

USING STABILITY PARAMETERS AND VARIANCE COMPONENTS FOR SELECTION GENOTYPES UNDER DIFFERENT ENVIRONMENTAL CONDITIONS IN EGYPTIAN COTTON.

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ABSTRACT

Plant breeder use yield traits to identify promising genotypes. This goal depends the magnitudes of genotype by environments and stability performance of genotypes. Therefore, twenty Egyptian extra long genotypes were grown in three locations under two years for yield, yield components earliness and fiber traits to identify promising stability genotypes. The genotype x environment interaction was significant for yield and fiber traits. It also noticed that variation due genotype x environment were further partitioned into linear and non-linear components. Genotype x environment linear was insignificant for all studied traits except for MC trait, insignificant of genotype x environment linear indicated that genotypes didn't differ genetically in their response to different environments. Pooled deviation mean squares were significant for all studied traits, indicated that the major components for differences in stability were due to deviation from the linear function. Therefore, it could be concluded that the relatively unpredictable components of the interaction maybe more important than the predictable components.

The results illustrated that lines 3, 5 and 15 were stable for seed cotton yield (\bar{x} = high, $b = 1$ and $s^2_d = 0$). While, the line (7) has high mean performance and regression coefficient equal to one but the deviation from regression was larger than zero. However, for lint percentage, some lines has high mean performances over grand mean (2, 3, 7, 8, 9, 12 and 14) but these lines did not parallelism with the stability parameters. Therefore, the best performing, highest value in this trait or genotypes was not necessary. The best stable genotype for fiber length is 2, 10, 11 and 12 when had mean performances same the check variety (Giza 70) and regression coefficient (b_i) was equal unity for all genotypes and deviation from regression was significant differ from zero. The best genotypes according to these criteria (three indexes) are also identified in this when selection based on mean yield alone when have yield ranks of one because all lines were similar for mean performance for yield due to low variability of these material (Extra long staple) while, selection based on index 3 the top lines were 1, 3, 5, 6, 9, 11, 15 and 16. Using principal components analysis to selection the better stability lines to comparison regression model, the results shown that the percentage contribution of PCA components of seed cotton yield. Each PAC1 and PCA2 were more important. In addition results show that the strains 1 and 3 which PCA1 equal unity and PCA2 equal zero. The two strains were stable by using regression model (\bar{x} = high = 1 and $s^2_d = 0$). On the other hand, lines 5 and 15 were stable by using regression model but the values of PCA equal zero and PCA2 close to unity. Therefore, using the two models to identify promising genotypes stability in cotton breeding programs is very useful.

Keywords: Stability, Interaction, Selection and Cotton.

INTRODUCTION

Cotton is one of the oldest fiber crops. Four species of the genus *Gossypium* have contributed to a great demand for modern cultivated cotton. Upland cotton (*Gossypium hirsutum*, L.) and Egyptian cotton (*Gossypium barbadense*, L.) account for more than 99 percent of the world supply of raw cotton for factory use. The *Gossypium barbadense*, L. produced high fiber characters

Due to its importance, plant breeders have been working for improving its yield and quality. Consequently, they achieved a great success in this respect through the evaluation of varieties having high yield and better qualities. Hybridization program requires selection of bendable parental lines to be used to produce genetically modified and potentially rewarding germplasm with collection of fixable gene effects relatively in a homozygous line. Cotton is one of the most important fiber crops of the world and is likely to enjoy this advantage in the future in Egypt, cotton is important for both export and local textile industry. Now, cotton area is low and decrease from year to year in Egypt, because environmental conditions vary from one environment to another. Cotton as other field crops is greatly influenced by seasons, location and any changes for growth environments. Therefore genotype x environments interaction (GE) are a continuing challenge to plant breeders because of the complications they cause in selecting genotypes evaluated in divers' environments. Plant breeder's use yield traits to identify promising genotypes and agronomists use a recommendation for farmers. The level of success in meeting these goals depends critically on two factors (1) the accuracy of yield estimates and (2) the magnitudes of genotype by environments (Gauch, 1988).

The GE interaction reduced the correlation between phenotypic and genotypic values and has been shown to reduce progress from selection Comstock and Moll, (1963). When GE interaction is presence estimates of genetic parameters such as heritability and genetic correlation may vary (Larsson *et al* 1997). Therefore, evolution and stability parameters for genotypes under different environment are very important especially in breeding programs. The gene expression for most cotton traits changes under different environments. Screening of genotypes for stability under varying environmental conditions has thus becomes as essential part of modern breeding program Falconer (1960) and Gill and Singh (1982). Stability of a lines and cultivar refers to its consistency of in performance a cross environments, which is a affected by the presence of genotype x environment interaction stability parameters were estimated to determine the superiority of individual genotypes a cross the range of environments. Finaly and Wilkinson (1963) used the slop of the regression line (b) to estimate stability and adaptability for several genotypes. While, Eberhart and Russel (1966) suggested that it should refer to the deviation from regression (S^2d). Lin *et al.*, 1986 reported that a particular genotype may be considered to be stable if it's among environments variance is small. Studies on stability parameters for comparing Egyptian Cotton Cultivars and lines were made by

several workers i.e. EL-Marakby *et al.* , (1986) , Shofshak *et al.*, 1993, EL-Shishtawy *et al.* , 1994, Bader 1999 , Abdel-Hafez *et al.*, 2000 and Shaker 2009 .

Therefore, the main objectives of this investigation were to estimate the stability parameters for 14 lines in addition to six check varieties in order to select the best lines (high yield, high fiber properties and stable) with check varieties to using in general farm.

MATERIALS AND METHODS

The experiments were carried out under three locations (Kafre el Sheikh, Damietta and El baheria Govern.) over two growing seasons 2007and 2008, to evaluating 14 lines and six check varieties. The Characterization and Pedigree of lines and Check varieties in this investigation are presented in Table 1:

Data were recorded to many traits as follows:

- 1- Seed cotton yield per fed. (S.C.Y.), lint percentage (L. %), Boll weight (B.W.) in gram. and earliness index. (E. I.) .
- 2- Fiber properties i.e., micronair reading (M.C.), Fiber length (2.5% span length) elongation.

Hair – weight in terms of millitex (10^{-8} g/cm) (FIN) and Yarn strength (STR.) is product lea strength x Yarn count" by The Good Brand Tester.

Table (1): Pedigree of genotypes used in this study.

Number	Genotypes	Origin
1	F.5 1141/2005	{ G.87 x (G.77x G.70)} x)G.45 x Sea Iland)
2	F.5 1145/2005	{ G.87 x (G.77x G.70)} x)G.45 x Sea Iland)
3	F.5 1200/2005	G.87 x G. 92
4	F.5 1215/2005	G.87 x G. 92
5	F.5 1224/2005	G.87 x G.92
6	F.5 1243/2005	G.88 x G. 92
7	F.5 1250/2005	G.88 x G.92
8	F.5 1264/2005	G.88 x G. 92
9	F.6 1272/2005	G.87 x (G.74 x Sea Iland)
10	F.6 1286/2005	G.87 x (G.45 x Sea Iland)
11	F.6 1304/2005	(G.84 x G. 45) x Pima62
12	F.7 1387/2005	{ G.84 x (G.70 x G.51 B) } x Pima 62
13	F.7 1396/2005	{ G.84 x (G.70 x G.51 B) } x Pima 62
14	F.8 1415/2005	G.45 x { G.84 x (G.70 x G.51 B)}
15	G. 92	(G. 84 x G. 74) x G. 62
16	G.77 x Pima S6	G.77 x Pima S6
17	G.87	G.77 x G.45 (A)
18	G.88	G.77 x G.45 (B)
19	G.45	G.28 x G.7
20	G.70	G.59 A x G.51 B

Analysis of variance for randomized complete blocks design was made according to Snedecor and Cochran (1961) for each environment. The combined analysis of variances was calculated for 20 genotypes under three locations over two years according to Le Clerg *et al.*, (1962). The analysis of

variance and estimates of its components were partitioned to genotypes (σ^2_g) and its interactions with environmental conditions. Variance components were used to estimate the broad sense heritability ($h_b^2\%$), phenotypic (PCV) and genotypic (GCV) coefficients of variability.

Stability parameters:

The statistical analysis for stability was done according to Eberhart and Russell (1966), parameters of regression coefficient (b_i) and mean squares of deviation from regression (s^2_d) for each variety. A coefficient of determination (r^2) was suggested by Pinthus (1973).

To combine the estimate of yield and stability, rank index was used. Ranks were assigned for mean yield with the genotype giving the significant highest yield receiving the rank of 1, ranks were assigned for (s^2_d) with the insignificant estimated value receiving the rank of 1. And also, ranks were assigned for b the lower value than unity receiving the rank of 1.

Three indices were calculated.

- 1- Index (1) was derived from the sum of yield rank and b rank.
- 2- Index (2) from the sum of yield rank and s^2_d - rank.
- 3- index (3) from the sum of yield rank, b - rank and s^2_d -rank according to Kang (1988).

Multivariate techniques were conducted by using principal components analysis and cluster according to Haire *et al.*, (1987) and Anderberg (1973) all these computations were performed using SPSS (1995).

RESULTS AND DISCUSSION

The results in Table 2 revealed that differences among genotypes and environments which were significant for all traits for 14 lines and 6 check varieties under different environments except for strength of genotypes B.W., F.L., FIN, This finding revealed that the presence of a variability among genotypes included in this study for yield, yield components and micronaire reading.

Mean performance for 14 lines and six check varieties in Table 3 revealed that all lines were close to the best check variety (G.88) but, there are some lines that were high in mean performance for seed cotton yield i.e. 2, 5, 7 and 12 compared to all check varieties. The any increase for a seed cotton yield especially from extra long staple lines in Egyptian cotton varieties are very important and necessary because there are negative linkage between fiber traits and cotton yield, although some new varieties are high fiber quality and medium seed cotton yield i.e. G. 88 and G.92. Breeding for improvement quantitative characters are very difficult, therefore, selection and evaluation of new lines under different environment are very important to help us for choosing available environment to cultivation the new varieties as well as helping the cotton breeder to correct selection for any new varieties. One line (1415/2005) were higher lint percentage than best check variety and some lines were higher than grand mean (i.e. 2, 3, 7, 8, 9 and 12) while for fiber length all lines were similar with best check varieties.

There are some lines were higher fiber strength than the check variety (G.77 x Pima S6) i-e, 4, 7, 8, 11 and 13 while, the lines i-e 7, 8, 11, were the highest in Yarn strength. The pervious results reported that there are some lines are mean performed for strength similar to check variety (G.88) with high seed cotton yield i-e, 1, 2, 7, 14 and 15. Therefore, these lines considered the promising lines and able to cultivate in general cultivation.

Estimation of variance components, heritability in broad sense, phenotypic and genotypic coefficient of variability for yield and fiber properties are presented in Table 4, The results indicated that the genotypes behavior affected by different environmental conditions. This affect of environments appeared on heritability values estimates for these traits which were low 16.2, 35.9, 7.2 and 22.9 for B.W., S.C.Y., S.T.F., and S.T.R., respectively. Heritability and genetic variation would give the best indication of the amount of genetic variance to be expected from selection (Burton 1952). Therefore, estimation of these parameters under different environments is very important for breeding programs. Also, mean squares were partitioned to environments and their interaction with genotypes. High heritability of lint percentage, earliness index and micronair reading indicating that the phenotypic expression of these traits was indicated of their genetic behavior. While, low heritability for the rest traits indicated that these material are similar of performance, the similarity due to the Egyptian cotton breeder for breeding programs maintenance of limit level of fiber traits for the selection. Therefore, the low variability between the produced lines was observed programs. For most fiber traits, the genotype by environments interaction was high indicated that these genotypes differed in their performance under different environments. Falconer (1960). suggested that a character measured in two different environments could be regarded not as one character but as two. Therefore, the evolution of new strains in breeding programs in early generation is very important to correct selection for any promising strains.

Table 4: The variance components, heritability, Phenotypic and genotypic of variation for all studied traits.

Prameters	B.W	SCY	L%	EI%	FL	MC	FIN	STF	STR
SP	0.00385	0.23	1.386	13.59	0.21	0.038	27.97	1.05	4864
SG	0.00063	0.10	1.001	7.567	-0.02	0.022	15.06	0.08	1111
H ² b	16.2162	35.9	72.26	55.66	-	56.58	53.85	7.52	22.85
PCV	-	0.15	3.34	5.81	1.28	5.46	4.10	2.09	2.15
GCV	-	0.10	2.83	3.60	-	4.15	3.01	0.58	1.03

B.W.: boll weight, S.C.Y. : Seed cotton yield , L. %: lint percent , E...I.: Earliness index, F.L.: fiber length at 2.5%, M.C. Micronair reading, FIN: fiber fineness, STF. : Fiber strength and STR; yarn strength.

Table 2 cleared that the genotype x environment interaction was significant for yield and fiber traits. If the G X E interaction components were larger relative to the genotypic components and if they were related to predictable environment factor (such as geographic areas, major pest problems), the breeder searches for a cultivar to meet the specific requirements of that environment, while the interaction is small and

unpredictable (microclimatic or yearly variation in weather and management practices) the breeder searches for a cultivar that has general adaptability and universal performance over the range of environments

It also noticed that variation due genotype x environment were further partitioned into linear and non-linear components. Genotype x environment linear was insignificant for all studied traits except for MC traits, insignificant of genotype x environment linear indicated that genotypes didn't differ genetically in their response to different environments, while significant indicating that the regression coefficient of some varieties more or low than unity ($b=1$) and some lines were more stable than others over the environments.

Pooled deviation mean squares were significant for all studied traits, indicated that the major components for differences in stability were due to deviation from the linear function therefore, it could be concluded that the relatively unpredictable components of the interaction maybe more important than the predictable components, similar results were reported by Awaad(1989), Ismail *et al* .1992, EL-Harony.*et al.*,(2000) and Shaker (2009)

Eberhart and Russell (1966) proposed that an ideal genotype is one which has the highest yield over broad range of environments regression coefficient (b) value of 1.0 and deviation mean Square (s^2d) of zero. Characterization of mean performances of individual genotypes coupled with different stability parameters for yield, yield components and earliness genotype grown index, (E.I.) are presented in Table 5. The results illustrated that lines 3,5 and 15 were stable for seed cotton yield (\bar{x} =high, $b=1$ and $s^2d=0$). While, the line (7) has high mean performance and regression coefficient equal one but the deviation from regression was larger than zero and determinations coefficient were small. However, for lint percentage some lines has high mean performances over grand mean (2, 3, 7, 8, 9, 12 and 14) but these lines did not parallelism with the stability parameters. Therefore, the best performing, highest value in this trait or genotypes was not necessarily to be best stable genotype. Similar results reported by EL-Harony. *et al* (2000) found that correlation between \bar{X} and r^2 , b and S^2d) was insignificant for seed cotton yield.

Earliness index (E.I.) trait is very important parameter for breeding method to selection early varieties in Egyptian cotton breeding programme. Therefore, selection lines have high yield, more earliness and high stable are important. Most lines and check varieties have regression coefficient and deviation from regression did not differ from one and zero but, line (6) which has high mean (over best check variety (G.92), and more stable than the rest genotypes. Therefore can be using this line for stock in breeding program to produce varieties more earliness with selection to high yielding. In this respect, Allard and Work man (1963) reported that heterozygote's were more buffered than homozygotes. However, Kohel (1969) and Kohel (2003) stated that the buffering ability had no relation with heterozygosity, but, Bahatade and Bhale (1983). Reported that the stability of genotypes could be resulted from balanced and optimal combinations of development traits in such genotypes.

The results in Table (5) revealed that, the lines for fiber length have mean performances were the same as check variety (Giza 70) and regression coefficient (b_i) was equal unity for all genotypes and deviation from regression was significant differ from zero. Therefore, the determination (r^2) was low of most genotypes. Therefore, all genotypes were unstable for this trait. Similar trend was in the rest fiber traits EL-Shaarawy 1998 and Seyam *et al* 1994 reported that micronaire reading, fiber strength and fiber length differed significantly in estimated α . The cultivars varied greatly in the estimated λ statistic, the deviation from three liner response. Also, similar results of reported by EL-Marakby *et al.*, 1986 and Shaker 2009. . Although, fiber properties controlled the genetic compare with the yield and yield components but these traits affect by of environment factors. This effect appeared in the expression of these lines. Therefore, all lines nearly were unstable for micronaire, fiber length, fiber fineness and fiber strength and this is very important to breeders, because the genetic parameters or the gene expression may vary of the presence of genotype x environment interaction (Larsson *et al.*, 1997).

In over environments are given in Table 6. The superiority of the seed cotton yield ranged between 1.0 for line 2 and line 3-5-6-15, for check Variety G.45. Selection is based primarily on P_i values and function of both genotypic as well as GE interaction values. The small of P_i value indicates general superiority of the cultivar. The results indicated that, there is relationship between the mean performance and regression coefficient with superiority measure (P_i). 1, 3, and 15 were more superior, high stable and above performance. Parameter multiple, to identify and selection the top yielding lines are important in early selection generate for breeding programs because these help the breeder to correct suggesting especially most economic characters are given genes multiple and effect by environments.

Rasmusson and Lambert (1961), Lin and Binns (1988) and Abdel-Hafez *et al.*, (2000) using the superiority and stability parameters to evaluate some Egyptian cotton varieties and reported that most stable varieties were more superiority over all environments.

The mean of genotypes, stability parameters and the three indices of 20 genotypes are shown in Table 6 for seed cotton yield. The best genotypes according to these criteria are also identified in this table when selection based on mean yield alone have yield ranks of one because all lines were similar for mean performance for yield due to low variability of these material (Extra long staple) while, selection was made on the basis of index on the top times included the lines 1, 2, 3, 4, 5, 6, 7, 8 and 9 when selection of index two the lines 1, 3, 5, 6, 9, 10, 15 and 16. While, selection based on index3 the top lines were 1, 3, 5, 6, 9, 11, 15 and 16.

The previous results of lines selection were similar of ranks due to the Low variability of ranks of lines (1, 2, 3) and rank for each b and S^2d depended on and significant for them while, the ranks depended on absolute value are low important for identify of genotypes. Therefore selection in these lines showed is dependent on the three indices. The best lines of exprnel were 1, 2, 5 and 9 (high yield and high stable).

Table 6: The superiority and the mean of genotypes and the three indices of 20 genotypes of the seed cotton yield.

Genotypes	Yield	Rank Yield	Rank b	Rank S ² d	Index 1	Index 2	Index 3	Superiority
1	9.148	1	2	1	3	2	4	1.119
2	9.296	1	2	2	3	3	5	1.025
3	9.135	1	2	1	3	2	4	1.460
4	9.021	1	2	1	3	2	4	1.510
5	9.285	1	2	1	3	2	4	1.060
6	9.563	2	2	2	4	4	6	2.077
7	9.244	1	2	2	3	3	5	1.631
8	8.771	1	2	1	3	2	4	2.100
9	8.849	1	2	1	3	2	4	1.660
10	8.968	1	2	2	3	3	5	1.485
11	8.205	2	2	2	4	4	6	3.730
12	9.119	1	3	2	4	3	6	1.518
13	8.869	1	2	2	3	3	5	1.954
14	9.195	1	2	2	3	3	5	1.140
15	9.119	1	2	1	3	2	4	1.320
16	8.801	1	2	1	3	2	4	2.660
17	8.429	2	3	1	5	3	6	2.630
18	8.880	2	3	1	5	3	6	1.850
19	7.345	3	1	1	4	4	5	5.560
20	8.092	2	2	2	4	4	6	3.420

The rank of these materials were little due to, rank of yield, b and S²d depended on significant for them and low variability of these material. Absolute value ranks (without significant) give us more ranks, but it is not efficiency for screening and selection for genotypes. Quantitative traits affected by major factors e.g. multiple genes, environmental factors and interaction. Therefore, selections to families' copies are very important in breeding programs for improvement of these traits.

Plant breeder's use yield traits to identify promising genotypes and agronomists make recommendations for farmers. The level of success in meeting these goals depends critically on two factors (1)the accuracy of yield estimates and (2) the magnitudes of genotype by environments (Gauch, 1988). These two factors reflect within trail accuracy and between trail predictability.Using principal components analysis to selection the better stability lines to comparison regression model. Therefore, the results in Table 7 shown that the percentage contribution of PCA components of seed cotton yield. Each PAC1and PCA2 were more important. These results agreed with these obtained by EL-Shaarawy (1998 and 2000) and El-Helow. *et al.*,(2002).The results in Figures 1and 2 show that the strains (1and 3)which PCA1 equal unity and PCA2 equal zero. The two strains were stable by using regression model ($x=high, b=1$ and $s^2=0$). On the other hand, lines 5 and 15 were stable by using regression model but the values of PCA equal zero and PCA2 nearly equal unity. Therefore, using the two models to identify promising genotypes stability in cotton breeding programs is very useful

Table 7: Percentage contribution of PCA components of seed cotton yield.

Cumulative %	% of Variance	Extraction Sums of Squared Loadings	Cumulative %	Eigen values	Component
		Total		Total	
44.376	44.376	2.663	44.376	2.663	1
68.336	23.960	1.438	68.336	1.438	2
84.565	16.228	0.974	84.565	0.974	3
94.026	9.462	0.568	94.026	0.568	4
99.919	5.893	0.354	99.919	0.354	5

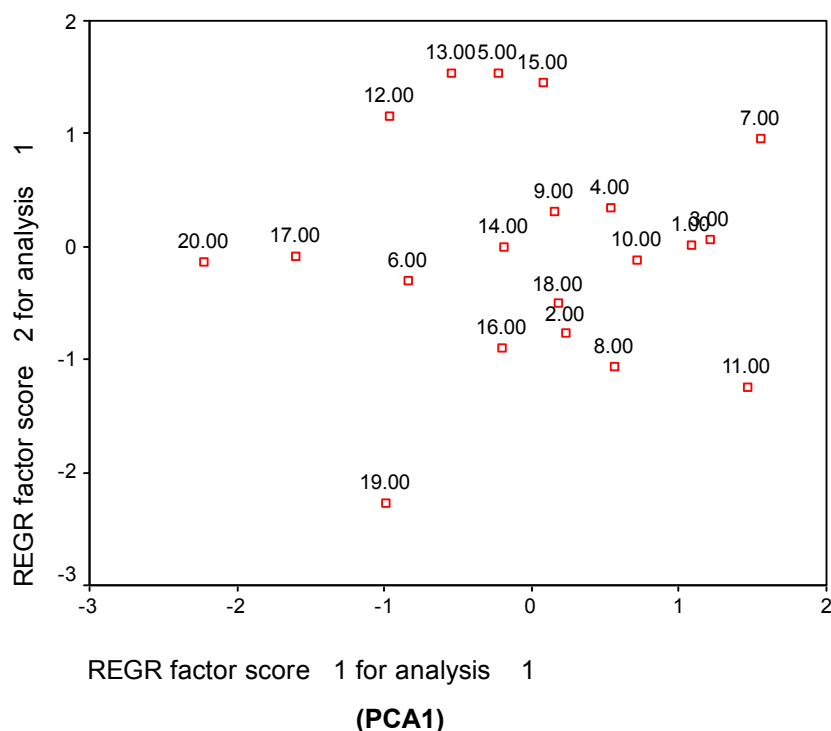


Figure 1: Principal axis factoring of 20 genotype according 6 environments for seed cotton yeiled.

Genetic diversity

In this part of the study all cotton genotypes are accounted for cluster analysis to determine the relative genetic diversity and genetic distances. It is interesting to not that the multivariable analyses were important and very efficient for exploiting the genetic variability existing among the Egyptian cottons varieties. The results in Figure 1 of the hierarchical cluster analysis in the from of dendogrames. It is clear evident that the line 11 was wide divergent from their check of varieties.

Also, check varieties were divided for most clusters (2, 3 and 5 cluster).

The lines are in same cluster indicated that near similar. Therefore selection for lines depends on the relationship between these lines for cluster

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استخدام مقاييس الثبات ومكونات التباين لانتخاب التراكيب الوراثية تحت ظروف
بيئية مختلفة في القطن المصري
محمد نشأت عبد العزيز نظمي، وليد محمد بسيوني يحيي ، عادل عبد العظيم ابو اليزيد
الاخضر و محمد عزت عبد السلام .
معهد بحوث القطن – مركز البحوث الزراعية – مصر

يستخدم مربى القطن تجارب التقييم المحصولي لتقييم وانتخاب الهجن المبشرة ولاتمام هذا
الهدف فانه يعتمد على اهمية التفاعل ما بين البيئة والوراثة وايضا على درجة الثبات الوراثي لهذه
الهجن . لهذا تم في هذا البحث تقييم ٢٠ تركيب وراثي في ثلاث مواقع زراعية لموسمين زراعيين
ومن النتائج المتحصل عليها يتضح الاتي :-

تشير النتائج الي وجود تفاعل عالي بين البيئة والوراثة لكل من صفات المحصول والتيلة
وان التفاعل الخطي بين البيئة والوراثة كان غير معنوي لجميع الصفات الموجودة تحت الدراسة عدا
صفة الميكرونير وعدم وجود معنوية يدل على ان التراكيب الوراثية الموجودة تحت الدراسة كانت
استجابتها للبيئة غير مرتبطة بتركيبها الوراثي وان الجزء الاهم للتفاعل يرجع الي اختلاف
الانحرافات عن خط الانحدار .

يتضح من النتائج ايضا ان السلالات ٣ و ١٥ كانت اكثر ثباتا لصفة المحصول (-X
1 = high , b=1 and S2d = 0) بينما السلالة ٧ كانت اعلى محصولا ولكن معامل الانحدار
اكبر من ١ (الوحدة) و S2d لا يساوي الصفر .

اشارت النتائج ايضا الي انه توجد مجموعة من السلالات كان متوسطها اعلى من المتوسط
العام وهي (٢ ، ٣ ، ٧ ، ٨ ، ٩ ، ١٢ ، ١٤) ولكن يعاب عليها انها غير ثابتة ومن ذلك يتضح انه ليس
بالضرورة ان تكون السلالات عالية الاداء ان تكون ثابتة وعلى الجانب الاخر كانت جميع السلالات
ذات متوسط عادي للصفة ج.٧٠ في صفة طول التيلة ولكن جميع السلالات كانت غير ثابتة في تلك
الصفة .

من النتائج يتضح ان انتخاب افضل التراكيب الوراثية على اساس مؤشرات الانتخاب الثلاثة
ان معظم السلالات كانت متساوية في ترتيبها بالنسبة لصفة المحصول ويرجع ذلك الي قلة
الاختلافات والمحصول في طبقة الاقطان فائقة الطول للحفاظ على مستوي معين في السلالات
المبشرة في صفات التيلة والانتخاب على اساس الـ 3 index فكانت هناك عدد من السلالات
افضل وهي ١ ، ٣ ، ٥ ، ٩ ، ١١ ، ٦ وتعتبر من الهجن المبشرة جدا في برامج التربية.

استخدام تحليل المكونات الاساسية للتراكيب الوراثية والثبات المختلفة لصفة المحصول زهر
لانتخاب افضل السلالات بالمقارنة بنموذج الانحدار اتضح ان PCA1 , PCA2 كانت اكثر
اهمية واتضح ان السلالتين ١ ، ٣ ذات PCA1 مساوي للواحد و PCA2 مساويا للصفر وان
تلك السلالتين كانتا اكثر ثباتا باستخدام الانحدار . على الجانب الاخر السلالتين ٥ ، ١٥ كانت اكثر
ثباتا باستخدام الانحدار ولكن قيم الـ PCA1 يساوي صفر و PCA2 يساوي تقريبا الواحد
لذلك تقرر النتائج المتحصل عليها ان استخدام الطريقتين لانتخاب الهجن المبشرة الاكثر ثباتا في
برامج التربية يكون اكثر فائدة .

قام بتحكيم البحث

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