Phenotypic Stability of Some Egyptian Cotton Genotypes Grown at Different Environments of Upper Egypt

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Abstract: Five promising cotton (*Gossypium barbadense* L.) advanced lines viz., [G.83 x (G.75x 5844)] x G.80, (G.90 x Australy), [G.83 x (G .75 x 5844)] x G.85, [G.83 x (G .75 x 5844)] x G.90 and [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] with two varieties (Giza 80 and Giza 90) of Egyptian cotton were evaluated for their yield, , yield components and fiber properties performance under five environments for two years which gave ten field experiments.The ten field experiments were conducted during the two successive seasons 2012 and 2013 at five different regions at Upper Egypt (El-Mattana, Sohag, Assiut, Beni–Soueif and El–Fayium) governorates, to study the phenotypic stability for seven Egyptian cotton genotypes. Adaptability estimates indicated that Giza 80 which yielded below average mean yield over environments are poorly adapted to all environments. However, the promising strain [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] which were above average mean yielding ability had general adaptability or well adapted to all environments. The remaining commercial cultivar Giza 90 and the promising strain (G.90 x Australy) were not significantly different from the average mean performance of all genotypes had average stability. The promising strain [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] which was above average mean performance of all genotypes had stable for seed cotton yield (k/f) and lint cotton yield (k/f). While, the promising strains [G.83 x (G .75 x 5844)] x G.80, [G.83 x (G .75 x 5844)] x G.85 and [G.83 x (G .75 x 5844)] x G.90 which were above or below average mean performance of all genotypes had unstable for seed cotton yield (k/f) and lint cotton yield (k/f).

[Ibrahim, M.M.; M.S.H.Ahmad; I.S.M. Hassan; A.A.Abd El-Sameea. **Phenotypic Stability of Some Egyptian Cotton Genotypes Grown at Different Environments of Upper Egypt.** *World Rural Observ* 2014;6(4):93-102]. ISSN: 1944-6543 (Print); ISSN: 1944-6551 (Online). http://www.sciencepub.net/rural. 15

Keywords: Phenotypic Stability, Egyptian Cotton Genotypes, Environments, Upper Egypt

1. Introduction

Cotton (*Gossypium barbadense* L) is one of the most important fiber crops in the world as well as in Egypt. It is greatly influenced by seasonal and other environmental fluctuations as other field crops. Genotype × environment interaction has a major importance for cotton breeders because the phenotypic response to a change in environment is not the same for all genotypes. Breeding for stable varieties has received much attention recently. Several methods have been proposed to characterize the stability of yield performance when several varieties were tested at a number of locations. **Eberhart and Russell (1966)** suggested that the regression of the varietals mean performance on an environmental index and that the deviations from regression may be considered as two parameters for measuring the varietals phenotypic stability. **Tai (1971)** described another statistical approach for estimating stability parameters for each variety. He reported that his method is similar to method of **Eberhart and Russell (1966)** in that both analyses attempt to determine the linear response of variety to the environmental effects. **Liu and Sun (1993)** evaluated 17 statistics recommended for description of cultivar stability, and preferred the use of **Eberhart and Russell (1966)** regression model in yield stability analysis of cultivars. **Kang and Magari (1995)** depending only on **Shukla (1972)** proposed an integrated yield and stability of performance statistical (Ysi) for simultaneous selection for yield stability. In stability analyses, various statistics should be applied to characterize the genotypes for responsiveness to environments as much as possible and to be sure of G X E interactions effects. Check or local cultivars for stability can be used in the further experiments as standards. Way forward for this study is to define the environments in form of location by years combination as opposed only to the studied locations only.

2. Materials and Methods

The materials used in the present investigation were two Egyptian cotton varieties, in addition to five Egyptian promising strains (*G. barbadese L.)* belonging to the Egyptian cotton long staple grown at Upper Egypt (Table 1).

These materials were tested in regional yield trials at five different locations (El–Mattana, Sohag, Assiut, Beni–Soueif and El–Fayium**)** for two years. Data of the yield and its components of the studied genotypes were obtained from the yield miniature experiments conducted by **Regional Evaluation Research Section** of the **Cotton Research Institute**, during the two successive seasons (2012 and 2013).

Table (1). Pedigree of genotypes and year released.

Genotypes	Pedigree	Year released
Giza 80	(G.66 x G.73)	1981
Giza 90	(G.83 x Dandara)	1999
[G.83 x (G.75x 5844)] x G.80	[G.83 x (G.75x 5844)] x G.80	Not released
(G.90 x Australy)	(G.90 x Australy)	Not released
[G.83 x (G .75 x 5844)] x G.85	[G.83 x (G .75 x 5844)] x G.85	Not released
[G.83 x (G .75 x 5844)] x G.90	[G.83 x (G .75 x 5844)] x G.90	Not released
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	Not released

1- Cultural practices:

Ten field experiments were carried out to evaluate and estimate the stability of seven genotypes at five different locations in Middle and Upper Egypt i.e., [El–Mattana (Luxor governorate), Sohag, Assiut, Beni–Soueif and El–Fayium], during the two growing seasons 2012 and 2013. The experimental design was a randomized complete block design with four replications at each location. The sowing dates were from March- 23 to April- 9 for the two seasons. The plot size was 52 m^2 and each plot contained 20 ridges of four meters long and 65 cm wide. Distance between hills was 25 cm apart. The plants were thinned to two seedlings per hill after six weeks. The first irrigation was given three weeks after sowing, and the second was added three weeks later, thereafter the experiments were irrigated every two weeks until the end of the season for a total of nine irrigations. Ten field experiments were carried out to evaluate and estimate the stability of seven genotypes at five different locations in Middle and Upper Egypt i.e., [El–Mattana (Luxor governorate), Sohag, Assiut, Beni – Soueif and El–Fayium], during the two growing seasons 2012 and 2013. The experimental design was a randomized complete block design with four replications at each location. The plot size was 52 m^2 and each plot contained 20 ridges of four meters long and 65 cm wide. Distance between hills was 25 cm apart. The plants were thinned to two seedlings per hill. All cultural practices were applied as usually done in the ordinary cotton fields.

The plot was picked together and was used to estimate seed cotton yield and some lint quality characters, while, picking 50 bolls from each plot, for estimating boll weight, lint percentage and lint index contributing variables, Data were collected for the following characteristics.

Data were collected for the following traits:

- Seed cotton yield (k/f): obtained from the weight of seed cotton yield per plot and converted to kentar per feddan (kentar = 157.5 k.g).
- Lint cotton yield (k/f): calculated as follows: weight of seed cotton yield per feddan × lint percentage (kentar = 50 k.g).

A random sample of 50 bolls was harvested at random from each plot and was used to obtain of means values for:

a- Boll weight in grams: the average weight in grams of 50 bolls.

b- Lint percentage (L.P): ratio of lint weight to seed cotton weight in the sample expressed as percentage.

c- Seed index (S.I): weight of 100 seeds in grams.

d- Lint index: the weight of lint produced by 100 seeds in grams, using the following formula:

- Lint index = Si × LP /(100 - LP)

e) Seed oil percentage: it was determined according to **A.O.C.S (1982)** using Soxhelt apparatus and petroleum ether (60-80C) as a solvent.

Samples of lint cotton from each genotype under each environment were analyzed in the laboratories of the Cotton Technology Research Division at Giza, Cotton Research Institute to determine fiber qualities, under controlled conditions of 65 ± 2% of relative humidity and 70 ± 2F^o temperature. The fiber properties were measured by using High Volume Instrument (HVI) according to **(A.S.T.M. D-4605-1986).**

2- Statistical analysis:

The standard analysis of variance was computed for each experiment, combined analysis for genotypes, locations and seasons were done according to **Senedecor and Cochran (l982).** Differences among means were tested by least significant differences L.S.D **(Steel and Torrie, 1961)**. or Duncan's multiple range tests. The form of the analysis of variance and the expectations of mean square were followed after **Le-Clerg *et al.* (1962)** and **Micntosh (1983).**

The statistical analysis for stability was carried out according to the method described by **Eberhart and Russell (1966)**, to determine the parameters of regression coefficient **(b_i)** and mean square of deviation from regression **(S^2d)** for each genotype were estimated. Pooled error in the regression analysis of variance was used to test whether each deviation mean square was significantly different from zero. Hence, the definition of the stable genotype will be the one with b= 1.0 and $S^2d = 0$.

a) The regression coefficient which is the regression of the performance of each genotype under different environments on the environmental mean over all genotypes, is estimated as follows:

$$b_i = \sum_j y_{ij} I_j / \sum_j I_j^2 \quad \text{(Finaly and Wilkson, 1963)}$$

$$I_j = \left(\sum_i y_{ij} / v\right) - \left(\sum_i \sum_j y_{ij} / vn\right), \quad \sum_j I_j = 0.$$

Where:
b_i = Regression coefficient
y_{ij} = A mean performance of character on i^{th} variety in j^{th} environment j,
I_j = the environmental index,
v = number of varieties,
n = number of environments.

b) The deviations from regression can be summarized to provide an estimate of another stability parameter.

$$S^2 d_i = \left[\sum_j \delta_{ij}^2 / n - 2\right] - S^2 e/r,$$

$$\sum_j \delta_{ij}^2 = \left[\sum_j y_{ij}^2 - \frac{y_{i.}^2}{n}\right] - \left[\sum_j y_{ij} I_j\right]^2 / \sum_j I_j^2 .$$

Where:
S^2d_i = deviations from regression of each variety,
S^2e/r = the estimate of pooled error,
Y_i = total of the i^{th} variety of all environments.

c) The second stability measurement was the coefficient of determination (R^2), a statistic suggested by **Pinthus (1973)** which was computed from the linear regression.

$$r^2 = b_i^2 S_{Ij}^2 / S_i^2 \qquad \text{With} \quad S_{Ij}^2 = \sum I_{Ij}^2 / (m - 1)$$

Where:
r^2 = coefficient of determination,
b_i = regression coefficient,
S^2_i = phenotypic variance,
I_j = environmental index.

d) The third measurement was the ecovalence **(w_i);** the contribution of each variety to the genotype x environment interaction. It was calculated for each variety according to the expression of **Wricke (1962).**

$$\mathbf{W_i = \sum_j (\bar{x}_{ij} - \bar{x}_{.j})^2 - (\bar{x}_{j.} - \bar{\bar{x}}_{..})^2}$$

Where:
$\bar{x}_{ij}$ = a mean performance of character on the i^{th} variety in j^{th} environment;
$\bar{x}_{.j}$ = mean of the j^{th} environment of all varieties.
$\bar{x}_{i.}$ = mean of the i^{th} variety of all environments.
$\bar{\bar{x}}_{..}$ = grand mean.

e) The magnitude of regression coefficient (b_i) values was considered as indicator for adaptation (**Bilbro and Ray, 1976**), such that, if (b_i) was not significantly different from 1.0; the genotype is considered adapted for all environments (A). If (b_i) was significantly larger than 1.0, the genotype was considered better adapted to high yielding environments (H). If (b_i) was significantly smaller than 1.0, the genotype was considered better adapted to lower yielding environments (L).

3. Results and Discussion

The climatic conditions of Egypt differ from location to another and within the province as well. The cotton crop behaves differently under different environmental conditions; therefore, stability in performance is one of the most desirable characteristics of any varieties to be released for commercial cultivation. The genotype × environment interaction detects different patterns of response among the genotypes across environments.

Table (2) presented the combined analysis of variance for stability for all characters. Mean squares were highly significant among genotypes for all characters. This could be due to high environments and (genotypes × environments) interaction for all studied characters, indicating that genotypes considerably varied across different environments. The mean squares of genotype × environment interactions shown in table (2) were highly significant for all characters, indicating the presence of variability among the genotypes as well as environments under which the experiments were conducted, the genotype × environment interaction was further partitioned into linear and non-linear components.

In table (2); environment + (genotype x environment) interaction source of variation was partitioned into environment (linear), genotype x environment (linear) interaction (sum of square due to regression, b_i) and unexplainable deviation from regression (pooled deviation mean square; S^2d). The data in table (2) indicated that the genotype × environment linear was non significant for seed cotton yield (k/f), lint cotton yield (k/f), lint percentage, lint index (%), fiber length (mm), fiber uniformity index (%), fiber strength (g/tex) and fiber elongation (%). The non significant interaction indicated that genotypes did not differ genetically in their response to different environments. These results suggested that the major components for differences in stability parameters were due to deviation from the linear function, therefore, it could be concluded that the relatively unpredictable component more important than the predictable component (linear response). But the mean squares due to genotypes × environment (linear) were significant for boll weight (g), seed oil percentage and micronaire reading, indicating that genotypes differed genetically in their response to different environments when tested by pooled deviation.

Table (2): Mean squares for the studied characters of seven Egyptian cotton genotypes grown at ten environments (five locations and two seasons) at Upper Egypt.

Characters	S.O.V	Genotypes (G)	Environment (Env.)	GxEnv.	Env. + (GxEnv.)	Env. (Linear)	G x Env. (Linear)	Pooled deviation
	d.f	6	9	54	63	1	6	56
Seed cotton yield (k/f)		38.29**	96.44**	5.592**	4.643**	217.0**	2.049	1.128
Lint cotton yield (k/f)		56.98**	120.0**	8.387**	6.086**	270.2**	2.134	1.793
Boll weight (g)		0.199**	3.635**	0.112**	0.154**	8.180**	0.058*	0.021
Lint percentage		9.315**	37.95**	1.392**	2.368**	130.4**	0.486	0.284
Seed index (g)		9.962**	32.38**	1.148**	1.402**	72.85**	0.538*	0.219
Lint index (g)		2.722**	7.186**	0.370**	0.336**	16.16**	0.152	0.073
Seed oil percentage		12.07**	6.63**	1.448**	0.515**	14.92**	0.885**	0.218
Micronaire reading		1.492**	1.287	0.109**	0.069**	2.897**	0.131**	0.012
Fiber length (mm)		12.29**	7.994**	1.292**	0.562**	17.98**	0.468	0.261
Fiber uniformity index (%)		11.81**	11.11**	4.675**	1.398	25.00**	1.101	1.009
Fiber strength (g/tex)		33.16**	4.263	9.477**	2.183	9.591*	2.485	2.018
Fiber elongation (%)		0.197**	0.062	0.189**	0.0426	0.1386	0.0239	0.0430

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

Ideally, a cultivar would be adapted to all environments if (b_i) did not differ significantly from unity, (S^2d) did not differ significantly from zero and had above yielding ability particularly for a given production area **Eberhart and Russel (1966)**.

1- Yield, yield components and seed oil percentage:

It is clear from the results presented in Table (3) for seed cotton yield (k/f), that the commercial cultivar Giza 80 which yielded below average mean yield over environments are poorly adapted to all environments. However, the promising strain [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] which gave above average mean yield are well adapted to all environments. The remaining genotypes (G.90 x Australy) and the commercial cultivar Giza 90, which were not significantly differed from the average mean performance of all genotypes had average stability, but the promising strains [G.83 x (G .75 x 5844)] x G.80, [G.83 x (G .75 x 5844)] x G.85 and [G.83 x (G .75 x 5844)] x G.90 were unstable. Only, the promising strain [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] met the production response and stability. Its mean performance (X= 10.15 k/f) was significant above the average mean of genotypes, or the highest second check genotype b_i = 1.1714 which did not significantly differ from unity and S^2d = 0.6976 which did not significantly differ from zero, beside its (R^2) = 0.8100 which was maximum and minimum W= 10.8645. Therefore, this promising strain may be recommended to be released as commercial stable high yielding and / or incorporated into the breeding stock in any future breeding program aiming for producing stable high seed yielding lines. The results showed that all genotypes were adaptation to all environments, except the promising strain [G.83 x (G .75 x 5844)] x G.80 was high yielding adaptation.

Lint cotton yield (k/f) the results in Table (3) showed that the two promising strains i.e. [G.83 x (G .75 x 5844)]x [G.83 x (G .72 x Dandara)] and [G.83 x (G .75 x 5844)] x G.85 were of above average stable because they had high lint cotton yield. Only, the promising strain [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] met the production response and stability. Its mean performance (X= 12.35 k/f) was significant above the average mean of genotypes, or the highest second check genotype b_i = 1.2033 which did not significantly differ from unity and S^2d = 0.7949 which did not significantly differ from zero, beside its (R^2) = 0.8099 which was maximum and minimum W= 14.7030. Therefore, this promising strain may be recommended to be released as commercial stable high yielding and / or incorporated into the breeding stock in any future breeding program aiming for producing stable high lint yielding lines. The results showed that all genotypes were adaptation to all environments, except the promising strain [G.83 x (G .75 x 5844)] x G.80 was high yielding adaptation.

Boll weight character, Only, the promising strains [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] and [G.83 x (G .75 x 5844)] x G.85 met the production response and stability. Its mean performance (X= 2.90 and 2.89, respectively) were non significant above the average mean of genotypes, or the highest second check genotype b_i = (1.513 and 1.1671, respectively) which did not significantly differ from unity and S^2d = (0.0124 and 0.0105, respectively) which did not significantly differ from zero, beside its (R^2) = (0.8952 and 0.9056, respectively) which were maximum and minimum W= (0.2098 and 0.2029, respectively). The results showed that all genotypes were adaptation to all environments, except the commercial cultivar Giza 80 was low adaptation.

Lint percentage character, the promising strains i.e. (G.90 x Australy) was of above average stable because they had high lint percentage was of above average stable and this genotype was high lint percentage genotype had a regression coefficient not significantly different from unity and not significant deviation sum square from zero.

Seed index (g), the commercial cultivar Giza 80 met the production response and stability. Its mean performance (X= 9.86 g) was significant above the average mean of genotypes, or the highest second check genotype b_i = 0.7557 which did not significantly differ from unity and S^2d = 0.0530 which did not significantly differ from zero, beside its (R^2) = 0.8479 which was maximum and minimum W= 1.6885. The results showed that all genotypes were adaptated to all environments, except the promising strain [G.83 x (G .75 x 5844)] x G.85 was high yielding adaptation.

Only, the promising strain [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] met the production response for lint index (g) and stability. Its mean performance (X= 6.56 g) was significant above the average mean of genotypes, or the highest second check genotype b_i = 1.2398 which did not significantly differ from unity and S^2d = 0.0148 which did not significantly differ from zero, beside its (R^2) = 0.9056 which was maximum and minimum W= 0.4987. The results showed that all genotypes were adaptation to all environments.

Seed oil percentage only, the commercial cultivar Giza 80 met the production response and stability. Its mean performance (X= 21.93 %) was significant above the average mean of genotypes, or the highest second check genotype b_i = 1.0543 which did not significantly differ from unity and S^2d = 0.2339 which did not significantly differ from zero, beside its (R^2) = 0.4446 which was maximum and minimum W= 3.2503. The results showed the most genotypes were adaptation to all environments, but the promising strain (G.90 x Australy) was high adaptation to all environments and the promising strain [G.83 x (G .75 x 5844)] x G.90 was low adaptation to all environments.

These results for yield, yield components and seed oil percentage are in agreement with those reported by **Bilbro and Ray (1976), El- Marakby *et al.* (1986), Abo El-Zahab *et al.* (2003), Hassan (2006), Rahouma *et al.* (2008), Shaker (2009) and Hassan *et al.* (2012 a)**.

2- Fiber properties:

It is clear from the results presented in Table (4) that the commercial cultivar Giza 90 met the production response for micronaire reading and stability Table (4). Its mean performance (X= 4.41) was significant below the average mean of genotypes, or the highest second check genotype b_i = 0.4830 which did not significantly differ from unity and S^2d = 0.0012 which did not significantly differ from zero, beside its (R^2) = 0.6880 which was maximum and minimum W= 0.1548. The results showed that all genotypes were adaptation to all environments,

Table (3): Averages of genotypes and estimates of stability parameters for yield, yield components and seed oil percentage over ten environments at Upper Egypt.

Genotype	Mean (x^-)	Regression coefficient (b_i)	Deviation from regression (S^2d)	Coefficient of determination (R^2)	Ecovalence W	Adaptation #
Seed cotton yield (K/F)						
Giza 80	7.36	0.7114	0.1100	0.7483	7.8352	A
Giza 90	8.78	0.8700	0.1768	0.8015	6.3204	A
[G.83 x (G .75 x 5844)] x G.80	9.41	1.2411++	-0.3492	0.9675	3.3993	H
(G.90 x Australy)	9.03	0.9529	0.4054	0.7865	7.7019	A
[G.83 x (G .75 x 5844)] x G.85	10.00	1.3470	2.1997**	0.7189	25.6775	A
[G.83 x (G .75 x 5844)] x G.90	8.29	0.7062	0.8124*	0.5866	13.5774	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	10.15	1.1714	0.6976	0.8100	10.8645	A
Mean ($x^=$)	9.00					
LSD: 0.05	1.05					
lint cotton yield (k/f)						
Giza 80	9.05	0.7455	0.3696	0.6883	12.2527	A
Giza 90	10.56	0.8809	0.2159	0.7792	9.0382	A
[G.83 x (G .75 x 5844)] x G.80	11.55	1.2306+	-0.4744	0.9517	4.9978	H
(G.90 x Australy)	11.28	0.9566	0.6863	0.7425	12.3384	A
[G.83 x (G .75 x 5844)] x G.85	12.22	1.2710	3.7171**	0.6308	39.3173	A
[G.83 x (G .75 x 5844)] x G.90	10.08	0.7121	1.3280*	0.5296	20.6354	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	12.35	1.2033	0.7949	0.8099	14.7030	A
Mean ($x^=$)	11.01					
LSD: 0.05	1.89					
boll weight (g)						
Giza 80	2.85	0.5543++	-0.0010	0.8294	0.3137	L
Giza 90	2.83	1.0443	0.0123	0.8758	0.1881	A
[G.83 x (G .75 x 5844)] x G.80	2.82	1.1124	0.0156*	0.8750	0.2197	A
(G.90 x Australy)	2.75	0.8605	0.0172*	0.7975	0.2401	A
[G.83 x (G .75 x 5844)] x G.85	2.89	1.1671	0.0105	0.9056	0.2029	A
[G.83 x (G .75 x 5844)] x G.90	2.71	1.1101	0.0078	0.9091	0.1656	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	2.90	1.1513	0.0124	0.8952	0.2098	A
Mean ($x^=$)	2.82					
LSD: 0.05	0.20					
lint percentage						
Giza 80	39.12	1.2347+	0.0588	0.9443	2.6944	H
Giza 90	38.32	0.9733	0.1182	0.8914	2.1760	A
[G.83 x (G .75 x 5844)] x G.80	39.17	1.0766	0.1309	0.9056	2.3515	A
(G.90 x Australy)	39.86	1.0730	-0.0742	0.9723	0.7095	A
[G.83 x (G .75 x 5844)] x G.85	39.04	0.9668	0.0615	0.9112	1.7024	A
[G.83 x (G .75 x 5844)] x G.90	38.67	0.9717	0.0478	0.9172	1.6003	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	38.78	0.7040	0.5878**	0.6098	7.5083	A
Mean ($x^=$)	38.99					
LSD: 0.05	0.75					

Table (3): Cont.

Genotype	Mean ($\bar{x}$)	Regression coefficient (b_i)	Deviation from regression (S^2d)	Coefficient of determination (R^2)	Ecovalence W	Adaptation #
seed index (g)						
Giza 80	9.86	0.7557	0.0530	0.8479	1.6885	A
Giza 90	9.81	0.9346	0.2376**	0.7814	2.6001	A
[G.83 x (G .75 x 5844)] x G.80	9.60	1.2352	0.1543*	0.8943	2.4479	A
(G.90 x Australy)	8.73	0.7174	0.0425	0.8451	1.8142	A
[G.83 x (G .75 x 5844)] x G.85	9.78	1.3319+	0.1135*	0.9226	2.6969	H
[G.83 x (G .75 x 5844)] x G.90	9.40	1.0238	0.1913**	0.8339	2.1699	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	10.36	1.0014	0.1791**	0.8341	2.0709	A
Mean ($\bar{x}$)	9.65					
LSD: 0.05	0.20					
lint index (g)						
Giza 80	6.33	0.8304	0.1005**	0.6013	1.1273	A
Giza 90	6.07	0.7869	0.0453*	0.6993	0.7263	A
[G.83 x (G .75 x 5844)] x G.80	6.14	1.1887	0.0149	0.8979	0.4590	A
(G.90 x Australy)	5.77	0.6238	0.0132	0.7153	0.6799	A
[G.83 x (G .75 x 5844)] x G.85	6.22	1.2915	0.0425*	0.8668	0.7931	A
[G.83 x (G .75 x 5844)] x G.90	5.91	1.0389	0.0581*	0.7766	0.7228	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	6.56	1.2398	0.0148	0.9056	0.4987	A
Mean ($\bar{x}$)	6.14					
LSD: 0.05	0.38					
seed oil percentage						
Giza 80	21.93	1.0543	0.2339	0.4446	3.2503	A
Giza 90	20.20	0.1035	0.1999	0.0084	4.7018	A
[G.83 x (G .75 x 5844)] x G.80	20.57	1.2705	0.0640	0.6826	2.0361	A
(G.90 x Australy)	20.69	1.8637+	0.1231	0.7813	3.9595	H
[G.83 x (G .75 x 5844)] x G.85	20.64	1.2475	0.0118	0.7372	1.6108	A
[G.83 x (G .75 x 5844)] x G.90	20.60	0.1549++	-0.0630	0.0805	2.3876	L
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	20.56	1.3046	0.0068	0.7605	1.6361	A
Mean ($\bar{x}$)	20.74					
LSD: 0.05	0.66					

+, ++ indicates regression coefficient is significantly different from unity at 5% and 1% levels of probability, respectively.
***, ** indicates deviation from regression is significantly different from zero at 5% and 1% levels of probability, respectively.**
#, A, H, L indicates adaptation to all, high yielding and low yielding environments, respectively.

but the promising strain [G.83 x (G .75 x 5844)] x G.90 was high adaptation to all environments.

Fiber length (mm), the commercial cultivar Giza 80 met the production response and stability. Its mean performance (X= 31.72) was significant above the average mean of genotypes, or the highest second check genotype b_i = 0.4532 which did not significantly differ from unity and S^2d = 0.0569 which did not significantly differ from zero, beside its (R^2) = 0.3309 which was maximum and minimum W= 1.8420. The results showed that all genotypes were adaptation to all environments, except the promising strain [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)] was high adaptation to all environments.It is clear from the results presented in Table (4) that the promising strain [G.83 x (G .75 x 5844)] x G.90 which below average mean fiber uniformity index (%) over environments are poorly adapted to all environments and significantly differed from the average mean performance of all genotypes. But all genotypes, except Giza 80 were unstable. The commercial cultivar Giza 80 met the production response and stability. Its mean performance (X= 85.23) was significant above the average mean of genotypes, or the highest second check genotype b_i = 1.7200 which did not significantly differ from unity and S^2d = 0.6037 which did not significantly differ from zero, beside its (R^2) = 0.6562 which was maximum and minimum W= 7.4115. The results showed that all genotypes were adaptation to all environments.

Table (4): Averages of genotypes and estimates of stability parameters for fiber properties over ten environments at Upper Egypt.

Genotype	Mean ($\bar{x}$)	Regression coefficient (b_i)	Deviation from regression (S^2d)	Coefficient of determination (R^2)	Ecovalence W	Adaptation #
micronaire reading						
Giza 80	4.81	0.6072	0.0142**	0.5081	0.2142	A
Giza 90	4.41	0.4830	0.0012	0.6880	0.1548	A
[G.83 x (G .75 x 5844)] x G.80	4.66	0.6964	0.0085*	0.6633	0.1400	A
(G.90 x Australy)	4.66	1.0541	0.0049	0.8632	0.0756	A
[G.83 x (G .75 x 5844)] x G.85	4.54	1.2108	0.0180**	0.7729	0.1965	A
[G.83 x (G .75 x 5844)] x G.90	4.34	2.1405++	0.0097**	0.9445	0.6431	H
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	4.86	0.8078	0.0002	0.8847	0.0496	A
Mean ($\bar{\bar{x}}$)	4.65					
LSD: 0.05	0.16					
fiber length (mm)						
Giza 80	31.72	0.4532	0.0569	0.3309	1.8420	A
Giza 90	30.34	0.8223	0.3815**	0.3217	3.7323	A
[G.83 x (G .75 x 5844)] x G.80	30.88	1.0388	0.2023**	0.5542	2.2407	A
(G.90 x Australy)	30.44	1.2138	0.0826	0.7484	1.3894	A
[G.83 x (G .75 x 5844)] x G.85	31.52	1.6506	0.5779**	0.5721	6.2927	A
[G.83 x (G .75 x 5844)] x G.90	31.58	0.5368	0.0336	0.4567	1.4310	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	30.98	1.2830++	-0.0403	0.9360	0.4922	H
Mean ($\bar{\bar{x}}$)	31.06					
LSD: 0.05	0.62					
fiber uniformity index (%)						
Giza 80	85.23	1.7200	0.6037	0.6562	7.4115	A
Giza 90	84.66	0.5725	0.7752**	0.1449	7.5618	A
[G.83 x (G .75 x 5844)] x G.80	84.78	1.7986	1.3378**	0.5031	13.6559	A
(G.90 x Australy)	85.08	0.6139	0.7191**	0.1724	6.9671	A
[G.83 x (G .75 x 5844)] x G.85	84.30	0.3833	1.3491**	0.0436	12.8667	A
[G.83 x (G .75 x 5844)] x G.90	83.60	0.9287	0.3920**	0.4450	3.8524	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	84.45	0.9703	1.2659**	0.2369	10.7688	A
Mean ($\bar{\bar{x}}$)	84.59					
LSD: 0.05	0.60					
fiber strength (g\tex)						
Giza 80	37.13	1.0334	3.0809**	0.0519	26.7025	A
Giza 90	35.98	-1.128++	0.7576**	0.1763	14.3616	L
[G.83 x (G .75 x 5844)] x G.80	37.48	0.2032	2.1376**	0.0029	20.0920	A
(G.90 x Australy)	35.97	0.5565	0.3805*	0.0764	5.4022	A
[G.83 x (G .75 x 5844)] x G.85	36.48	0.2348	0.9137	0.4214	11.4946	A
[G.83 x (G .75 x 5844)] x G.90	34.70	2.9974	2.6157**	0.3485	28.5005	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	35.93	1.1006	2.4133**	0.0719	21.3905	A
Mean ($\bar{\bar{x}}$)	36.24					
LSD: 0.05	1.01					
fiber elongation (%)						
Giza 80	8.00	2.1222	0.0085	0.4190	0.1517	A
Giza 90	8.04	0.8877	0.0916**	0.0194	0.7856	A
[G.83 x (G .75 x 5844)] x G.80	7.86	-0.5118	0.0211**	0.0226	0.2705	A
(G.90 x Australy)	8.03	1.1427	0.0306**	0.0793	0.2998	A
[G.83 x (G .75 x 5844)] x G.85	7.90	-0.2748	0.0493**	0.0033	0.4878	A
[G.83 x (G .75 x 5844)] x G.90	7.92	1.2463	0.0407**	0.0746	0.3794	A
[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]	8.00	2.3944	0.0099	0.4560	0.1759	A
Mean ($\bar{\bar{x}}$)	7.96					
LSD: 0.05	0.29					

+, ++ indicates regression coefficient is significantly different from unity at 5% and 1% levels of probability, respectively.
***, ** indicates deviation from regression is significantly different from zero at 5% and 1% levels of probability, respectively.**
#, A, H, L indicates adaptation to all, high yielding and low yielding environments, respectively.

Fiber strength (g/tex), the promising strain [G.83 x (G .75 x 5844)] x G.85 met the production response and stability. Its mean performance (X= 36.48) was non significant above the average mean of genotypes, or the highest second check genotype b_i = 0.2348 which did not significantly differ from unity and S^2d = 0.9137 which did not significantly differ from zero, beside its (R^2) = 0.4214 which was maximum and minimum W= 11.4946. The results showed that all genotypes were adaptation to all environments except, the commercial cultivar Giza 90 was low yielding adaptation to all environments.

Fiber elongation(%), the genotypes Giza 80 and [G.83x(G.75 x 5844)] x [G.83 x (G .72 x Dandara)] met the production response and stability. Its mean performance (X= 8.00 for the two genotypes) were non significant above the average mean of genotypes, or the highest second check genotype b_i = 2.1222 and 2.3944, respectively which did not significantly differ from unity and S^2d = 0.0085 and 0.0099, respectively which did not significantly differ from zero, beside its (R^2) = 0.4190 and 0.4560, respectively which were maximum and minimum W= 0.1517 and 0.1759, respectively. The results showed that all genotypes were adaptation to all environments.

These results for fiber properties are in agreement with those reported by **Badr (2003), El-Oraby (2003), Mohamed *et al.* (2005), Hassan *et al.* (2006), El-Adly *et al.* (2008), Shaker (2009) and Hassan *et al*. (2012 a).**

Conclusion

The previous results of stability parameters on this study no there are any genotype stable for all traits or for most characters. Therefore, the present study for yield, yield components, seed oil percentage and fiber properties characters indicated that for selection for stability with the objective of incorporating these important traits in the Egyptian cotton genotypes, the following genotypes may be considered as breeding stocks for specific characters:

Seed cotton yield (k/f)	[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]
Lint cotton yield (k/f)	[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]
Boll weight (g)	[G.83 x (G .75 x 5844)] x G.85 and [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]
Lint percentage	(G.90 x Australy)
Seed index (g)	Giza 80
Lint index (g)	[G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]
Seed oil percentage	Giza 80
Fiber uniformity index (%)	Giza 80
Micronaire reading	Giza 90
Fiber length (mm)	Giza 80
Fiber elongation (%)	Giza 80 and [G.83 x (G .75 x 5844)] x [G.83 x (G .72 x Dandara)]
Fiber strength (g/tex)	[G.83 x (G .75 x 5844)] x G.85

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12/20/2014