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YIELD AND FIBER QUALITY POTENTIAL FOR TRIALLEL CROSSES IN COTTON:
1- NATURE OF GENE ACTION.

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ABSTRACT

This investigation carried out to determine combining ability and gene action estimates for yield and yield components traits with some fiber properties in cotton . The genetic materials in this investigation included five cotton varieties i.e. Suvin (P_1) ; TNB (P_2) ; Pima S6 (P_3); G.88 (P_4) and G.89 (P_5) and their 30 three way crosses . All these varieties belong to the species *Gossypium Barbadense* L. In 2008 growing season these all genotypes were evaluated in experimental Agriculture Research Station at Sakha, the following traits were estimated : boll weight , seed cotton yield per plant , lint cotton yield per plant , lint percentage , number of bolls per plant , seed index , lint index , number of seeds per boll, lint per seed , fiber strength , fiber fineness, span length at 50%, span length at 2.5% and uniformity ratio % .

The results indicated that the mean squares of genotypes were highly significant for all studied traits . The results also showed that the three way crosses (P_3 x P_5) x P_2 cleaned the highest mean performance for boll weight and the combinations (P_3 x P_4) x P_1 , (P_2 x P_5) x P_4 and (P_4 x P_5) x P_2 showed the best promising for seed cotton yield per plant , lint cotton yield per plant and lint percentage , respectively .Meanwhile the combinations (P_3 x P_4) x P_1 , (P_2 x P_3) x P_1 and (P_1 x P_2) x P_5 were the superior combinations for number of bolls per plant , seed index and lint index . On the other hand, the highest mean for number of seeds per boll and lint per seed were observed for the crosses (P_4 x P_5)x P_3 and (P_1 x P_2) x P_5 . The results also cleared that the hybrids (P2 x P_3) x P_5 , (P_1 x P_4) x P_3 and (P_2 x P_3 x P_4 appeared to be the best promising for fiber traits .

From the analysis of triallel crosses the results illustrated that the variety Pima S_6 was the best combiner for yield traits ,While G.88 and Suvin were the best combiner for fiber traits and the results also cleared that these parental varieties could be utilized in a breeding programs to improve these traits through the selection in segregating generations.

The results indicated that the yield and yield components as well as fiber traits were mainly controlled by additive variance and additive x dominance epistatic variances . These results also revealed that the calculated values of heritability in broad sense ranged from 91.92 % for seed index to 98.36% for seed cotton yield per plant . In the same time the heritability in narrow sense ranged from 1.64% for seed cotton yield per plant to 43.53% for number of seeds per boll.

INTRODUCTION

Cotton is a major fiber crop grown throughout tropical and sub-tropical regions of the world. It also play a principle role in the economy of a large number of developing as well as developed countries . Among the cotton growing countries , yield increase in crops occurred due to plant breeding and improved production and management techniques . In order to produce high yielding cotton varieties in Egypt , cotton improvement has carried out by conventional breeding techniques for hybridization and selection with import new varieties to use a parent in the hybridization .

Most of increase in seed cotton yield has come via cultivar improvement . Current cultivars show better yield stability and greater response to favorable conditions than ancestral line . The successes of hybridization are largely dependent on the correct selection for parents.

Partition of genetic variations to its components are useful in determining the breeding value of some populations and the appropriate procedures to use in breeding program .

The general combining ability effects are important indicators in hybrid combinations . Differences in general combining ability effects have been attributed to additive , additive x additive and higher order additive interactions , where differences in specific combining ability have been attributed to non-additive genetic variance in this respect , Falconer (1960) and Miller and Marani (1963) reported significant general and specific combining ability effects for lint yield and boll weight , Lee *et al* (1967) found significant general combining ability for lint percentage and boll weight , Baloch *et al* (1995) revealed the importance of specific combining ability for yield , seed index and lint percentage and general combining ability for boll number per plant and lint percentage . Naddeem *et al* (1998) ; Lasheen (2003) ; Rokaya et al (2005) ;' Samreen (2007) Abd El Bary *et al* (2008) ; El-Mansy and El-Lawendy (2008) and Panhwar *et al* (2008) reported significant general and specific combining ability effects for yield , yield components and fiber traits . On the other hand , the relationships among yield and yield components traits are very complex , since they are influenced by both genetically and environmental variations. Also , the heritability in broad and narrow senses are of great importance to plant breeders in selecting the most suitable breeding program .

The Main objective of this study was conducted to determine some genetic measurements i.e. performance of three way crosses , general and specific combining ability , heritability in both broad and narrow senses . The estimated of the genetic parameters are very important to select parents for crossing which could lead desirable features in the progeny .

MATERIALS AND METHODS

Five cotton varieties belong to *Gossypium barbadense* L. representing a range of yield , yield components and fiber properties were devoted to establish the genetic materials of this investigation . Three of these varieties new germplasm materials , Suvin (P_1) and TNB (P_2) Indian cotton varieties ; and Pima S6 (P_3) is American cotton variety . In addition G.88 (P_4) was belonging to extra long staple variety as well as G. 89 (P_5) was belonging to long staple variety .

In the growing season 2006 , the five parents were planted and mated in a half diallel crosses to obtained ten F1 single crosses . The parental varieties were also self- pollinated to obtain enough seeds for further investigations .

In 2007 growing season, the five parents and their ten single crosses were planted and mated in three- way crosses to obtain 30 combinations . In the same time the five parents were planted and mated in half diallel crosses to obtained ten F_1 crosses again .

In the growing season of 2008 , all genetic materials obtained from hybridization and their parental varieties (five parents + ten single crosses + 30 three way crosses) were evaluated in field experiments at Sakha Agriculture Research Station. The experimental design used was a randomized complete blocks design with three replications as outlined by Cochran and Cox (1957) . The significance was determined using the least significant differences value (L.S.D.) , which was calculated as suggested by Steel and Torrie (1980) . Each plot was one row 4.0 m long and 60 cm wide . Hills were 40 cm apart and were thinned to keep constant stand of one plant per hill at seedling stage . Ordinary cultural practices were followed as usual for the cotton field .

The data were taken from eight plants from plot and data were recorded on the following traits .

A- yield and yield components traits :-

1-Boll weight (B.W.)
2-Seed cotton yield per plant (S.C.Y./P.)
3-Lint cotton yield per plant (L.C.Y./P.)
4-Lint percentage (L.%)
5-Number of bolls per plant (No.B./P.)
6-Seed index (S.I.)
7-Lint index (L.I.)
8-Number of seeds per boll (No.S./B.)
9-Lint per seed (L./S.)

B- Fiber traits :-

1-Fiber Strength (F.S.)
2-Fiber fineness (F.F.)
3-50% Span length (50% S.L.)
4-2.5% Span length (2.5%S.L.)
5- Uniformity ratio %(U.R.%)

A three – way crosses or triallel is a product of three parents for example : (P_1 x P_2) x P_3 . Thus the number of all possible three – way crosses would be P x (P-1) x (P-2) / 2 Rawling and Cockerham (1962) , Hinkelmann (1965) , Pannuswamy (1972) and Pannusway *et al* (1974) ., have dealt with theoretical aspect of triallel analysis .

Triallel crosses analysis provides additional information about the components of episistatic variance viz. additive x additive , additive x dominance and dominance x dominance besides additive and dominance components of genetic variance . The technique also gives information on the order in which parents should be crossed for obtaining superior recombination . Analysis of triallel crosses data is carried out according to the procedure outlined by Singh and Chaudhary (1985) .

Considering Y_{ijkl} as the measurement recorded on a triallel cross $G_{(ij)\,k}$, the mathmetical model takes the following form: $Y_{ijkl} = m + b_1 + h_i + h_j + d_{ij} + g_k + s_{ik} + s_{jk} + t_{ijk} + e_{ijkl}$

Where:

Y_{ijkl}:	Phenotypic value in the l^{th} replication on ij^{th} cross (grand parents) mated to k^{th} parent.
m:	general mean
b_l:	effects of l^{th} replication
$h_{i:}$	general line effect of i^{th} parent as grand parent (first kind general line effect)
$h_{j:}$	general line effect of j^{th} parent as grand parent (first kind general line effect)
d_{ij}:	two-line (i x j) specific effect of first kind (grand parents)
g_k:	general line effect of K as parent (second kind effect)
s_{ik}, s_{jk}:	two - line specific effect where i and j are half parents and K is the parent (specific effects of second kind)
t_{ijk}:	three-line specific effect
e_{ijkl}:	error effect

Estimation of the various effects:

(i) h_i : General line effect of first kind (grand parent). This is in fact the general combining ability effect of a line used as one of the grand parents.

h_i = [P-1 /(rP(P-2)(P-3))] [$Y_{i...}$ + [(P-4)/(P-1)]$Y_{..i.}$ – [(P-4)/(P-1)] $Y_{....}$]

(ii) gi : General line effect of the second kind. This refers to the general combining ability of a line used as parent which crossed to the single hybrid.

g_i = [(P-4)/rP(P-3)][$Y_{..i.}$ + [1/(P-2)] $Y_{i...}$ - [1/(P-2)] $Y_{....}$]

(iii) dij : Two-line specific effect of first kind (grand parents).

$$d_{ij} = \frac{P-3}{r(P-1)(P-4)}\left[Y_{ij} + \frac{1}{P-3}(Y_{i.j.} + Y_{j.i.}) - \frac{2}{P(P-3)}Y_{....} - \left(\frac{r(P^2-4+P+2)}{P-3}\right)(h_i + h_j) - \frac{r}{P-3}(g_i + g_j)\right]$$

(iv) Sik = two-line specific effect where i is half parent and K is parent. (Specific effect of second kind)

$$S_{ik} = \frac{D}{D_2}\left[Y_{i.k.} + \frac{1}{D}\ Y_{k.i.} + \left(\frac{V-3}{D}\right)Y_{ik..} - \left(\frac{2(P-3)}{PD}\right)Y_{....} - r\,(P-2)\,h_i - \left(\frac{P-2}{D}\right)rhi - \frac{rg_i}{D} - \frac{D_1}{D}rg_j\right]$$

Where: $D = P^2 – 5 P + 5$ $D_1 = P^3 – 7 P^2 + 14 P – 7$

and $D_2 = r (P-1) (P-3) (P-4)$.

(v) Tijk : Three-line specific effect.

$$t_{ijk} = \bar{y}_{ijk} - \bar{y} - h_i - h_j - g_k - d_{ij} - S_{ik} - S_{jk}$$

Ponnuswamy *et al.* (1974) investigated that the variances and co-variances components of general effects i.e., σ^2h, σ^2g, σgh are the function of additive and additive x additive type of epistasis, whereas, σ^2d and σds are the functions of additive x additive type of epistasis only. σ^2s and σ_{ss} involve dominance components while σ^2t and σtt account for epistatic components other than additive x additive.

Estimates of genetic variances:

The genetic variance components could be calculated from the previous variances using the following manner if the breeding coefficient assumed to be equal to one (F = 1).

$$\sigma^2 A = \frac{1}{227F}\left[448\ \sigma^2 h + 40\sigma^2 g + 604\sigma gh - 292\sigma^2 d - 584\sigma ds\right]$$

$$\sigma^2 D = \frac{1}{127F^2}\left[416\sigma^2 h - 352\sigma^2 g + 496\sigma gh - 336\sigma^2 d - 672\sigma ds - \frac{1816}{3}\sigma^2 s + \frac{4540}{3}\sigma ss - 254\sigma^2 t - \frac{3556}{3}\sigma tt\right]$$

$$\sigma^2 AA = \frac{1}{227F^2}\left[-832\sigma^2 h + 704\sigma^2 g - 992\sigma gh + 672\sigma^2 d + 13446 ds\right]$$

$$\sigma^2 AD = 32/3F^3\ [\sigma^2 S - \sigma^2 S + 4\sigma tt\ ]$$

$$\sigma^2 DD = \frac{1}{3F^4}\left[-16\sigma^2 s + 16\sigma ss + 24\sigma^2 t - 32\sigma tt\right]$$

Table1: Form of the analysis of variances of the triallel crosses and the expectation of mean squares

S.O.V.	d.F	M.S	E.M.S
Replications	r-1		
Due to crosses	C-1		σ^2e + [2r /P (P-1) (P-2)-2] $\sum\sum\sum C^2_{ijK}$
Due to *h* eliminating *g*	P-1	M (h/g)	σ^2e + [rp (P-2) (P-3)/(P-1)^2] $\sum h^2_i$
Due to *g* eliminating *h*	P-1	M (g/h)	σ^2e + [rp (P-3)/(P-1)] $\sum g^2_i$
Due to *s* eliminating *d*	P^2-3P + 1	M (s/d)	σ^2e + [r/(P^2-3P + 1)] $\sum\sum S_{ij}$ [(P^2-5 P + 5) S_{ij} - S_{ji}]
Due to *d* eliminating *s*	P(P-3)/2	M (d/s)	σ^2e + [2 (P-1)(P-4)/P(P-3)^2]$\sum\sum d^2_{ij}$
Due to *t*	P(P^2-6 P + 7)/2	M (t)	σ^2e + [2r/P (P^2 – 6 P + 7)] $\sum\sum\sum t^2_{ijk}$
Error	(r-1) (C-1)	ME	σ^2e

Where: C, P and r are number of crosses, parents and replications, respectively

RESULTS AND DISCUSSION

To produce promising crosses the breeders usually choose of parental lines as well as determination their order in hybridization , which yielded . the undesirable linkage between some quantitative traits could be break up , as well as to give new combinations through increasing the variability among genotypes. Therefore, in this investigation triallel crosses analysis provides additional information a bout the components of epistatic variance . viz. additive x additive , additive x dominance and dominance x dominance . This technique also gives information's on the order in which parents be crossed for obtaining superior recombinants (Singh and Narayanan (2000) .

The results of three way crosses analysis of variances and the mean squares for yield , yield components and fiber traits were calculated and presented in Table 2.The results indicated that the mean square of crosses were highly significant indicating the presence of real genetic differences among them . These results were noticed for all the studied traits . This finding suggested that the planned comparisons between means and the determination of gene action for these studied traits are valid and could be mad . In addition, the mean squares of replication were insignificant for all the studied traits , with except of seed index , number f seeds per boll and fiber strength . These results also showed that the mean square due to h eliminating g showed significant for most of studied traits with except of seed cotton yield per plant , lint cotton yield per plant , lint percentage , number of bolls per plant , span length at 50 and 2.5 % . Similarly , the mean square of g eliminating h indicated significant for most of studied traits . therefore, this finding revealed the importance of additive (σ^2A) , as well as , additive by additive (σ^2AA) epistatic variance in the genetic expression of yield components and fiber traits . In the same time , the mean squares due to s eliminating d were highly significant for all the studied traits with except of number of bolls per plant . Also , the mean squares due to d eliminating s was significant for seed cotton yield per plant , lint cotton yield per plant , lint index and lint per seed . While , the mean squares due to t were highly significant for all the studied traits . These results indicated the important of dominance , dominance by dominance , as well as , additive by dominance epistatic variances for the inheritance of all studied yield , yield components and fiber traits . these results were agree with these reported by Abd EL-Maksoud *et al* (2003 1-2) , Abd EL- Hadi *et al* (23005 a and b) , Hemida *et al* (2006) , Abd EL-Bary *et al* (2008) and EL-Mansy and EL-Lawendy (2008).

The mean performances for 30 three – way crosses of yield , yield components and fiber traits were determined and the results are presented in Table 3. the results showed that there no specific cross was superior for all the studied traits . However , it could be noticed that for boll weight the cross (P_3 x P_5) x P_2 cleared the highest mean with the value 3.56 gm. The results also indicated that the crosses (P_3 x P_4) x P_1 and (P_2 x P_5) x P_4 and (P_4 x P_5) x P_2 showed the highest mean for seed cotton yield per plant , lint cotton yield per plant and lint percentage , respectively , with the mean values of 95.87 gm , 36.38 gm and 40.01 % , respectively . The results also illustrated that the highest mean performances were found for the crosses (P_3 x P_4) x P_1 for number of bolls per plant and (P_2 x P_3) x P_1 for seed index with the mean values 33.33 and 11.15 , respectively . In the same time , for lint index , the cross (P_1 x P_2) x P_5 was the highest values with the mean 6.17 .

The results also showed that the highest mean performances for number of seeds per boll and lint per seed were observed for the crosses (P_4 x P_5) x P_3 and (P_1 x P_2) x P_5 with the means 21.68 and 0.067 , respectively .

For fiber traits the results showed that the cross (P_2 x P_3) x P_5 was the superior and the highest means for 50% Span length , 2.5% Span length and uniformity ratio % with the mean values 31.69 , 36.07 and 87.87 , respectively . On the other hand , the crosses (P_2 x P_3) x P_4 and (P_1 x P_4) x P_3 were the desirable performances for fiber strength and fiber finenesses with the mean values are 11.20 and 3.90 , respectively .

The estimates of general line combining ability effects of first kind (h_i) of parental varieties were obtained for yield , yield components and fiber traits and the results are presented in Table 4 . The results indicated that positive general combining effect was found for most of studied traits . The comparison of the general combining ability effect (h_i) of individual parent exhibited that no parent was the best combiner as a grand parent for all the studied traits .

T2-3

Also , the results indicated that the variety P_1 was the best combiner for fiber fineness , in the same time, the variety P_3 was the best combiner as a grand parent for boll weight , seed index and number of bolls per plant, as well as, the variety P_5 was the best combiner for S.L.50% and uniformity ratio . While , P_4 variety was the best combiner for fiber strength .

The estimates of general line effect of second kind (g_i) were calculated for all studied traits and the results arte presented in Table5. The results indicated that no parental variety was good combiner for any traits from all yield and yield components and fiber traits .

The specific combining ability effects (d_{ij}) for all possible combinations with respect to the studied yield and yield components , as well as fiber traits were obtained and the results are presented in Table 6 . The results revealed that no any combination was (positive or negative) significant for all studied traits and no combination was the best combiner for all studied traits . The combinations between a line 1 and line 3 (P_1 x P_3) was the best combination for seed cotton yield per plant , lint cotton yield per plant and number of seeds per boll , as well as , the combination (P_1 x P_5) was the best combiner for seed index .

The results also showed that the combination P_2 x P_3 was the best combiner for lint percentage , lint index , lint per seed and uniformity ratio , On the other hand, P_2 x P_5 combination was the best combiner for number of bolls per plant , while the combination P_4 x P_5 was the best combiner for boll weight and fiber strength . These results explained the minor role of dominance genetic variances in the inheritance of these studied traits .

The estimates of specific combining ability effects of the second kind (S_{ik}) for possible combinations for yield and yield components and fiber traits were calculated and the results are shown in Table 7. The results indicated that no combination exhibited desirable positive or negative significant values for all the studied traits . The combination $S_{2.3}$ was the best specific combining ability effects of second kind for seed cotton yield per plant , lint cotton yield per plant , seed index and number of bolls per plant . Also , the combinations between line 3 was one of the grand parent and line 1 as a parent gave desirable and was the best specific combining ability for lint percentage , lint index and lint per seed . On the other hand , the combination between 3 as a one of the grand parent and line 1 as a parent ($S_{1.3}$) was the best specific effect for 2.5% span length (2.5% S.L.) .

The results also indicated that the combination $S_{1.5}$ was the best specific combining ability effect for fiber strength . While , for 50% span length and uniformity ratio the results cleared that the combination between line 5 and line 1 ($S_{5.1}$) was the best specific effects . In addition the combination between the line 3 as a one of grand parent and line 2 as a parent was the best specific for number of bolls per plant and fiber fineness . While , the combination between line 4 and line 3 ($S_{4.3}$) was the best specific effect for boll weight trait

The specific combining effects (t_{ijk}) for all possible combinations of (30 three – way crosses) with respect to studied yield , yield components and fiber properties were obtained and the results are presented in Table 8 .

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The results indicated that 8,12, 10, 6, 8, 9 and 12 crosses out of 30 three – way crosses for seed cotton yield per plant , lint percentage , seed index , lint cotton yield per plant , lint index , lint per seeds and number of bolls per plant , respectively. These above crosses showed positive (desirable) and significant specific combining ability effects (t_{ijk}) values and the highest positive desirable specific effect for the above traits was the cross t_{153} .

For boll weight the results cleared that the combination among the line 2 as a parent in grand parent , line 5 as anther parent in a grand parent and line 1 as a parent showed the best specific combining ability effect . On the other hand , for number of seeds per boll the combinations among line 3 and line 5 as grand parent and line 2 as a parent (t_{352}) was the best specific combining ability effects . While, for span length 50% and 2.5% the combination among line 2 as a parent in the grand parent and line 4 is a another parent of grand parent with line 1 is a parent was the best specific effect for two traits .

The results also indicated that 8 and 11 crosses out of 30 F_1 three way crosses were highly positive specific combining ability effect (desirable) for uniformity ratio and fiber strength and the best specific effect were for t_{134} and t_{123} , respectively .

For fiber fineness the combination among parents 1 , 5 and 4 (t_{154}) was the best specific combining ability and negative (desirable) .

The estimates of genetic variance components and heritability in broad and narrow senses , were calculated and the results are presented in Table 9. The results indicated that the additive genetic variances (σ^2A) were positive and larger than dominance genetic variances (σ^2D) for all studied traits . These could be appeared by the dominance degree (D. d) ratio which was equal to zero for all studied traits .

Concerning epistatic genetic variances , the results indicated that the most of genetic variances were additive x dominance genetic variance (σ^2AD) was larger than epistatic those of dominance x dominance (σ^2DD) and additive x additive (σ^2AA) for all studied traits . These results suggested that both additive and additive by dominance gene action played the major role in the genetic expression of these traits , and this finding could be answer the question , why the superiority of most three way crosses over the single crosses ?

Broad sense heritability ($h^2_{b.s}$.%) estimated were larger than those of narrow sense heritability ($h^2_{n.s}$.%) for all the studied traits . Broad sense heritability ranged form 91.92% at seed index to 98.36% for seed cotton yield per plant , and narrow sense heritability ranged from 1.64% for seed cotton yield per plant to 43.53 % for number of bolls per plant .

These results were agreement with thes reported by Abd EL-Maksoud *et al* (2003 1-2) ; Abd EL-Hadi *et al* (2005 a-b) ; Hemida *et al* (2006) ; Abd EL-Bary *et al* (2008) and EL-Mansy and EL-Lawendy (2008) .

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تقدير المحصول وصفات التيلة في القطن باستخدام الهجن الثلاثية:
١- طبيعة فعل الجين.

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الهدف الرئيسي من هذه الدراسة هو دراسة القدرة علي التآلف وكذلك تقدير الفعل الجيني لصفات المحصول ومكوناته بالإضافة لبعض صفات جودة التيلة باستخدام تحليل الهجن الثلاثية والمواد الوراثية المستخدمة في هذه الدراسة هي خمسة أصناف من القطن وهي سيوفين ، TNB ، بيما س٦ ، جيزة ٨٨ والصنف جيزة ٨٩ وجميع هذه الأصناف تابعة للنوع باربادنس في موسم ٢٠٠٦ تم التهجين بين الخمسة أصناف بنظام التهجين نصف الدائري للحصول علي ١٥ هجين فردي وفي موسم ٢٠٠٧ تم زراعة الهجن الفردية والأباء وتم التهجين فيما بينهم بنظام الهجن الثلاثية للحصول علي ٣٠ هجين ثلاثي. في موسم ٢٠٠٨ تم زراعة الهجن المتحصل عليها وهي ٣٠ هجين ثلاثي مع الآباء والهجن الفردية في تجربة تقييم بمحطة البحوث الزراعية بسخا في قطاعات تامة العشوائية من ثلاث مكررات وكانت الصفات المأخوذة هي وزن اللوزة ، محصول القطن الزهر للنبات ، محصول القطن الشعر للنبات ، تصافي الحليج ، عدد اللوز المتفتح علي النبات ، معامل البذرة ، معامل الشعر ، عدد البذور في اللوزة ، وزن الشعر علي البذرة الواحدة ، متانة التيلة ، النعومة ، متوسط الطول عند ٥٠%، متوسط الطول عند ٢,٥ % بالإضافة لمعامل الانتظام .

ويمكن تلخيص أهم النتائج المتحصل عليها فيما يلي :-

- أشارت نتائج اختبارات تحليل التباين إلي وجود اختلافات عالية المعنوية بين كل التراكيب الوراثية المستخدمة لكل الصفات الموجودة تحت الدراسة .
- أظهرت الهجن (بيما س٦ x جيزة ٨٨) x سيوفين، (TNB x جيزة ٨٩) x جيزة ٨٨ بالإضافة للهجين (جيزة ٨٨ x جيزة ٨٩) TNBx امكانية استخدامهم فى تحسين صفات القطن الزهر و محصول القطن الشعر بالاضافه لتصافى الحليج.
- أظهرت الهجن (بيما س٦ x جيزه ٨٨) x سيوفين، (TNB x بيماس ٦)x سيوفينx بالاضافه للهجين (سيوفينx ل TNB) x جيزة ٨٩ امكانية استخدامهم في تحسين صفات عدد البذور في اللوزة ومحصول القطن الشعر للبذرة الواحدة .
- أظهر الهجين (TNB x بيما س٦) x جيزة ٨٩ والهجين (سيوفين x جيزة ٨٨) x بيما س٦ بالإضافة للهجين (TNB x بيما س٦) x جيزة ٨٨ إمكانية استخدامهم في تحسين صفات جودة الألياف
- أظهر الصنف بيما س٦ انه ذو قدرة علي التآلف لصفات المحصول ومكوناته في حين أظهر الصنفان جيزة ٨٨ و سيوفين قدرة علي التآلف لصفات جودة التيلة .
- أظهرت النتائج أن التباين المضيف والتباين التفوقي المضيف x السيادي يلعبان دورا هاما في توارث جميع الصفات المدروسة ولذلك يمكن من خلال برامج انتخاب في الأجيال الانعزالية لهذه الهجن الثلاثية استنباط أصناف وسلالات متفوقة .
- أظهرت قيم معامل التوريث أن معامل التوريث بالمدى الواسع كانت اكبر من قيم معامل التوريث بالمدى الضيق وكانت تتراوح بين ٩١,٩٢% لصفة معامل البذرة إلي ٩٨,٣٦% لصفة محصول القطن الزهر في حين تراوحت في المدى الضيق بين ١,٦٤% لصفة محصول القطن الزهر للنبات إلي ٤٣,٥٣% لصفة عدد البذور في اللوزة .

للحصول عل نتائج ذات قيمة وأكثر أهمية من تحليل الهجن الثلاثية يجب تصميم برنامج انتخاب للأجيال الانعزالية للهجن المتفوقة سواء في صفات المحصول ومكوناته أو في صفات الجودة .

Table2: The results of the analysis of variances and the mean squares of the five parents and their 30 triallel crosses for yield and yield component traits and some fiber properties

S O V	d f	B.W	S.C.Y./P.	L.C.Y./P.	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
Rep.	**2**	0.061	53.02	11.86	1.244	17.941	1.171**	0.133	16.652**	0.000013	0.021	0.070*	1.242	1.207	0.319
Crosses	**29**	0.145**	414.86**	58.75**	5.227**	48.208**	0.664**	0.532**	8.827**	0.000053**	0.807**	0.112**	3.530**	3.071**	2.265**
Due to h eliminating g	**4**	0.134**	47.46	9.04	1.520	12.737	0.620**	0.245*	15.049**	0.000024*	1.073**	0.333**	1.013	0.485	2.374**
Due to s eliminating d	**11**	0.119**	433.38**	59.16**	3.237**	56.833**	0.417**	0.369**	4.069	0.000037**	0.791**	0.062**	2.921**	2.669**	1.402**
Due to t	**5**	0.366**	1078.37**	157.60**	20.724**	104.266**	2.055**	1.781**	27.017**	0.000178**	1.558**	0.196**	11.306**	9.975**	6.715**
Due to g eliminating h	**4**	0.045	241.78**	33.02**	0.029	32.273**	0.252	0.094	1.337	0.000009	0.370*	0.052*	1.584*	1.416**	0.751
Due to d eliminating s	**5**	0.072	143.01*	19.37**	1.235	14.302	0.183	0.222*	2.122	0.000022**	0.232	0.010	0.663	0.443	0.839
Error	**58**	0.031	53.11	7.64	0.614	6.421	0.150	0.088	2.019	0.000009	0.136	0.019	0.458	0.461	0.403

*** & ** significant at 0.05 and .01 levels of probability, respectively.**

Table 3 :The mean performance of the parents and thier triallel crosses for yield and yield component traits and some fiber properties

Geno.	B.W	S.C.Y./P.	L.C.Y./P.	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
12 × 3	3.28	64.60	24.91	38.58	19.71	9.59	6.02	19.31	0.06	10.40	3.87	28.30	33.63	84.13
12 × 4	3.35	77.55	27.53	35.53	23.12	9.54	5.26	20.63	0.05	10.33	4.27	29.22	34.40	84.93
12 × 5	2.81	49.25	19.32	39.30	17.50	10.35	6.71	17.66	0.07	9.93	4.00	30.48	35.10	86.83
13 × 2	3.30	65.01	23.72	36.60	19.79	10.34	5.98	21.61	0.06	9.90	4.00	29.28	34.37	85.20
13 × 4	3.27	66.34	24.68	37.15	20.35	10.43	6.16	21.50	0.06	9.23	4.27	30.79	35.63	86.40
13 × 5	3.11	60.70	21.81	35.96	19.51	10.19	5.72	20.29	0.06	9.67	3.93	27.80	33.00	84.23
14 × 2	2.74	63.74	24.01	37.66	23.62	10.73	6.48	18.41	0.06	9.87	4.07	27.84	32.73	85.07
14 × 3	2.82	56.01	20.24	36.01	20.00	8.89	5.01	16.03	0.05	10.00	3.90	28.02	33.40	83.90
14 × 5	2.99	46.90	18.63	39.80	15.70	9.70	6.41	17.46	0.06	10.33	4.17	29.36	34.43	85.27
15 × 2	2.88	61.29	22.30	36.40	21.26	10.08	5.77	18.51	0.06	10.17	4.20	29.10	34.00	85.60
15 × 3	3.32	67.45	26.38	39.08	20.32	10.23	6.57	20.69	0.07	9.30	4.10	28.14	32.50	86.57
15 × 4	2.94	79.02	29.25	36.98	26.84	10.62	6.23	19.68	0.06	9.57	4.07	30.05	35.20	85.37
23 × 1	3.23	77.73	28.92	37.19	24.07	11.15	6.60	22.65	0.07	10.13	4.07	27.32	32.23	84.73
23 × 4	3.07	49.76	19.20	38.54	16.20	10.38	6.50	19.62	0.07	11.20	4.30	29.11	33.93	85.77
23 × 5	2.86	69.54	25.67	36.92	24.35	10.48	6.14	18.85	0.06	9.97	4.27	31.69	36.07	87.87
24 × 1	2.87	63.64	23.80	37.40	22.19	9.88	5.90	17.77	0.06	9.47	4.30	29.21	34.17	85.50
24 × 3	3.08	63.76	24.42	38.30	20.72	10.31	6.40	19.58	0.06	10.00	4.47	30.54	35.53	85.93
24 × 5	2.81	58.96	20.04	34.02	21.04	10.30	5.31	19.13	0.05	10.97	4.10	29.49	34.67	85.07
25 × 1	3.35	59.42	22.23	37.40	17.75	10.15	6.06	21.27	0.06	9.53	4.27	27.72	32.83	84.40
25 × 3	3.08	67.84	25.19	37.07	22.05	10.14	5.97	19.68	0.06	9.57	4.33	28.64	33.47	85.57
25 × 4	3.16	95.38	36.38	38.10	30.21	10.81	6.64	21.16	0.07	11.10	4.47	29.62	34.50	85.87
34 × 1	2.88	95.87	34.42	35.90	33.33	10.83	6.07	20.01	0.06	10.23	4.47	28.10	33.27	84.47
34 × 2	2.94	65.57	24.48	37.33	22.42	10.39	6.18	19.16	0.06	9.77	4.10	28.51	33.60	84.83
34 × 5	3.34	67.90	24.99	36.81	20.37	9.62	5.60	20.29	0.06	11.00	4.40	28.34	33.37	84.93
35 × 1	2.96	61.61	23.34	37.88	20.81	10.17	6.20	18.69	0.06	10.00	4.57	30.49	35.43	86.03
35 × 2	3.56	62.56	22.64	36.20	17.53	10.77	6.11	24.44	0.06	9.73	4.23	29.80	34.67	85.97
35 × 4	2.86	61.57	23.26	37.78	21.55	10.13	6.15	17.99	0.06	9.60	4.47	28.74	33.70	85.27
45 × 1	2.99	72.25	27.05	37.48	24.41	10.44	6.26	19.56	0.06	10.13	4.53	29.80	34.67	85.97
45 × 2	3.23	81.70	32.65	40.01	25.27	9.61	6.41	18.61	0.06	9.57	4.40	27.96	33.07	84.57
45 × 3	3.41	49.11	17.67	35.95	14.40	9.93	5.57	21.68	0.06	10.43	4.20	30.36	35.30	86.00
LSD 5%	0.286	11.900	4.513	1.280	4.138	0.632	0.485	2.320	0.005	0.603	0.227	1.105	1.108	1.037

Table 4: General combining ability effect (h_i) of parental varieties for yield and yield component traits and some fiber properties

Parents	B.W	S.C.Y./P.	L.C.Y./P.	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
P_1	-0.040	-2.386	-0.920	0.135	-0.560	-0.144	-0.045	-0.561*	0.0001	-0.280**	-0.193**	-0.295*	-0.231	-0.276*
P_2	0.004	0.847	0.392	0.105	0.087	0.126	0.105	0.229	0.001	0.207**	-0.024	0.090	0.042	0.147
P_3	0.082*	-0.329	-0.404	-0.387*	-0.573	0.177*	-0.003	1.016**	0.0001	-0.036	0.016	0.006	-0.033	0.084
P_4	-0.108**	1.226	0.397	-0.126	1.254*	-0.202**	-0.149**	-1.064**	-0.001	0.231**	0.084**	-0.081	0.060	-0.376**
P_5	0.061	0.642	0.535	0.274	-0.208	0.043	0.092	0.380	0.001	-0.122	0.118**	0.280*	0.162	0.420**
S.E.	0.033	1.374	0.521	0.148	0.478	0.073	0.056	0.268	0.001	0.070	0.026	0.128	0.128	0.120

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

Table 5: General combining ability effect (g_i) of parental varieties for yield and yield component traits and some fiber properties

Parents	B.W	S.C.Y./P.	L.C.Y./P.	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
P_1	-0.028	2.246	0.764	-0.018	0.967	0.080	0.039	-0.010	0.0001	-0.130	0.022	-0.251	-0.222	-0.181
P_2	0.014	0.500	0.263	0.054	0.072	0.088	0.064	0.254	0.001	-0.050	-0.036	-0.166	-0.168	-0.064
P_3	0.061	-2.384	-0.853	-0.003	-1.150	-0.134	-0.079	0.136	-0.001	-0.052	-0.037	-0.063	-0.070	-0.008
P_4	-0.014	3.074	1.139	-0.013	1.064	0.006	0.001	-0.082	0.0001	0.126	0.061	0.210	0.248	0.002
P_5	-0.034	-3.436*	-1.313*	-0.020	-0.953	-0.039	-0.026	-0.297	0.0001	0.107	-0.011	0.270	0.212	0.251
S.E.	0.040	1.683	0.638	0.181	0.585	0.089	0.069	0.328	0.001	0.085	0.032	0.156	0.157	0.147

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

Table 6: Specific combining ability effects (d_{ij}) of each cross for yield and yield components traits and some fiber properties

Crosses	B.W	S.C.Y./P.	L.C.Y./P.	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
d_{12}	0.1282*	-2.7904	-1.1207	0.0054	-1.7364*	-0.3053**	-0.1785*	0.1822	-0.0018*	0.1633	-0.0006	-0.3027	-0.2086	-0.3614
d_{13}	0.1256*	8.4271**	3.0844**	-0.4714*	1.7772*	0.0350	-0.1006	1.0213*	-0.0010	-0.0956	-0.0203	-0.2740	-0.1342	-0.4667**
d_{14}	-0.1277*	-0.5119	-0.3525	-0.0887	0.8562	0.0594	0.0101	-0.5879	0.0001	-0.1817	0.0347	0.1932	0.1231	0.2358
d_{15}	-0.1470**	-3.4402	-1.0378	0.5410*	-0.1717	0.2707*	0.2986**	-0.6232	0.0030**	0.0164	0.0028	0.1952	0.0531	0.4564*
d_{23}	-0.0314	-2.7872	-0.5081	0.8967**	-0.6530	0.2499*	0.3715**	0.0327	0.0037**	0.1078	-0.0764	0.3310	0.1906	0.4819*
d_{24}	-0.0614	-1.1212	-0.4549	-0.2522	-0.0885	0.1001	-0.0017	-0.1368	0.0000	-0.2200*	0.0453	0.2765	0.2561	0.2011
d_{25}	-0.0249	7.0738**	2.2805**	-0.6092**	2.5321**	0.0214	-0.1433	0.1123	-0.0014	-0.0886	0.0050	-0.4292*	-0.3639	-0.3700*
d_{34}	-0.0081	1.3605	0.3366	-0.0749	0.5590	-0.1096	-0.0810	-0.2884	-0.0008	0.1461	0.0256	-0.4262*	-0.3861	-0.2792
d_{35}	-0.0400	-8.7887**	-3.5527**	-0.3527	-2.5461**	-0.2758*	-0.2488**	-0.6637	-0.0025**	-0.1975	0.0436	0.3223	0.2772	0.2581
d_{45}	0.1867**	2.5781	1.3252	0.4058	-0.5289	-0.0456	0.0737	0.9515*	0.0007	0.3497**	-0.0597	0.1139	0.1928	-0.1561
S.E.	0.051	2.104	0.798	0.226	0.732	0.112	0.086	0.410	0.001	0.107	0.040	0.195	0.196	0.183

1, 2, 3, 4 and 5: Suvin, TNB, Pima S_6 , Giza 88, and Giza 89, respectively.

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

Table 7: Two-line specific effect of second kind (S_{ik}) for yield and yield components traits and some fiber properties

	B.W	S.C.Y./P.	L.C.Y./P	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
$S_{1.2.}$	-0.0782	-3.4186	-1.7804**	-0.7971**	-0.3605	0.1867*	-0.0932	0.0554	-0.0009	0.4517**	0.0292	-0.1388	-0.1937	0.0865
$S_{2.1.}$	0.1348*	4.9439**	2.3457**	0.3092	0.5808	-0.5008**	-0.2082**	-0.2068	-0.0021**	0.0878	-0.1590**	-1.2081**	-1.1243**	-0.7156**
$S_{1.3.}$	0.1011*	10.4860**	3.0103**	-1.3568**	2.8567**	0.0523	-0.3219**	1.1689**	-0.0032**	-0.3719**	0.1229**	1.3738**	1.4243**	0.4407**
$S_{3.1.}$	-0.1262**	-14.5383**	-4.4355**	1.8651**	-4.1650**	0.1723	0.5788**	-1.0060**	0.0058**	-0.0213	-0.0181	0.2557	0.1438	0.3921**
$S_{1.4.}$	0.1804**	-5.5111**	-2.0407**	0.0186	-2.9994**	-0.1879*	-0.1136	0.8455*	-0.0011	-0.5583**	-0.1275**	-1.5809**	-1.4554**	-0.9885**
$S_{4.1.}$	0.0258	0.1735	0.7323	1.1652**	-0.0598	-0.0011	0.2761**	-0.2216	0.0028**	-0.1639	0.0440	0.2196	0.3147	-0.1468
$S_{1.5.}$	0.1004*	6.8363**	2.4710**	-0.1534	1.3479**	-0.1316	-0.0991	0.4045	-0.0010	0.8722**	0.1760**	-0.0228	0.0175	-0.0656
$S_{5.1.}$	-0.3223**	-2.0613	-1.4579*	-1.0914**	1.6300**	0.2216*	-0.1354	-1.3140**	-0.0014*	-0.0937	-0.0525	1.5706**	1.3119**	1.2733**
$S_{2.3.}$	-0.0872*	18.4819**	6.7232**	-0.2343	6.5193**	0.4173**	0.1835**	0.3069	0.0018*	0.1711*	0.0560	-0.6531**	-0.4926**	-0.6789**
$S_{3.2.}$	0.1568**	-3.9210*	-1.5831*	-0.0923	-2.2671**	0.3151**	0.1613*	1.7422**	0.0016*	-0.0872	-0.1843**	0.5581**	0.5747**	0.2149
$S_{2.4.}$	-0.1443**	-13.2585**	-4.3256**	1.0758**	-3.3808**	-0.1814	0.1701*	-1.6072**	0.0017*	-0.0025	0.1261**	0.0506	-0.0114	0.1899
$S_{4.2.}$	0.0055	1.3801	0.1450**	-0.7460*	0.4228	-0.4002**	-0.4266**	-0.5948	-0.0043**	-0.0226	0.0435	0.1147	0.0081	0.2829
$S_{2.5.}$	-0.1853**	10.7338**	3.4980**	-0.4005*	5.0899**	0.3048**	0.0641	-0.4236	0.0006	-0.4053**	0.1146**	0.2730	0.1260	0.4824**
$S_{5.2.}$	-0.1096*	4.2883*	2.7885**	1.5056**	1.9696**	0.2372*	0.5218**	-0.7750*	0.0052**	-0.6178**	-0.0757*	-1.0206**	-1.1025**	-0.2322
$S_{3.4.}$	0.0814	-11.7954**	-4.9453**	-0.9343**	-4.2950**	-0.3054**	-0.4023**	0.2727	-0.0040**	0.0642	-0.0639	0.7334**	0.8086**	0.0949
$S_{4.3.}$	0.2291**	-6.6851**	-2.6228**	-0.1559	-3.9611**	-0.2431*	-0.1852*	1.0183**	-0.0019*	0.8176**	-0.0438	-0.2219	-0.1108	-0.3475*
$S_{3.5.}$	-0.0857*	-9.3849**	-3.3072**	0.5008**	-2.4443**	-0.0271	0.1177	-0.7935*	0.0012	-0.0363	0.0986**	0.3599*	0.4054*	0.0304
$S_{5.3.}$	0.1195**	6.2396**	2.2486**	-0.2698	1.1186	-0.1780	-0.1817*	0.5956**	-0.0018*	-0.0654	0.0042	-0.4557**	-0.3481*	-0.4800*
$S_{4.5.}$	0.1497**	-8.5229**	-3.5704**	-0.5585**	-3.5598**	-0.0477	-0.1662*	1.0222	-0.0017*	-0.3210**	-0.0549	-0.1437	-0.4453**	0.7179**
$S_{5.4.}$	-0.1457**	15.5337**	6.1062**	0.3501	5.9573**	0.2968**	0.2599**	-0.4896	0.0026**	0.3026**	-0.0354	-0.0639	0.1492	-0.5508**
S E	0.042	1.728	0.655	0.186	0.601	0.092	0.070	0.337	0.001	0.088	0.033	0.161	0.161	0.151

1, 2, 3, 4 and 5: Suvin, TNB, Pima S_6 , Giza 88, and Giza 89, respectively.

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

Table 8: Three-line specific effect (t_{ijk}) for yield and yield components traits and some fiber properties

	B.W	S.C.Y./P.	L.C.Y./P.	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
t_{123}	-0.1181**	0.1326	-0.3027	-0.4474*	0.9989	0.3406**	0.0727	0.0159	0.0007	0.4017**	0.0111	0.7273**	0.8149**	0.0860
t_{124}	-0.0103	-4.5875**	-2.0785**	-0.4991**	-1.4832*	-0.2685**	-0.2826**	-0.4421	-0.0028**	-0.4192**	-0.1006**	-0.9603**	-0.9876**	-0.3615*
t_{125}	0.1127**	7.5445**	3.5365**	0.9872**	1.6536**	0.1164	0.3263**	0.7004*	0.0033**	-0.1850*	0.0744*	-0.2360	-0.2660	-0.0007
t_{132}	-0.0473	0.0703	0.4220	0.8483**	0.1554*	-0.5271**	-0.0845	-1.6538**	-0.0008	-0.0400	0.1632**	0.4641**	0.4565**	0.2131
t_{134}	0.0756	-5.7407**	-1.5398*	0.8573*	-2.3770**	0.2794**	0.3770**	0.8145*	0.0038**	-0.1433	-0.0710*	0.5898**	0.2757	1.0172**
t_{135}	0.0094	5.5149**	1.0182	-1.7292**	2.0155**	0.1864*	-0.3364**	0.9807**	-0.0034**	-0.0217	-0.1085**	-1.4069**	-1.0610**	-1.4428**
t_{142}	0.1093*	-2.0254	-1.0270	-0.3299	-1.1615	0.2950**	0.0910	1.3620**	0.0009	0.2767**	-0.0026	0.2249	0.1499	0.2843
t_{143}	-0.2690**	0.8503	-0.0746	-0.5891*	1.7672**	-0.0860	-0.1939**	-1.6889**	-0.0019**	0.0942	0.0082	-0.3835*	-0.2618	-0.4640**
t_{145}	0.1127**	7.1605**	3.2431**	0.8838**	1.6789**	-0.1131	0.1489	0.2231	0.0015*	-0.3758**	0.0882*	0.1122	0.1407	-0.0215
t_{152}	-0.1296**	-2.9178	-1.6420*	-0.8511**	-0.1799	-0.3886**	-0.4444**	-1.3188**	-0.0044**	0.1796*	0.0494	0.5563**	0.6299**	0.0493
t_{153}	0.0163	12.5332**	5.2417**	1.0685**	3.8423**	0.5408**	0.5921**	0.8141*	0.0059**	-0.0654	0.1978**	0.2433	0.0599	0.5635**
t_{154}	0.0442	-10.9539**	-4.2170**	-0.2604	-3.6462**	-0.1067	-0.1330	0.1586	-0.0013	-0.1404	-0.2347**	-0.7788**	-0.7010**	-0.5340**
t_{231}	0.0231	-1.2886	-0.6413	-0.5009**	-0.8212	0.0862	-0.0633	0.4991	-0.0006	0.3350**	-0.0243	0.2471	0.1086	0.4610**
t_{234}	-0.0071	-10.6935**	-4.2013**	-0.2940	-3.2365**	-0.0742	-0.1226	-0.1029	-0.0012	-0.1108	-0.2035**	-0.6863**	-0.6156**	-0.4807*
t_{235}	0.0688	9.8622**	4.1784**	0.8528**	2.8448**	-0.0639	0.1697*	0.0423	0.0017*	-0.3392**	0.1465**	0.1823	0.2394	-0.0615
t_{241}	-0.0153	-10.8485**	-3.3928**	0.7601**	-3.6646**	-0.5462**	-0.1232	-1.4046**	-0.0012	0.3058**	-0.0401	1.3568**	1.2644**	0.8072**
t_{243}	-0.0067	10.7467**	4.5103**	1.0387**	3.4217**	0.5208**	0.5725**	0.6343	0.0057**	-0.1025	0.1924**	0.2337	0.0261	0.6131**
t_{245}	0.0220	4.1227*	0.4594	-1.7525**	1.5208*	0.1308	-0.3756**	0.9635**	-0.0038**	-0.1183	-0.1235**	-1.5410**	-1.2006**	-1.4903**
t_{251}	0.1596**	-2.5576	-1.0361	-0.1844	-1.7338**	-0.1132	-0.1132	0.7799*	-0.0011	0.2254*	-0.0506	0.1215	0.1694	-0.0653
t_{253}	-0.2773**	3.9464*	1.0332	-0.6137**	2.8589**	-0.0724	-0.1927**	-1.7071**	-0.0019**	0.0712	0.0569	-0.4379**	-0.2689	-0.6011**
t_{254}	0.0956*	-4.6916**	-1.1790	0.8366**	-2.1156**	0.2406*	0.3482**	0.8781*	0.0035**	-0.2329**	-0.0589	0.4332**	0.1494	0.8764**
t_{341}	0.1344**	-3.9172*	-1.5373*	-0.1656	-2.0314**	-0.0467	-0.0702	0.7433*	-0.0007	0.2192*	-0.0772*	0.1053	0.1194	0.0068
t_{342}	-0.1705**	-3.6226*	-1.9550*	-0.8594**	-0.1419	-0.3253**	-0.4106**	-1.4543**	-0.0041**	0.1433	0.0444	0.5080**	0.5594**	0.0776
t_{345}	0.0896*	8.3157**	3.8143**	1.0068**	2.0758**	0.2274*	0.3941**	0.7715*	0.0039**	-0.2800**	0.0603	-0.4476**	-0.4789**	-0.0907
t_{351}	-0.0258	-7.3255	-2.0549**	0.7841**	-2.4499**	-0.4461**	-0.0594	-1.2796**	-0.0006	0.3138**	-0.0126	1.2957**	1.2411**	0.6926**
t_{352}	0.0832*	2.1524	0.4991	-0.3331	0.3888	0.3920**	0.1457*	1.3880**	0.0015*	0.2546**	0.0465	0.1317	0.1061	0.1260
t_{354}	-0.0260	-1.3749	-0.8811	-0.4769*	-0.3048	-0.1407	-0.2044**	-0.2902	-0.0020**	-0.5071**	-0.0876**	-1.1943**	-1.1872**	-0.5449**
t_{451}	0.0692	-1.8595	-0.7974	-0.4691*	-1.2672*	0.0815	-0.0594	0.7876**	-0.0006	0.2096*	-0.0701*	-0.0183	-0.1531	0.3389*
t_{452}	-0.0169	0.1542	0.4541	0.8529**	0.0450	-0.5350**	-0.0897	-1.4642**	-0.0009	-0.1954*	0.1390**	0.1667	0.1744	0.0472
t_{453}	-0.1056*	1.2982	0.1476	-0.4213*	1.3470*	0.4160**	0.1209	0.2496	0.0012	0.2471**	-0.0126	0.3911*	0.4961**	-0.1011
S E	0.041	1.718	0.651	0.185	0.597	0.091	0.070	0.335	0.001	0.087	0.033	0.160	0.160	0.150

1, 2, 3, 4 and 5: Suvin, TNB, Pima S_6 , Giza 88, and Giza 89, respectively.

***, ** Significant at 0.05 and 0.01 levels of probability, respectively.**

Table 9 : The estimates of genetic parameters from the three – way crosses analysis for yield and yield components traits and some fiber properties

Geno.	B.W	S.C.Y./P.	L.C.Y./P.	L.%	No.B./P	S.I.	L.I.	No. S./B	L./S	Pers.	Micr.	50%S.L.	2.5%S.L.	U.R.%
σ^2A	0.180	31.98	6.738	2.893	10.251	0.691	0.170	11.447	0.00002	0.633	0.107	2.137	2.529	1.105
σ^2D	-0.391	-229.47	-37.773	-5.724	-63.553	-1.099	-0.801	-7.538	-0.00008	-1.705	-0.085	-3.037	-2.673	-1.336
σ^2AA	-0.292	-375.44	-53.310	-6.321	-51.201	-1.142	-0.392	-19.028	-0.00004	-1.278	-0.191	-5.184	-5.675	-2.446
σ^2AD	0.209	3155.19	415.137	18.987	307.171	1.017	1.521	12.829	0.00015	2.298	0.165	16.188	14.893	6.692
σ^2DD	-0.221	-263.815	-38.822	-3.614	-53.453	-0.659	-0.427	-6.209	-0.00004	-1.158	-0.088	-2.959	-2.788	-1.273
D.d	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000	0.00	0.00	0.00	0.00	0.00
h^2b.s.	92.62	98.36	98.22	97.29	98.02	91.92	95.05	92.23	94.97	95.57	93.47	97.56	97.42	95.09
h^2 n.s.	42.86	1.64	1.78	2.73	3.16	8.07	4.74	43.53	11.17	20.64	36.77	11.38	14.14	13.48