species and five allotetraploid (2n=4x=52) species (cultivated and wild) (Brubaker et al., 1999). Cotton is an important fibre crop of global importance which is grown in tropical and subtropical regions of more than 60 countries of the world. Despite threat from synthetic fiber or manmade fiber, cotton retains its reputation as ‘‘queen of the fiber plants’’ For multi uses of lint and by-products, cotton is also referred to as ‘‘white gold ‘‘ . Vineela et al (2013).

Cotton as one of the most important cash crop in the world, it has high economic value one of the industrial crops, where it enters go for many uses, such as the textile industry, the textile industry in medical fields (cotton wool and gauze), in the manufacture of explosives and carpets, paper, synthetic fibers, cellulose in the lining tissues furniture, glass industrial and automotive paint as well as in the chemical industry and photographic Films of X- ray, in the production of cotton seed oil plant, contains high percentage of oil in the seed abut 18 – 26% and is used in cooking and soap making butte, industrial and other food industrial. Also the loss of industrial waste (oil industry) where the seed contains 24 – 25% protein is used as livestock but does not fit in poultry because it contains a poisonous called substance gossypol which is not borne by animals, also used cotton is the cotton is as crop residue after harvest in animals feed, fuel and construction has been occupied cotton seed oil ranked fourth among the vegetable oils in the world in the terms of quantity of production. Most of cotton cultivars in Sudan characterized by

low yield, therefore in such environments it is better to select high Yield genotypes and use it as cultivars as parent in any cotton breeding program.

In any crop improvement program, knowledge of nature of gene action and inheritance of traits is essential so as to choose a suitable breeding methodology in crop improvement. Presence of wider spectrum of variability will enhance the chances of selection as ideal genotype. Besides genetic variability, information on heritability and genetic advance measure the relative degree to which a trait is transmitted to its off spring thereby aids the breeder to employ a suitable breeding technique to achieve the objectives Vineela et al (2013). There fore,the main objectives of this research are to study variability and heritability in eleven cotton (*Gossypium hirstum)*genotypes for some growth and yield characters and to select the most productive one.

CABTERAR TWO

LITERATURE REVIEW

2-1 Botanical Description:

2 - 1 - 1 Root system:

Enjoy the cotton with strong tap root violability. For instants in the clay soil as in the Gezira scheme along root up to 1.5 meters put in loamy soil and sediment could reach the root length of 4.5 – 6 meter branch of main roots large number seated side in four rows of sated side depends on the type of soil and water availability .The roots of cotton have the ability absorb high

2 - 1 - 2 Stem:

Herb high cylindrical smooth green harden at maturity and there by a large number of glands brown color, stem carrying leaves and vegetative branches of floral and vegetative branches also be given flower branches dunks spiral on the main stem.

2 - 1 - 3 Leaf:

Leaf a simple along neck and there are averting. Bald is broad trait. And lobular it varies 4.5 – 6 meter the leaf estimated the number of lobes between 3 – 5 cloves, but in some type of cotton have full blood not cloves or simple there are (11) races reship on the blade blosairat surface of the leaf is covered in some varieties may be the blade is smoothed in others. The presence of hair protects the plant from sucking insect.

Leaf surface as well as with number of oil glands there are also oil gonads in other ports of the plant and the bolls and flowers there Bremond Abbott in threw leaf and only one of which is given a branch vegetative or floral.

Basal branches vegetative and the upper reaches of the vase and bear bolls flowering branches out of the stem or basol vegetative branches.

2 - 1 - 4 Flowers:

The Round flower with (3-4) sepals inner sepals of the flower yellow from the outside and a five –quant at the base of the flower, and the internal leaves provider with glands nectar external and internal.

2 - 1 - 5 Fruit:

Fruit known as poll is as spherical capsule or oval shaped opining at the Edges of curable color from bright green cotton in the American cotton dark Green in Egyptian cotton also the ranging surface of the boll of American Cotton sleek with least oil glands or to the boll Egyptian cotton in it grooves And a large number of oil glands boll consist of 3 – 5 rooms each room Containing all clove from 6 – 9 needs.

2-1-6 Seeds:

Normally there should be mine seed in cash look or twenty – seven to forty –five per boll. However a lock usually contains on or two undeveloped (aborted) seeds called most. The seeds are usually ovoid in shape (figure 33.7) most of the up – land cotton varied have dark brown seeds covered with fuzz. (Tone *et al*) (2006):

2 - 1 - 7 Fiber:

Cotton fiber is single-cell specialized extensions of the epidermal cells of the ovules or seed. They usually beg ion growth about the day of a thesis and continue for approximately 25days. The inimical growth is known as the primary cell wall and consists of A very thin hyaline type. (Stephan 200).

2 - 2 Botanical Characterization:

Cotton is only agriculturally important member of the mallow family (malvaceae). Tow species in the genus are cultivated: G.hirsutum and G.barbadense .upland cotton (G.hirsutum) has relatively short fibers, from 0.75inch (2cm) to 2.25 inches (3cm) in Length.sea Island and Egyptian types (both classified as.G.barbadenses) have longer fibers.

Generally, cotton is classified as an annual, in the tropics however, plant of G.barba-denes may be short-lived perennials.

Flower are born on alternate sides of the fruiting branches, and they are typically complete and per feet (figure23-2) Three leaf like bracts are found at The base of each flower. The calyx is composed of five large sepals, and the corolla of five large. Showy petals color varies from white to purple and, depending on the cultivar. (Stephan et al 2000).

2 - 3 Environmental Requirements:

Cotton is warm – season crop, it is not pro-diced in regions in which the mean annulal-temperatura is below 60℉ (60c). Cardinal temperature for germination and seedling growth are minimum 60℉ optimum 93℉ and maximum 102℉ (16̊, 34̊and 39̊c respectively).

Cotton requires moderate to fairly large amounts of water. The minimum is about 20 inches (50cm) of rain fall per year. The optimum for economical yields is more than 60 inches (150cm) distributed throughout the growing season.

Irrigation requirements vary from 24 to 42 inch (61-107cm).Cotton is day – neutral in photoperiodic response amid flowers in determinately – until the fall frosts. However, the crop is sensitive to light quantity. Cotton requires high light in- testy during most of the growing season for efficient growth and economic yields. (Stephan *et al* 2000)

2 – 4 Production practices

Production practices in cotton was described as the following:

2 - 4 – 1 Seedbed preparation:

Initial seedbed preparation for cotton is some – what similar to that described for corn. Initial cultivation is done either immediately after harvesting or early in the ring as field conditions will allow, depnding on the pre – ceding crop in rotation. The primary objective is to work crop residues into the soil. Plowing and chiseling hand pan. If necessary.are com-pleated before find seedbed preparation.

2 - 4 - 2 Fertilizers:

Like all crops, cotton requires balanced supply of minerals for efficient growth and high yields. Cotton has high demand for nitrogen in its life – from about tow months tow four months (75-125) after planting – with highest demand for nitrogen coming about 90 days after planting(Stephan 2000)

2-4-3 Harvesting:

The princeling methods of harvesting cotton machine stripping and machine picking. In addition, cotton may be picked or snapped by hand but in most areas, hand picking and hand snapping have given way entirely to me chemical methods. Mechanical stripping first came into use about 1914 in the high plains area of taxes with many homemade sled strippers in use until about 1930. Two-row tractor-mounted strippers were in used by 1943.(Stephan 2000).

2-5 Pests:

The most significant can pest associated with cotton production in Australia is The Heicerpa bollworm complex. Even son and Bans ski (1973).

Some pests can sense significant damage every season particularly spider mint (*Tertanychus urticae*) Wilson (1993) while other pests such as trips (*Trips tacit, franklinite Schulte*). Myriads (Creontiades dilutes).aphids (Aphis gossipy) and tip borer (Crocidosema plebiama) are irregular in occurrence between season and sites. Evenson and Bansinski (1973)

2–6 Diseases:

Bacterial blight(Xanthomonas campes trips pv malvacecarum). Veryticillium milt (Verticillium dahliae) and other pathogenos are most likely endemic to Aus-trailer and reside in weeds in tow density. Black Root Rot (Thielaviopasis bascule) Alter aria leaf (Alter aria macrospora) and new strain of Fusarim wilt (Fusarium oxysporum f sp vasion fectam) Kochman (1995) are also significant and cause problem in at leaf some production areas very season.

2-7 Variability:

Variability is of paramount importance for improvement many studies showed that considerable amount of genetic variability are present in cotton. Various mathematical methods using certain basic assumption have been to describe. The existence of general combing ability nod additive variance reported indicated the existences of large amounts of dominance and specific combing ability variances gives encouragement for the production of high yielding hybrids.(Falconor,1996).

Wang *et al.* (2008) indicated the existence of great amount of variability for seine agronomic characters. He identified very early, very late,

extremely dwarf large-bulled, small-bulled, glandless and hairy types of cotton.

indicated that the number of days to boll opening and plant height showed high degree of arability.

However indicated no difference among genotypes continued the vegetative growth longer than the determinate ones. Highly significant differences among upland cotton genotypes were reported by many workers? , indicating considerable genetic variability was encountered across locations and years. Moreover, it was found that variability of cotton yield decreased and increased in response to the variability of different elements in the soil Yield is a complex character in inheritance and is determined by many components. reported that the impotent components of yield are boll number / plant, lint, percentage, boll weight, fiber breaking length. the angle by fruiting branch to the main stem, plant height, number of fruiting branches and the height to the first branch.

However, the most ilnportant yield component contributing to lint yield is bollshn. Also, it was indicated that the largest alteration in yield components with yield increase is the increase in number of bolls per unit area.

Many studies showed a wide range of variability for fiber properties. Singhl 1989 reported a wide range of variation for 2-5% span' length (21.6 to 35.1 mm), uniformity ratio (40552), fiber fineness (2.4 - 4.2micronaire units), maturity coefficient (52% - 88%) and fiber strength (37 – 58.1g/Tex) in 159 cotton lines. Abdurrahman, (2004) reported significant differences an long upland cotton genotypes for fiber characteristics (2.50span length, inicronaire value and fiber strength),But non significant differences and long genotypes of G.hirsutum and G .barb dense for 2 – 5% span length, micron ire value and fiber strength, but non – significant difference for uniformity ration. showed that the rate of

secondary wall deposition in the fiber varies among cultivars and environmental. conditions. indicated that the secondary wall thickening of the fiber is restricted at the base of fiber in the epidermis. This difference in thickening causes the difference in tendency to break away during gilming. The points of juncture with epidermis (wall pits) are the points of greatest mechanical weakness and there for them in influence the ease or difficulty of separating the fiber seed in the gambling process (Falconer 1996).

2–8 Heritability:

Heritability is defined as the ratio of variance due to hereditary difference and genotypic variance to the total phenotypic variance (Meredith, 1995). The higher the ratio the more heritable the trait would be. If conversely, the ratio is smaller,the bigger the influence of the environment on the phenotypic expression of the trait. Thus, it expresses the proportion of the total variance that is attributable to the average effects of genes. Tang et al. (1992; 1996) observed a relatively high heritability for fibre length and strength of cotton and low heritability for elongation and micronaire. dedaniya and Pethani (1994) reported that lint yield per plant, seed cotton and number of bolls ph err plant had high to moderate heritability estimates. Siddiqui (1997) observed that heritability estimates were high for seed cotton per plant, 2.5% span length, plant height and weight of 25 burst bolls. Locket (1989) observed substantial additive effects and high heritability for boll size, span length, and fiber strength and lint percentage on some of the plant materials. Lancon et al. (1993) observed a relatively high heritability for plant height, flowering earliness, number of bolls on vegetative branches, uniformity, fineness, maturity, strength, fiber percentage and seed weight. Carvalho et al. (1995) in a study of six G. hirsutum varieties and hybrids from a complete diallel set of crosses

observed a low heritability estimate (0.19) for yield, which was controlled mainly by dominant genes.

Heritability in cotton was also studied by many other researcher was studied in other crops e.g sorghum by (Idris, 2006),(Bello, 2007) and (Elmunsor, 2014),in millet by (Subi 2012) (Abu Ali, 2012).

CHAPTER THREE

MATERILS AND METHODS

3-1: The site of experiment:

The field experiment was cried out at summer season of the 2015 at the demonstration from of Agricultural Research Corporation (ARC), Shambat research station (15 40, N, 32 32, E).

3-2: Source of seeds and design:

The genetic material used in this study it are shown in table 3-1 is consisted of eleven American cotton (Gossypium hersutum L.) genotypes. Out of eleven American cotton were breeding lines , tow were introduced and selected by agricultural research corporation (ARC), Sudan and the last one is released but cotton introduced from china.

The experiment were laid out in a randomized complete block design (RCBD) with three replications.

3-3: Land preparation and description of the experiment:

The experiment site was disc ploughed, and leveled, ridging up was north- south 80cm apart, the land was divided into 33 plots. Each composed of for ridges, one meter long. Seeds were sown manually along the ridges in holes 50cm apart as three seeds per hole.

Sowing date was the 30th of July; 2015 hand weeding was conducted when needs. Irrigation was scheduled at 7 to10 days.

3-4: Data collection:

3-4-1: plant height (cm):

The average heights of three plant per plot at 50% boll opening from the surface of the ground to the fruit branches.

3-4-2: Number bolls/plant:

The average numbers of bolls of three plants per plot were measured at 50% boll opening.

3-4-3: Numbers of fruit branches/plant:

The average numbers of fruit branches of three plants per plot were measured at 50% boll opening.

3-4-4: Number of vegetative branches:

The average number of vegetative branches of three plants per plot mere measured at 50% boll opening.

3-4-5: Stem diameter (cm):

The average numbers of stem diameter of three plants per plot were measured at 50% boll opening.

3-4-6: 100-Seed weight (g):

100-weight was recorded as weight of 100-seeds counted from three plants per plot chosen at random.

3-4-7: Seed cotton yield (kg/ha):

It was based on seed cotton yield per plot measured by gram (kg) and then converted to kg per hectare.

3-4-8: Lint seed cotton yield (t/ha):

Based on lint seed cotton yield per plot measured in kilogram (kg)and then converted to kg per hectare

3-4-1: Statistical analysis:

The collected data were subjected to statistical analysis using randomized completely block design (RCBD) analysis of variance according (SAS) (Gomes and Gomes1984).

$$\text{C.V}\ \sqrt{\text{ERROR MEAN SQURE}}/\text{GM}$$

R = Number of Replications

GM= Grand Mean

Phenotypic and genotypic Variances were estimated from the analysis of variance as the following formmla:

Genotypic variance (δ^2g) = m1-m2\R

Where:

M1, M2= mean squares for error and treatment respectively.

Phenotypic variance (ph) =e2+g2

3-5 Heritability (h^2):

Broad sense heritability was estimated in season separately, using the formula suggested by Johnson *et al*,(1955) as the follows:

a/ Form the separated ANOVA:

$h2 = \delta 2g / \delta 2g$

$\delta^2 g$ = genotype variance, $\delta^2 ph$ = phenotypic variance

b/ form the combined ANOVA: It was calculated as a ratio of the genotypic variance to the phenotypic variance according to the formula:

$h^2 = \delta 2g / (\delta 2g + / \delta 2g / r + \delta 2g / rl)$

where:

$\delta 2g$ =the estimated genetic variance

$\delta 2gl$ =the variance due to genotypes x season interaction.

$\delta 2e$ = the pooled error variance.

L and r=are a number of season and replication respectively.

Table (3-1) list of cotton genotypes used in the study:

Cerotype	Description	Source
1	Breeding line	Shambat station
2	Breeding line	Shambat station
3	Breeding line	Shambat station
4	Breeding line	Shambat station
5	Breeding line	Shambat station
6	Breeding line	Shambat station
7	Breeding line	Shambat station
Shambat B	Local variety at Sudan	ARC
Abdin	Local variety at Sudan	ARC
Seine 1	Introduced and released Bt from china	ARC
L5	Advance Breeding line	ARC

ARC= Agricultural Research Corporation

Table (3-2) the from of individual analysis of variance with randomized complete block design for come yield and growth characters eleven cotton (gossypium hirsutum)eight genotypes. Evaluate in the period from 2015-2016.

Source of variation	Degree of freedom	Means squares	F. ration
Replication	(R-1)=2	M3	M3/M1
Genotype	(G-1)=7	M2	M2/M1
Error	(R-1)(G-1)=4	M1	
Total	(R G -1)=23		

R: replication.

G: genotypes.

M3, M2, M3: mean square for block, Treatment and error respect

CHAPTER FOUR

RESULTS AND DISCUSSION

4-1 Phenotypic variability:

The analysis of variance for the eleven genotypes of cotton (Gossypium hirsutum L.) revealed that was highly significant differences ($p<0.01$) were observed for all studied characters except of plant height and Number of vegetative branches. This variability could be of great value in any Cotton breeding program. Variation among cotton genotypes for yield and other charcters was other studied by many researcher e.g (Vineela 2013) (Ahmed 2000) (Dhivya 2013).

4-1-1 Plant height (cm):

Table (4-2) showed be that (Breeding line N.4) obtained the highest value of (102.3) where as genotype (Breeding line N.2) obtained the smallest value of (82),the coefficient of variation was (12.3) the overall mean for this character was (88.9). These result differ with the result of Vineela *et al* (2013) who obtained the heighest of value of plant was (161.80) where overall mean was (96.20).

4-1-2 Numbers bolls/plant:

Table (4-2) showed be that (Breeding line N.1) obtained the highest value of (32.7) where as genotype (shambat B) obtained the smallest value of (13.3).the coefficient of variation was (18.2), overall mean for this character was (18.2).These results were similar to the result of Dhivya *et al* (2013) who reported that heighest number bolls was (38.5), overall mean of (21.8). Also these results were similar the result of Vineela *et a*l

(2013) who obtained the heighest number of bolls was (46.40) where overall mean was(16.45).

4-1-3 Number of fruit branches/plant:

Table (4-2) showed be that (Breeding line N.5) obtained the highest value of (15.3) where as genotype (L.5) obtained the smallest value of (10.3).The coefficient of variation was (14.6) , the overall mean for this character was (12,4). These results differ with the result of Vineela *et al* (2013) who obtained (53.0) where overall mean (6.35) differ in the study.

4-1-4Seed cotton yield (k/ha):

Tabel (4-2) showed be that (L.5) obtained the highest value of (1028.8) Where as genotype (Breeding line N.6) obtained the smallest value of (480.7), the coefficient of variation was (27.8), the overall mean for this Character was (621).These result differ with the result of Mohamed Zahir *et al* (2015) obtained the seed cotton of (88.6) where overall mean was (24.6) differ in the study.

4-1-5 100- Seed weight (g):

Table (4-2) showed be that (Breeding line N.3) obtained the highest value of (12.8) were as genotype (Breeding N.2) obtained the smallest value of (9.1), the coefficient variation was (6.4) the overall mean for this character was (11.1). these results similar with the result of Ahmed (2013) who obtained the heighest value was (12.0) where overall mean (10.3) the similar in the study.

4-1-6 Lint seed cotton yield (t/ha):

Table (4.2) showed be that (L.5) obtained the highest value of (323.5) were as genotype (Breeding line N.1) obtained the smallest value of (150), the Coefficient of variation was (27.9) the overall mean for this

character was (219.6).These results were not similar to the results of Ahmed (2002) who obtained the value of (1278) the overall mean (45.51).

4-1-7 Stem diameter (cm):

Table (4.2) showed be that (Breeding line N.1) obtained the highest value of (11.2) where as genotype (Breeding line N.4) obtained the smallest value of (7.6).The coefficient of variation was (11.4), the overall mean for this Characters was (8.6). These results differ with result of Dhivya *et al* (2015) and Vineela *et al* (2013).

4-1-8: Number of vegetative branches:

Table (4.2) showed be that (Breeding line N.4) and (Abbdin) the highest value of (3.7), (3.7) where as genotypes (Breeding line N.7) and (L.5) the smallest of (3), (3). The coefficient of variation (32.9) the overall mean for this characters (3.3).These results the differ with the result of Vineela *et al* (2013) who obtained the value of (1.50) where overall mean of (28.27). The differ in the study.

4-2: Phenotypic and Genotypic Variances:

In this study, the highest (1187424.8) and the lowest (18.93) values of phenotypic variances were obtained by Seed cotton yield and 100-cotton yield, respectively. On the other hand, the highest (593710.7) and the lowest (8.67) value of genotypic variances were obtained by Seed cotton yield and 100-cotton yield, respectively. These results were in accordance with Kumari *et al* (2013) and Dhivya *et al* (2013).

4-3: Heritability (h^2):

In this study, the highest (49.90) and the lowest (45.80) values of heritability were obtained by Seed cotton yield and 100-seed cotton, respectively.

Table 4.1: Mean square different characters eleven genotypes of cotton evaluated at shambat for season (2015 - 2016).

Character	Replication	Genotypes	Error
1.Plant height	116.9	0.97 NS	2.2
2.Number bolls/plant	90.2	5.87 **	1.15
3.Number of fruit branches/plant	6.4	1.99 *	0.35
4.Number of vegetative branches	0.7	0.61 NS	O.17
5.Stem diameter(cm)	2.90	2.98 *	0.12
6.100-Seed weight(gm)	4.8	40.36 **	0.23
7.Seed cotton (kg/ha)	80671.4	2.72 **	37.2
8.Lint seed cotton yield(t/ha)	9559.4	2.55 *	12.8

** High significant differences 0.01%.

* Significant differences 0.05%.

NS non significant differences.

Table 4. 2: Means of different characters of cotton (Gossypium hirstum L.) evaluated at shambat for season (2015 - 2016):

G.N	PH	BN	FB	SC	SW	Lint	SD	RB
1	84.3	32.7	12.7	438	11.1	15	11.2	2.3
2	82	17.3	11.3	501	9.1	207	8.3	3
3	85.3	19.3	13	550	12.8	186.1	9.2	4
4	102.3	19	14	560.7	10.6	212.7	7.6	3.7
5	92.3	21.3	15.3	676.7	10.3	246.8	8.1	2.7
6	89.7	14.3	11.7	480.7	10.6	185	7.7	3.3
7	93.3	18.7	13.7	693.3	9.6	283.3	8.5	3
8	95	13.3	11.7	599.3	13	180	8.9	3.3
9	83.7	16	11.7	561.7	12.4	164.4	8.5	3.7
10	85.7	14	11.3	741	11.6	267.8	8	3.3
11	84.3	14	10.3	1028.3	11.3	323.5	9	3
Overall Mean	88.9	18.2	12.4	621	11.1	219.6	8.6	3.2
C.V %	12.3%	18.2%	14.6%.	27.8%	6.4%	27.9%	11.4%	32.9%

Table 4.3: Phenotypic and genotypic variances and Heritability of different characters in eleven genotypes of cotton (Gossypium hirsutum .L)

Variance	Phenotypic Variance	Genotypic Variance	Heritability (h^2)
Plant height	4768.60	2364.80	49.60
Numbers bolls	584.70	277.30	47.40
Numbers of fruit branches	126.90	62.40	49.20
Numbers of vegetative branches	44.57	22.17	49.70
Steam diameter	38.00	18.50	48.60
100-seed weight	18.93	8.67	45.80
Seed cotton yield	1187424.80	593710.70	49.90
Lint seed cotton yield	146849.30	71831.40	48.90

CHAPTER FIVE

CONCLUSION AND REVERNCES

Based on the result obtained from this study it could be conclusions that:

1- Variation among the eleven genotypes used in this study is promising for any breeding program genotypes of cotton.

2- Genotype (L-5) scored the highest yield of eleven genotypes. Could be suitable for selection o genotypes of high yield in any breeding program genotypes of cotton.

3- The highest values of phenotypic and genotypic variances were obtained by the character Seed cotton yield.

4- High estimates of heritability scored for seed cotton yield could be promising in selection for this charcters in any genotypes of cotton breeding program.

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