GENOTYPIC STABILITY FOR THE NEW EGYPTIAN COTTON VARIETIES GIZA 85, GIZA 86, GIZA 89, GIZA 87 AND GIZA 88

S.S. M. BADR

Cotton Research Institute, Agricultural Research Centre, Giza, Egypt.

(Manuscript received 5 January, 1998)

Abstract

The present investigation aimed to determine genotypic stability for some Egyptian cotton varieties under different environments. Five regional trials were carried out with Egyptian cotton varieties in 1995 and 1996 seasons. Each single trial was grown in a randomized complete block design with four replications. All characters showed highly significant mean squares for varieties, environments and variety x environment interaction.

Average genotypic stability degrees were recorded for seed and lint cotton yield for Giza 86, Giza 87, Giza 88; boll weight for Giza 85 and Giza 87; seed index for Giza 85, Giza 86 and Giza 89; micronaire reading for Giza 88; yarn strength for Giza 86, while all varieties under study were unstable for 2.5% and 50% span length.

INTRODUCTION

Cotton as well as many field crops, is greatly influenced by seasonal and environmental fluctuations. In order to obtain consistently better yield and good quality, plant breeders prefer to produce varieties that have a wide adaptation. In this respect, El-Kadi *et al.* (1978) evaluated 13 Egyptian cotton cultivars and lines which showed different degrees of genotypic stability. El-Marakby *et al.* (1986) found that all studied characters showed highly significant mean squares for environments, varieties and genotype by environment interaction. Genotypic stability analysis showed that the most stable Egyptian varieties over the six environments were Giza 69, Giza 67 and Giza 80. These varieties were the highest yielders among all other Egyptian varieties and exhibited the highest number of stable characters among which the seed cotton yield was the most important.

Abd El-Rahman and El-Mazar (1987) found that the most stable varieties over eight environments were Giza 76, Giza 45, Giza 70, Giza 77 and Giza 69. These varieties exhibited the highest number of stable characters. Awaad (1989) and Abou-Zahra *et al.* (1989) showed that the relatively unpredictable component of variance for the genotype-environment interaction may be more important than the relative predictable component. Estimates of genotypic stability revealed varying degrees of stability for the different genotypes.

Awaad *et al.* (1994) reported information on genotype environment interaction derived from data on 6 yield components in 28 genotypes grown at seven locations in Middle and Upper Egypt in 1992. The best three genotypes were F5-148/90, F5-160/90 and F6-197/90 which were stable for all traits recorded. The new cultivar Giza 83 was the highest yielding and most stable commercial cultivar.

El-Shistawy *et al.* (1994)found average genotypic stability degrees for boll weight, lint index and lint/boll for Giza 69, boll weight for the promising hybrid Giza 75 x (44 x C.B. 58) and lint percentage for the hybrid Giza 67 x C.B. 58.

Seyam *et al.* (1994) recorded average genotypic stability degrees for seed index and micronaire reading for Giza 76, Giza 80, Giza 81 and Giza 83, lint percentage for Giza 83 and lint index for Giza 81 while most varieties were unstable for seed cotton yield, lint yield per plant, boll weight, lint percentage, lint index and fiber strength traits.

Abo-tour *et al.* (1996), based on data all over environmental means of Giza 85 cultivar, stated that the high yielding genetic potential and the recorded wide adaptability supported the evidence that this cultivar may be recommended to be included in any breading program for improving lint yield and lint percentage.

The present study aims to determine the genotypic stability for some agronomic and fiber characteristics for the new Egyptian cotton varieties Giza 85, Giza 86, Giza 89, Giza 87 and Giza 88.

MATERIALS AND METHODS

Five Egyptian cotton varieties namely Giza 85, Giza 86, Giza 89, Giza 87 and Giza 88 were planted at five locations i.e., Kafr El-Sheikh, El-Behairah (Damanhur), El-Gharbia (Tanta), El-Dakhlia (Meat Ghamr) and El-Sharkia, in two successive seasons (1995 and 1996). A randomized complete block design with four replications was used at each location. Plot size consisted of five rows four meter long, and 60 cm apart. Distance between hills was 20cm and each hill was thinned to two plants. Cultural practices were carried out as recommended. The characters studied were seed cotton yield per plot, lint yield per plot, boll weight, lint percentage, seed index, fiber length, micronaire reading and fiber strength.

Statistical analysis:

The genotypic stability analysis was done according to the method described by Tai (1971). A combined analysis of variance was carried out for each character with fixed variety effects and random replicate and environmetal effects.

Stability parameters αi and λi were estimated for each variety separately by using the following equations:

$$\alpha i = \frac{S1\ (gL)i}{(MSL - MSB)\ /\ Vr}$$

$$\lambda i = \frac{S^2\ (gL)i - \alpha i\ S\ (gl)i}{(V-1)\ MSE/\ Vr}$$

where

αi = The linear response of the ith variety to the environmental effect.

λi = The deviation from the linear response of the ith variety to the environmental effect.

S1 (gl) i = The sample covariance between the environment and interaction effects,

S^2 (gl) i = The sample variance at the interaction effect of the ith variety to the nth environment.

i = The environmental effects.

(Gl) i = The interaction effect of the ith variety.

MSL = Mean square of environments.

MSB = Mean square for replicates within environments.

MSE = The mean square for error.

r = Number of replicates.

v = Number of genotypes.

A perfectly stable cultivar will not change its performance from one environment to another. This is equivalent to stating that alpha i = -1 and lambda i = 1. Perfectly stable cultivars probably do not exist and plant breeders will have to be satisfied with obtainable levels of stability, i.e. average stability (alpha i = 0 and lambda i = 1). Denoting the tabulated value of the probability level a (a = 1-p) with (n-2) degrees of freedom, as ta the prediction limits for alpha i corresponded to alpha i = 0 can be shown to be

$$\pm t^2a = \left[\frac{\lambda\ O\,(V-1)\ MSE.\ MSL}{(MSL - MSB)\ \{n-2)\ MSL - (t^2a + n-2)\ MSB]}\right]^{1/2}$$

Lambda 0 = 1 the confidence interval at the probability level P is Fa $(n_2, n_1) \leq$,$\leq$ Fa (n_1, n_2).

where

Fa (n2, n1) = 1/Fa (n1, n2)

n1 = n-2 degrees of freedom

n2 = n (v-1) (r-1) degrees of freedom

a = 1-P

and P = 0.90

RESULTS AND DISCUSSION

The results of the combined analysis of variance for all characters are shown in Table (1). The environment, variety and variety x environment interaction mean squares were highly significant for all studied characters.

These results indicate that : (a) As an average over all tested environments, all characters showed significant difference among varieties, and (b) for all characters, the varieties responded differently at the different environments.

For all characters, variety means in addition to the estimates of the parameters αi and λi for each variety are presented in Table (2). It is clearly shown that: (a). The relative ranking of varieties according to their mean performance over the environments were not the same for all characters; and (b) the estimated αi statistics ranged from -1 and +1 for all characters.

The distribution of αi λi and values are shown in Figs.1-9.

For seed cotton yield, lint cotton yield, boll weight, lint percentage, seed index, 2.5 span length, 50% span length, micronaire reading and yarn strength, respectively. From the distribution of αi and λi statistics, it could be seen that (a) mostly, the estimated αi statistics for different varieties, do not differ significantly from $\alpha = 0$, and b. the varieties varied greatly in the estimated λi statistics. There-

Table 1. Analysis of variance for stability of some characters for cotton cultivars under different environments.

Source of variance	Seed cotton yield/plot	Lint yield per plot	Boll weight (g)	Lint percentage %	Seed index g	2.5% span length (mm)	50% span length (mm)	Micronaire reading	Yarn strength
Environment (E)	38.5193**	5.6376**	1.2508**	15.0357**	17.6899**	3.5878**	1.1175*	3.2638**	374353.2**
Rep. within Env.	0.7742**	0.1188**	0.0201	1.0731	0.3754	0.0816	0.0282	0.0289	9420.875
Genotypes (G)	5.3967**	1.915**	0.5754**	258.7997*	12.2733**	195.7583**	52.0139**	4.8413**	2456322**
E x G	0.6379**	0.1164**	0.0621**	2.1929**	0.7559**	0.6689**	0.3308**	0.1719**	46491.52**
Pooled erro	0.356	0.0495	0.0267	0.5836	0.3112	0.09	0.0325	0.0157	7154.481

* and ** Significant at 5% and 1% for pooled error, respectively.

Table 2. Variety means over environments and estimates of stability parameters (αi and λi).

Traits		Giza 85	Giza 86	Giza 89	Giza 87	Giza 88
Seed cotton yield (kg/p)	x	3.81	4.11	3.75	3.14	3.94
	αi	0.0335	0.1736	0.0109	-0.2023	-0.0157
	λi	1.2068	10.1038	2.8997	1.0716	0.7552
Lint yield (kg/p)	x	1.48	1.60	1.40	1.03	1.49
	αi	0.0395	0.2349	0.008	-0.2897	0.0073
	λi	1.0487	1.2363	3.6195	0.8716	1.0528
Boll weight (g)	x	2.90	3.03	2.82	2.71	2.94
	αi	0.192	0.0707	0.2591	-0.3267	-0.1951
	λi	1.4547	2.398	1.6937	0.8094	2.3313
Lint percentage	x	38.85	38.69	37.49	32.66	37.78
	αi	-0.3308	0.4834	0.3041	0.0364	-0.4931
	λi	2.1325	0.8905	4.2201	2.7121	4.7651
Seed index	x	10.13	10.75	9.42	9.74	10.57
	αi	0.2665	0.1344	0.0595	-0.2538	-0.2066
	λi	1.6609	1.33048	1.5819	2.7054	2.1148
2.5% span length	x	30.16	31.84	31.46	35.11	34.94
	αi	-0.0941	0.4039	0.0122	0.0993	-0.4213
	λi	3.4162	7.8929	11.1161	8.3364	2.8442
50% span length	x	15.10	15.76	15.65	17.51	17.55
	αi	-0.0902	-0.1237	-0.0641	0.6377	-0.3597
	λi	4.4245	11.6494	8.8637	6.0903	4.1353
Micronaire reading	x	3.61	3.87	3.91	3.06	3.77
	αi	0.1926	0.069	0.1503	-0.3836	-0.0282
	λi	11.6538	7.7646	5.8414	7.4108	1.0128
Yarn strength	x	2370	2460	2305	2850	2785
	αi	0.2188	0.0466	-0.2391	0.4647	-0.4910
	λi	4.8272	1.2731	5.2808	6.6205	7.2950

Plot area = 12 m^2.

fore, it could be concluded that relatively unpredictable component (the deviation from the linear response, λi) of the genotype x environment interaction variance may be more important than the relatively predictable component (the linear response, αi).

The varieties showed different degrees of genotypic stability for the different characters as follows:

1. Giza 85 showed average degrees of stability for seed and lint cotton yield/plot, boll weight and seed index. It was unstable for the other characters.

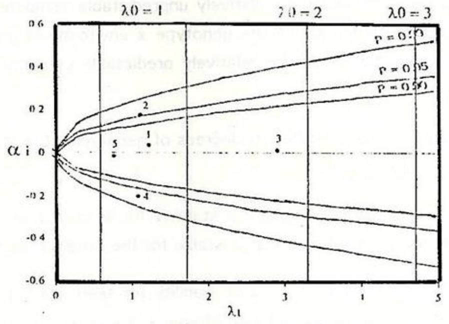
2. Giza 86 showed average degrees of stability for seed and lint cotton yield/plot, lint percentage, seed index and yarn strength, it was unstable for the other characters.

3. Giza 89 showed average degrees of stability for seed index, it was unstable for the other characters.

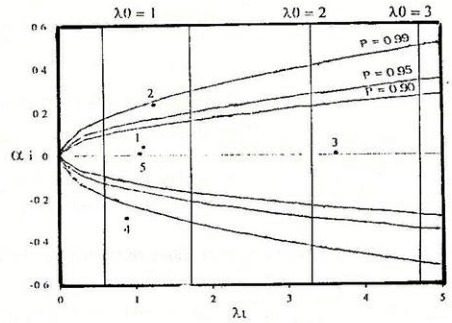
4. Giza 87 showed average degrees of stability for seed, lint cotton yield/plot and boll weight, it was unstable for other characters.

5. Giza 88 showed average degree of stability for seed lint, cotton yield/plot and micronaire reading. It was unstable for the other characters.

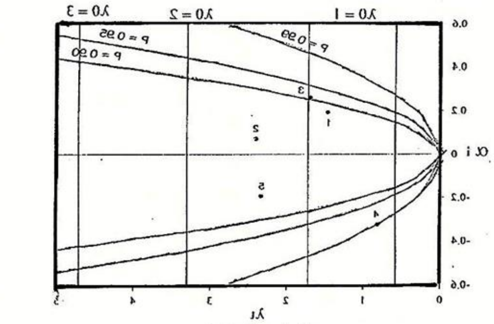
These results are in agreement with those obtained by El-Kady *et al.* (1978), El-Marakby *et al.* (1986), Abdel-Rahman and El-Mazar (1987), Abou-Zahra *et al.* (1989), Awaad (1989), El-Shishtawy *et al.* (1994) and Seyam *et al.* (1994). They found that cotton varieties showed different degrees of genotypic stability for agronomic and fiber characteristics.



a. Seed cotton yield



b. Lint cotton yield

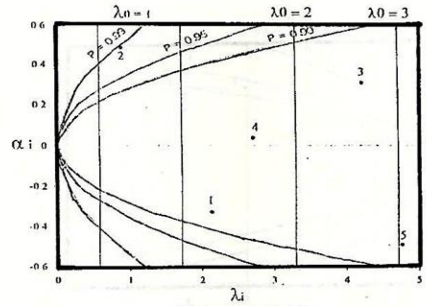


C. Boll weight

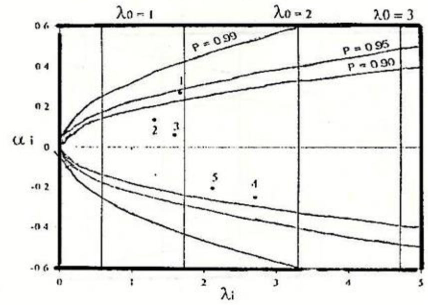
Fig.1. Distribution of estimated stability, where:

1. Giza 85, 2. Giza 86, 3. Giza 89,

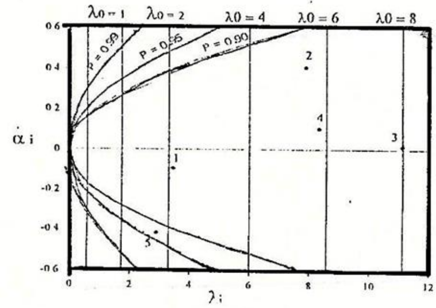
4. Giza 87, and 5. Giza 88



a. Lint percentage



b. Seed index

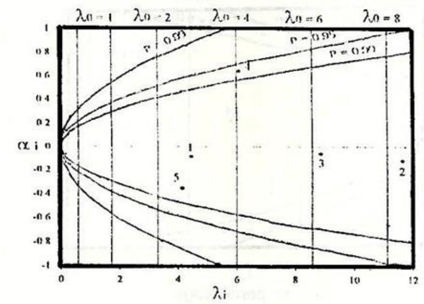


C. 2.5% Span length

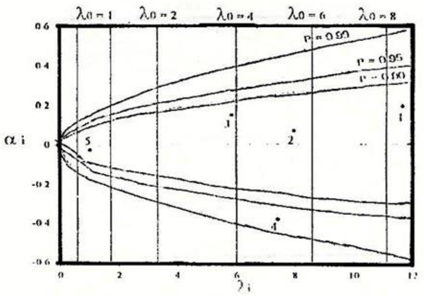
Fig.2. Distribution of estimated genotypic stability, where:

1. Giza 85, 2. Giza 86, 3. Giza 89,

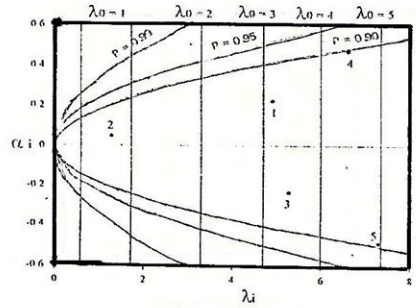
4. Giza 87, and 5. Giza 88



a. 50% span length



b. Micronaire reading



C. Yarn strength

Fig.3. Distribution of estimated genotypic stability where:

1. Giza 85, 2. Giza 86, 3. Giza 89,

4. Giza 87, and 5. Giza 88

REFERENCES

1 . Abdel-Rahman, I.M.A. and M.F. El-Mazar. 1987. Evaluation of genotypic stability for a set of Egyptian cotton varieties in regional traits. 12th Intr. Congr. Statis., Computer Sci. Soc. and Demo. Res., Ain Shams Univ., Egypt, pp. 131-148.

2 . Abou-Tour, H.B., A.E. Ayoub, and S.S. Badr. 1996. Stability parameters for lint yield and some of its components of a set of Egyptian cotton cultivars. J. Agric. Sci., Mansoura Univ., 21 (6): 2023-2031.

3 . Abou-Zahra, S.I.S., M.M. Awad, and S.A. El-Shaaray. 1989. Analysis of genotypic stability in some Egyptian cotton genotypes under different locations. Agric. Res. Rev., 67 (5): 679-686.

4 . Awaad, M.M. 1989. Breeding behaviour of some characters in an Egyptian cotton hybrid. Ph.D. Thesis, Zagazig Univ., Egypt.

5 . Awaad, M.M.M., F.S. Mustafa, and F.A. Al-Enani. 1994. Evaluation of some long staple cotton genotypes for genotypic stability through a breeding program. Annals of Agricultural Science, Moshtohor, 1994m 32, 4: 1727-1740.

6 . El-Kadi, D.A., A.A. Abo-El-Zahab and S.A. El-Shaarawy. 1978. Genotypic stability parameters for comparing Egyptian cotton cultivars. Fac. Agric. Ain Shams Univ., Egypt. Res. Bull. 873.

7 . El-Marakby, A.M., A.M. Abou-Alam, and S.H.M. El-Hariry. 1986. Genotypic stability analysis for some G.barbadense and G.hirsutum genotypes of cotton. Ann. Agric. Sci., Moshtohor 24, 3: 1347-1367.

8. El-Shishtawy, M.M., I.A.I. Helal, A.R. Abo Arab, and A.E. Ayoub. 1994. Studies on stability parameters in some Egyptian cotton varieties. J. Agric. Mansoura Univ., 19 (1) : 193-199.

9. Seyam, S.M., I.M.A. Abdel-Rahman, H.B. Abou-Tour, and S.S. Badr. 1994. Genotypic stability for some Egyptian cotton cultivars under different environments. Egypt. J. Apppl. Sci, 9 (9): 135-146.

10. Tai, G.C.C. 1971. genotypic stability analysis and its application to potato regional trails. Crop Sci., 11 : 184-189.

الثبات الوراثى للأصناف الحديثة من القطن المصرى (جيزة ٨٥ ، جيزة ٨٦، جيزة ٨٩، جيزة ٨٧ وجيزة ٨٨)

سامى سعد محمد بدر

معهد بحوث القطن ، مركز البحوث الزراعية ، الجيزه .

أجرى هذا البحث لدراسة الثبات الوراثى فى أصناف القطن المصرى الحديثة وهى ثلاثة أصناف من طبقة طويل التيلة (جيزة ٨٥ ، جيزة ٨٦ وجيزة ٨٩) وصنفان من طبقة فائق الطول (جيزة ٨٧ وجيزة ٨٨)، وتناول هذا البحث دراسة سلوك هذه الأصناف وتقدير درجة الثبات الوراثى لها فى بعض محافظات الوجه البحرى من جمهورية مصر العربية (كفر الشيخ – البحيرة – الغربية – الدقلهية – الشرقية) خلال موسمى الزراعة ١٩٩٥ و ١٩٩٦ مع إستخدام تصميم القطاعات الكاملة العشوائية فى أربعة مكررات لكل بيئة من هذه البيئات، وكانت الصفات المدروسة هى محصول القطن الزهر – محصول القطن الشعر – وزن اللوزة – معدل الحليج – معامل البذرة – طول التيلة عند نسبة توزيع (٢,٥ ٪ و ٥٠٪) قراءة الميكرونير – متانة الشلة.

ويمكن تلخيص النتائج المتحصل عليها فيما يلى :

كانت الفروق بين الأصناف (كمتوسطات لكل البيئات المدروسة) عالية المعنوية لكل الصفات سالفة الذكر. وكذلك كان تأثير البيئات على كل الصفات المدروسة عالى المعنوية. كما أوضحت النتائج أن كل الصفات أظهرت إختلافاً عالى المعنوية فى إستجابة الأصناف للبيئات المختلفة. أى أن تأثير كل من الصنف والبيئة وتفاعل الصنف مع البيئة كان عالى المعنوية على الصفات المدروسة.

أوضحت النتائج أن الصنف جيزة ٨٥ كان متوسط فى الثبات الوراثى لصفات محصول القطن الزهر والشعر ووزن اللوزة ووزن ١٠٠ بذرة. أما الصنف جيزة ٨٦ فقد كان متوسط الثبات الوراثى لصفات محصول القطن الزهر والشعر ومعدل الحليج ومعامل البذرة ومتانة الشلة. الصنف جيزة ٨٩ كان متوسط فى الثبات الوراثى لصفة معامل البذرة فقط أما الصنف جيزة ٨٧ فكان متوسط فى الثبات الوراثى لصفات محصول القطن الزهر والشعر ومعدل الحليج. الصنف جيزة ٨٨ كان متوسط فى الثبات الوراثى بالنسبة لصفات محصول القطن الزهر والشعر وقراءة الميكرونير.