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STABILITY PARAMETERS FOR COMPARING SOME AGRONOMIC EGYPTIAN COTTON GENOTYPES

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ABSTRACT

The present work aims to determine the phenotypic and genotypic stability of some Egyption cotton genotypes using three methods of stability. For this purpose, five commercial cultivars and one promising strain were used. The results of combined analysis showed highly significant mean square due to environments and genotypes X environments interaction for all studied traits.

Average phenotypic stability degrees were recorded for G.83 and the new cultivar G.91 for seed cotton yield (k/f), lint yield (k/f), earliness % and number of opening bolls per plant, G.80 for lint percentage and seed index, G.90 for boll weight and lint percentage; G.85 for seed index only and the promising strain (G.89 - Pima S6) for earliness %.

Average genotypic stability degrees were recorded by (G.89 - Pima S6) for all studied traits except, lint percentage; G.83 for seed index, seed cotton yield (k/f) and earliness %; while G.90 showed genotypic stability for boll weight and lint percentage.

Yield–stability statistic (Ysi) identified G.83 and G.90 as stable genotypes for most characters.

It was concluded that the promising strain (G.89 - Pima S6) and the commercial cultivar G.83 recorded phenotypic and genotypic stability by use of the three methods of stability for earliness %; while G.83 recorded phenotypic and genotypic stability using the three methods of stability for seed cotton yield and lint yield (k/f). Therefore, genotype (G.89 -Pima S6) and G.83 may be recommended to be released as commercial stable high yielding cultivars and/ or be incorporated as breeding stock in any future breeding program aiming for producing stable high yielding lines for yield and earliness.

Key words: *Cotton, Genotypes by environment interaction, Stability parameters.*

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 fluctuation 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 varietal mean performance on an environmental index and that the deviations from regression may be considered as two parameters for measuring the varietal 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. While Tai method differs from that of Eberhart and Russell (1966) in that estimation of the stability parameters, it involves an extension of the conventional mathematical model used for analysis of variance and it estimates the genotypic potential of a genotype for stabilizing its performance over varying environments.

Studies on stability parameters for comparing Egyptian cotton cultivars and lines were made by several workers, i.e. 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 the genotypic stability for the most Egyptian cotton varieties Giza 69, Giza 67 and Giza 80 over six environment were the highest yields among all other Egyptian varieties and exhibited the highest number of stable characters among which the seed cotton yield was the most important. El-Feki and Moustafa (1990) reported that the most stable varieties over nine environments were Giza 83 and Dandara followed by Giza 80 variety. Results of a study conducted by Abdel-Hakim and Gad El-Karim (1994) indicated that three cultivars (Giza 80, Giza 69 and Giza 75) out of fourteen showed phenotypic and genotypic stability. The other studied cultivars exhibited different degrees of stability. El-Feki *et al* (1994) indicated that the best genotypes were F5-873190 and F5-899190 which were more productive and showed average degree of stability for most traits. Badr (1999) found that Giza 86, Giza 87 and Giza 88 Egyptian cotton varieties showed an average degree of genotypic stability for seed and lint cotton yields. Also, Giza 85 and Giza 87 for boll weight and Giza 85, Giza 86 and Giza 89 exhibited stability of an average degree for seed index. Eight cotton genotypes were evaluated under six locations by Hassan *et al* (2000) who found that phenotypic and genotypic stability were exhibited by Giza 89 for both seed and lint cotton yield and Giza 85 for lint percentage. Giza 83 showed phenotypic stability for seed and lint cotton yield whereas Giza 70 and Giza 77 were genotypic stability for seed and lint yield. Abo El- Zahab et al (2003) they found that Yield – stability statistic (Ysi) for G.83 in seed cotton yield and two genotypes

(G.83 and G.85) in lint yield were stable. However, for Pima cotton all four genotypes (Earlipima, PS-4, PS-6 and PS-7) in seed cotton yield and three ones (PS-4, PS-6 and PS-7) in lint cotton were stable. Ashmawy *et al* (2003) evaluated 20 of Egyptian cotton genotypes under seven different environments. They found that genotype No14 (H_{12} 1347/99) was phenotypically and genotypically stable for lint yield using four stability methods namely: phenotypic stability of Eberhart and Russell (1966), genotypic stability (Tai 1971), stability variance of Shukla (1972) and yield stability statistic of Kang and Magari (1995).

The methods that provide a stability-variance parameter assignable to each genotype should be useful to breeders. Shukla (1972) developed an unbiassed estimate of stability variance statistic (^{2}i) and also a criterion for testing significance of ^{2}i to determine whether or not a genotype was stable. Eagles and Frey (1977) evaluated the stability- variance method to select oat (Avena sativa) cultivars. This method can be extended to use a covariate to remove its linear effect from GE interaction. The remainder variance of GE interaction can be assigned to each genotype (S^2_I) and the significance of each component was proposed by, Kang and Miller (1984). Recently, Kang and Magari (1995) depending only on Shukla (1972) proposed an integrated yield and stability of performance statistical (Ysi) for simultaneous selection for yield and stability.

The present study is an attempt to evaluate phenotypic stability, genotypic stability and yield–stability statistic for yield and its components for six genotypes evaluated under ten environments.

MATERIALS AND METHODS

The materials of the present study consisted of the one promising strain i.e. (Giza 89 – Pima S6), it is long – staple category and characterized by earliness%, high seed cotton yield and lint yield. It is now in the F17 generation) and five commercial cultivars Giza 80, Giza 83, Giza 85, Giza 90 and Giza 91 were evaluated in two successive seasons (2003 and 2004) at five locations across middle and Upper Egypt (Sohag, Assuit, El-Minia, Bini Sueif and El-Fayium governorates) to test for their general adaptation. The date of planting at all location was during the month of March in the two growing seasons at each location. The experimental design was a randomized complete block with four replications at each location. The plot area was 13 m^2containing five ridges of four meters long and 65 cm wide. Hills in ridges were spaced 25 cm apart. Plants were thinned to two plants per hill after six weeks. The first irrigation was given three weeks after sowing, and the second was three weeks later. Culture practices were carried out as recommended in cotton fields.

The yield was obtained from the three middle ridges of each plot. Data were collected for the following characteristics:

1- Seed cotton yield (SCY): obtained from the three middle rows of the plot and was converted to kentar per feddan.

2- Lint cotton yield (LY): estimated as the weight of lint yield in kentar per feddan.

3- Boll weight (BW): the average weight in grams of 25 bolls, picked at random from the first and fifth rows of each plot.

4- Lint percentage (LP %): the amount of lint in seed cotton sample, expressed in percentage.

5- Seed index (SI): estimated as the weight of 100 seeds in grams.

6- Earliness (EAR) %: estimated as portion of yield harvested in the first pick the total yield.

7- Number of opening bolls (NOP): the average number of harvested bolls per ten plants.

Statistical analysis

Analysis of variance

A regular analysis of variance was applied on individual environment as mentioned by Snedicor and Cochran (1969). The combined analysis of variance was performed on six genotypes and ten environments (five locations and two years) to estimate the effect of genotype – environment interaction on the yielding ability.

Phenotypic stability

Stability analysis was computed according to Eberhart and Russell (1966), to detect the phenotypic stability. In the analysis of the data, the genotypes were treated as fixed variables, while years and locations were considered as random variables.

A genotype has unit regression coefficient (b=1), the deviation not significant different from zero (S^2d= zero) and above yielding ability is considered to be stable one.

Genotypic stability

The statistical 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 environmental effects.

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

$\alpha = \{ si(gI)_I)\}/\{(MSL-MSB)/vr\}$.

and $\lambda = \{s^2 (gI)_i - iS1. (gI)_I\}/\{(v-1)(MSE/vr)\}$ where:

α = The linear response of the i^{th} genotype to the environmental effects,

λ = The deviation from the linear to the environmental effects.

I = The environmental effects

$(gI)_i$ = The interaction effect for i^{th} genotype,

$S^2 (gI)_i$ = The sample variance of the interaction effects of the i^{th} genotype to the environmental effects,

$Si (gI)_i$ = the sample covariance between the environmental and interaction effects,

MSL = Mean square for environments,

MSB = Mean square for replicates within environments,

MSE = Mean square for error,

r = Number of replicates

v = Number of genotypes.

Perfectly stable genotypes would not change its performance from one environment to another. This is equivalent to stating that $\alpha = -1$ and $\lambda = 1$, because, perfectly stable genotypes probably do not exist. Plant breeders will have to be satisfied with the obtained levels of stability, i.e., average stability ($\alpha = 0.0$ and $\lambda = 1$), whereas the values ($\alpha > 0.0$ and $\lambda = 1$) will be as below average stability and the values ($\alpha < 0.0$ and $\lambda = 1$), will be referred as above average stability.

The tabulated value of the probability level a (a=1-P) with (n-2) degrees of freedom, as ta the prediction limits for i corresponded to $\alpha i = 0$ can be shown to be

$$+ t^2a = (\{ \lambda 0 (v-1) MSE. MSl)/(MSL-MSB)(n-2) MSL- (t^2a + n-2) MSB)\})^{1/2}$$

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

Yield- stability statistic

A universally acceptable selection criterion takes genotype by environment interaction into consideration does not exist (Kang and Magari, 1995).

Whenever a genotype × environment interaction is significant, the use of main effects (e.g., overall genotype means across environment) is questionable. Researchers need a statistic that provides a measure of stability or consistency of performance across a range of environments, particularly one that reflects the contribution of each genotype to the total GE interaction. Kang (1993) developed a yield – stability (Ysi) statistic to be used as a selection criterion when GE interaction is significant.

Determine the contribution of each genotype to GE interaction by calculating $\delta^2 i$ (Shukla, 1972) as follows:

$$\delta^2 i = [\ 1/(s-1)(t-1)(t-2)] \times [t(t-1)\ {}_j(\mu_{ij}-\mu i.)^2 \quad {}_i\ {}_j(\mu_{ij}-\mu i.)^2$$

Where $\mu_{ij} = X_{Ij} - X_{.j}$, X_{ij} = observed trait (yield) value of i[th] genotype in j[th] environment

$\bar{X}_{.j}$ = mean of all genotypes in j[th] environment, $\bar{\mu}_{i.} = {}_j\ \mu_{i.} / s$, s = number of environments, and t = number of genotypes. The $^2 i$, can be efficiently computed using Kang (1989), (Kang, 1993) and Kang and Magari 995).

Yield- stability (Ysi) statistic was calculated using program STABLE (a basic program for calculating stability and yield – stability statistic).

RESULTS AND DISCUSSION

The individual analysis of variances for each environment are shown in Table (1). The results showed that the effect of the cotton genotypes were significant for all studied characters, except boll weight for the second season at Assiut location and the first season at El- Minia, Beni – Sueif and El – Fayium, lint percentage for the second season at Beni - Sueif, seed index trait for the second season at El – Minia, seed cotton yield (k/f) and number of openning bolls per plant traits for the second season at Assuit and the first season at Sohag and Beni–Sueif, lint yield (k/f) for the first season

Table 1. The individual analysis of means squares for each environment for all studied traits.

Source of variation	df	Sohag		Assuit		El-Minia		Bini sueif		El-Fayium	
		2003	2004	2003	2004	2003	2004	2003	2004	2003	2004
Boll weight (g)											
Rep	3	0.018	0.007	0.020	0.008	0.064	0.004	0.039	0.005	0.045	0.007
Genotypes	5	0.096**	0.096**	0.182**	0.036	0.073	0.244**	0.094	0.146**	0.097	0.647**
Error	15	0.031	0.033	0.013	0.023	0.040	0.025	0.050	0.009	0.034	0.35
Lint percentage (%)											
Rep	3	1.694	2.036	0.290	0.219	1.469	1.523	1.097	0.458	0.323	0.645
Genotypes	5	9.789**	13.16**	6.689**	6.436**	6.758**	3.057**	9.885**	1.063	6.916**	9.450**
Error	15	0.601	0.454	0.447	0.407	0.632	0.776	0.438	0.466	0.497	0.568
Seed index (g)											
Rep	3	0.204	0.160	0.216	0.077	0.133	0.269	0.086	0.178	0.659	0.403
Genotypes	5	0.287	0.822**	1.098**	0.550**	1.911**	0.732	1.485**	0.766**	1.128**	2.761**
Error	15	0.236	0.255	0.114	0.164	0.118	0.380	0.133	0.248	0.222	0.279
Seed cotton yield (k/f)											
Rep	3	3.368	2.490	1.379	9.600	9.648	1.486	1.813	4.920	3.672	1.080
Genotypes	5	1.180	9.281**	4.774**	0.573	13.52**	1.356**	3.434	7.224**	8.922**	3.220**
Error	15	0.804	0.757	0.563	0.774	1.307	0.458	1.529	1.089	0.682	1.028
Lint yield (k/f)											
Rep	3	3.112	3.954	2.068	13.717	15.136	2.642	2.976	7.904	5.276	2.545
Genotypes	5	2.446	17.65**	9.530**	2.780	17.16**	3.971**	8.036**	11.08**	17.30**	6.110**
Error	15	1.000	0.868	0.827	1.232	1.713	0745	2.406	1.599	0.895	2.012
Earliness (%)											
Rep	3	19.615	22.632	92.979	39.781	39.700	49.526	52.969	105.56	64.808	31.39
Genotypes	5	64.82**	174.6**	155.0**	263.9**	55.84	291.3**	229.9**	165.0**	24.14**	202.0**
Error	15	5.606	15.285	35.436	8.334	38.742	20.533	18.454	20.483	3.484	5.290
Number of opening bolls (NOP)											
Rep	3	7.492	4.047	1.654	10.410	8.816	1.368	2.239	5.990	1.659	0.812
Genotypes	5	3.084	12.85**	2.749**	0.746	14.07**	2.191**	4.250	8.014**	23.97**	16.74**
Error	15	1.907	1.926	0.797	1.059	1.445	0.673	3.849	1.290	1.701	1.304

***and ** significant at 0.05 and 0.01 probability levels, respectively.**

at Sohag and the second season at Assuit and earliness (%) trait for the first season at El – Minia .

Data in Table (2) indicated that G.80 produced the highest values for boll weight (3.76g) and seed index (11.02 g) at El – Fayium in the second season, while G.85 produced the lowest values for boll weight (2.15 g). Giza 83 genotype at El – Fayium in the first season gave the highest value (42.08 %) for lint percentage trait, but the promising strain G.89 - Pima S6 at El – Minia in the first season gave the lowest value (35.2 %) for the same trait.

Table 2. Mean performance of genotypes for all studied traits.

Genotypes	Sohag		Assuit		El-Minia		Bini Suief		El-Faytum		Mean
	2003	2004	2003	2004	2003	2004	2003	2004	2003	2004	
	Boll weight (g)										
Giza 80	2.66	2.49	2.87	2.72	2.91	3.39	2.79	2.75	2.76	3.76	2.91
Giza 83	2.50	2.49	2.50	2.96	2.69	2.88	2.61	2.51	2.51	2.77	2.64
Giza 85	2.40	2.15	2.58	2.82	2.93	3.11	2.89	2.37	2.77	3.45	2.75
Giza90	2.36	2.19	2.42	2.82	3.04	2.84	2.80	2.57	2.61	3.35	2.70
Giza 91	2.37	2.24	2.49	2.76	3.00	2.76	3.06	2.37	2.40	2.80	2.64
Giza89×Pima S6	2.20	2.21	2.22	2.70	2.77	2.76	2.71	2.19	2.46	2.78	2.50
Mean	2.414	2.29	2.51	2.80	2.89	2.96	2.81	2.46	2.58	3.18	2.69
	Lint Percentage (%)										
Giza 80	40.25	38.65	40.00	38.65	38.30	39.88	39.93	39.43	41.95	39.70	39.67
Giza 83	39.13	38.15	39.78	38.65	38.00	40.95	40.85	39.78	42.08	40.88	39.82
Giza 85	36.05	33.68	36.93	35.50	35.35	39.25	37.53	38.43	39.53	36.48	36.87
Giza90	38.50	37.55	37.90	37.80	36.95	39.80	38.83	38.83	41.03	38.80	38.60
Giza 91	37.08	38.15	38.00	37.15	36.45	38.33	37.75	39.58	39.73	37.65	37.99
Giza89×Pima S6	37.00	37.25	37.23	36.35	35.20	39.23	36.70	38.93	39.00	38.85	37.57
Mean	38.00	37.24	38.30	37.35	36.71	39.57	38.60	39.16	40.55	38.73	38.42
	Seed Index (g)										
Giza 80	9.82	10.09	10.25	10.70	11.79	10.24	10.67	9.47	9.66	11.02	10.33
Giza 83	9.08	10.03	9.53	10.40	10.20	9.43	9.75	9.19	8.81	9.69	9.61
Giza 85	9.49	10.06	10.02	10.93	11.53	9.73	10.90	9.17	9.46	11.31	10.26
Giza90	9.00	9.26	9.97	10.49	11.50	9.55	10.94	9.28	9.34	9.93	9.92
Giza 91	8.78	9.07	8.86	9.84	10.39	9.21	9.51	8.43	8.48	9.63	9.22
Giza89×Pima S6	9.09	9.46	9.29	10.36	10.57	9.02	10.14	8.48	8.42	9.24	9.40
Mean	9.14	9.66	9.65	10.45	10.99	9.53	10.32	9.00	9.03	10.14	9.79
	Seed Cotton yield (k/f)										
Giza 80	10.84	8.34	9.57	13.64	6.40	11.15	12.49	7.08	9.83	11.43	10.08
Giza 83	11.10	10.82	7.37	13.58	11.39	11.34	13.61	8.97	11.59	11.20	11.09
Giza 85	11.08	6.97	7.03	13.36	10.90	10.96	11.99	7.16	9.14	10.13	9.87
Giza90	10.52	10.58	6.99	13.26	8.96	11.05	13.72	10.58	11.95	11.17	10.88
Giza 91	11.76	9.54	6.48	12.62	10.74	10.29	14.38	8.07	12.29	11.54	10.77
Giza89×Pima S6	10.18	8.02	7.91	13.03	9.37	9.83	12.45	7.54	8.93	9.27	9.65
Mean	10.92	9.04	7.56	13.25	9.63	10.77	13.11	8.23	10.62	10.79	10.39
	Lint Yield (k/f)										
Giza 80	13.74	10.14	12.04	16.60	7.73	13.98	15.74	8.79	12.98	14.29	12.60
Giza 83	13.67	13.01	9.23	16.53	13.66	14.64	17.52	11.25	15.35	13.17	13.80
Giza 85	12.59	7.40	8.18	14.95	12.14	13.54	14.17	8.67	11.38	11.63	11.46
Giza90	12.76	12.51	8.35	15.79	10.43	13.86	16.77	12.94	15.42	13.65	13.25
Giza 91	13.72	11.46	7.76	14.77	12.35	12.42	17.08	10.04	15.36	13.96	12.89
Giza89×Pima S6	11.85	9.41	9.28	14.92	10.41	12.02	14.39	9.25	10.98	11.35	11.39
Mean	13.06	10.65	9.14	15.59	11.12	13.41	15.94	10.16	13.58	13.01	12.57
	Earliness (%)										
Giza 80	83.43	64.10	71.58	68.98	78.55	51.93	70.55	75.05	91.08	64.98	72.02
Giza 83	87.25	65.23	70.10	76.35	81.00	65.83	83.50	87.00	90.80	74.13	78.11
Giza 85	78.80	57.88	58.83	71.40	84.33	63.63	79.38	79.38	84.93	66.60	72.51
Giza90	86.48	74.83	67.30	87.45	77.30	68.63	85.38	88.73	91.45	79.70	80.72
Giza 91	88.93	73.95	75.55	88.70	86.65	65.20	89.93	90.23	89.45	80.13	82.87
Giza89×Pima S6	80.30	71.30	62.00	78.78	84.80	78.40	91.13	90.53	90.78	80.88	80.89
Mean	84.20	67.88	67.56	78.61	82.10	65.60	83.31	85.15	89.75	74.40	77.85
	Number of opening bolls (NOP)										
Giza 80	11.68	10.35	9.65	13.98	6.45	9.88	13.18	7.98	11.63	9.13	10.39
Giza 83	12.75	13.25	8.95	12.88	12.05	11.83	15.08	10.80	15.15	12.18	12.49
Giza 85	13.40	10.38	8.38	13.18	10.30	10.60	12.00	9.400	11.13	9.03	10.78
Giza90	12.90	14.70	9.13	13.08	9.15	11.70	14.15	12.20	15.23	10.15	12.24
Giza 91	14.35	13.08	8.30	12.83	10.40	11.20	13.70	10.28	17.25	11.65	12.30
Giza89×Pima S6	13.25	11.10	10.50	13.48	10.33	10.68	13.30	10.45	12.28	10.03	11.54
Mean	13.05	12.14	9.15	13.23	9.78	10.98	13.57	10.18	13.78	10.36	11.62

Regarding the seed cotton yield (k/f) and lint yield (k/f) traits, it can be seen that the new cultivar G.91 gave the highest values at Beni - Sueif in the first season (14.38 and 17.08 k/f) respectively, but G.80 gave the lowest value for seed cotton yield (k/f) at El- Minia in the first season (6.40k/f) and G.85 gave the lowest value for lint yield (k/f) at Sohag in the second season (7.40 k/f).

Giza 90 gave the highest value for erliness % (91.45 %) at El-Fayium in the first season, but G.80 gave the lowest value for earliness % (51.93 %) at El – Minia in the second season.

Regarding the number of opening bolls per plant, it can be seen that the new cultivar G.91 gave the highest value (17.25 NB/P) at El – Fayium in the first season, while G.80 gave the lowest value for this trait (6.45 NB/P) at El – Minia in the first season.

Data indicated that the new cultivar G.91 surpassed the other genotypes for the most studied traits at the most environments. These results are in harmony with those obtained by Badr (1999), El – Marakby *et al* (1986) and Hassan *et al* (2000), they reported that the effect of genotype × environment interaction was significant on some cotton characters.

The all characters were not significant for homogeneity of experimental error variances using Bartlett (1937) test. Thus, it can be concluded that the individual mean squares (s^2I) may be considered as estimates of the same population variance (δ^2).

Table (3) presented that combined analysis of variance for stability for seven characters. Mean squares were highly significant among genotypes for all characters. Highly significant mean squares due to environments and (genotype x environments) interaction for all studied characters, indicated that genotypes considerably varied across different environments.

Environment + (genotypes x environment) interaction was partitioned into environment (linear), genotype x environment (linear) interaction (sum of squares due to regression, bi) and unexplained deviation from regression (pooled deviation mean squares, S^2d). The results showed that non-significant genotype x environment (linear) mean squares for all studied traits except boll weight trait.

Table 3. Combined analysis of the studied characters for six Egyptian cotton varieties over ten environments.

Sources of variation	d.f	Mean of squares						
		BW (g)	LP (%)	SI (g)	SCY (k/f)	LCY (k/f)	EAR. (%)	NOP (plant)
Total	59	0.108	2.783	0.6518	4.312	6.767	100.624	4.232
Varieties	5	0.183**	13.633**	2.083**	3.586**	10.01**	210.44**	7.684**
Env + var*Inv	54	0.101**	1.778**	0.519**	4.379**	6.467**	90.46**	3.912**
Env (linear)	1	4.229**	73.633**	24.030**	187.48**	277.74**	3903.4**	161.46**
Var* Env (linear)	5	0.062*	0.793	0.156	0.273	0.389	6.459	1.386
Pooled deviat	48	0.019	0.380	0.067	0.992	1.449	19.768	1.101
Giza 80	8	0.047**	0.338	0.051	2.123**	3.155**	42.03**	1.716**
Giza 83	8	0.015	0.257	0.074	0.448	0.633	3.800	0.940
Giza 85	8	0.008	0.678**	0.069	1.054*	1.655*	12.700	0.977
Giza90	8	0.010	0.123	0.111*	1.066*	1.559*	15.483	1.231
Giza 91	8	0.023*	0.377*	0.023	0.860	1.226	11.948	1.293*
Giza 89×Pima S6	8	0.012	0.531**	0.076	0.400	0.465	32.643**	0.450
Pooled Error	180	0.028	0.589	0.219	1.407	2.038	21.953	2.069

*** and ** significant at 0.05 and 0.01 probability levels, respectively.**

With respect to analysis of variance for stability variance methods, results in Table (4) indicated that significant variances due to genotypes revealed the presence of genetic variability in the material under investigation. The genotype by environment interactions (GE) was found to be highly significant for all studied characters, indicating differential expression of genotypes over environment. Therefore, it is important to give consideration to GxE. Partitioning the GE interaction revealed that heterogeneity caused by the environmental index was significant for all traits. Environments differed significantly for all traits listed in Table (4), indicated the presence of a wide range of variation among used environments sampled.

Table 4. Analysis of variance for Kang and stability variance methods.

Source of variation	d.f	Mean of squares						
		BW (g)	LP (%)	SI (g)	SCY (k/f)	LY (k/f)	EAR (%)	NOP (plant)
Total	59	0.4325	11.129	2.6058	17.2455	27.0706	402.504	17.599
Genotypes	5	0.73**	54.51**	8.31**	14.341*	40.049**	841.83**	30.676**
Environments	9	1.88**	32.82**	10.68**	83.316**	123.454**	1735.01**	71.775**
Interaction	45	0.11**	1.970**	0.36**	4.354**	6.352**	87.189**	5.311**
Heterogeneity	5	0.41**	6.106**	1.141**	8.707*	12.618*	178.281*	13.970**
Residual	40	0.06**	1.292**	0.231	3.387**	4.950**	67.380**	3.758**
Pooled error	150	0.029	0.509	0.215	0.899	1.279	17.165	1.594

*** and ** significant at 0.05 and 0.01 probability levels, respectively.**

The significant residual of all traits indicates that the non-linear component were also highly significant except, seed index. These findings were in agreement with those obtained by El-Feki *et.al* (1994) and Ashmawy *et al* (2003) Therefore, it could be concluded that it is essential to determine the stability degree for each genotype.

Two measures of phenotypic stability regression coefficient and sum of square deviation from regression were computed for six genotypes for all studied traits. According to the definition of Eberhart and Russell (1966), a stable preferred cultivar would have approximately: b=1, s^2d = 0.0 and a high mean performance.

The regression of average mean performance of genotype on the environmental index resulted in regression coefficient (bi) value presented in Table (5), which ranged from 0.474 for Giza 83 to 1.344 for G. 85, 0.742 for G.91 to 1.438 for G.85, 0.655 for G. 83 to 1.133 for G. 90, 0.905 for G. 90 to 1.144 for G.91, 0.839 for (G.89 - Pima S6) to 1.102 for G.91, 0.885 for (G.89 × pima s_6) to 1.138 for G. 85 and 0.713 for (G.89 - Pima S6) to 1.315 for G.91 for boll weight, lint percentage, seed index, seed cotton yield (k/f), lint yield (k/f), earliness % and number of opening bolls per plant. The (bi) values obtained non significantly for some genotypes except the genotypes G.83, G. 85 in boll weight, G.85 in lint percentage, G.83 in seed index and promising strain (G.89 - Pima S6) in number of opening bolls per plant traits. On the other hand the results in Table (5), showed that the (b_I) values were insignificant from unity (b=1) for most genotypes for all studied traits. The deviation (s^2d) for some genotypes were significant and highly significant for all characters. It is clear from the results presented in Table (5), that the genotypes G.90 for boll weight, G.80, G.83 and G.90 for lint percentage, G.80 and G.85 for seed index, G.83 and new cultivar G.91 for seed cotton yield (k/f) and lint yield (k/f), G.83, G.91 and the promising strain (G.89 - Pima S6) for earliness % and G.83, G.90 and the new cultivar G.91 for number of opening bolls per plant which were above mean for the studied traits are well adapted and stable to all environments.

These results support the evidence that out of the six genotypes, only three genotypes G.83, G.91 and promising strain (G.89 - Pima S6) met the production response and stability for the most studied traits. Therefore, these genotypes may be recommended to be incorporated as breeding stock in any future-breeding program aiming for producing high performance and stability for most traits.

On the other hand, the estimates of genotypic stability parameters (λ and α) were calculated according to Tai's (1971) method using the combining analysis.

Table 5. Phenotypic and genotypic stability parameters for Egyptian cotton yield and yield components.

Genotypes	Boll weight (g)							Degrees of stability		
	X	A	λ	bi	S^2d	$t_b=0$	$t_b=1$	0.99	0.95	0.90
Giza 80	2.91	0.14	6.81	1.143	0.0402**	3.053**	0.379	+	+	+
Giza 83	2.64	-0.53	2.06	0.474**	0.0077	4.139**	-4.56**	+	+	+
Giza 85	2.75	0.35	0.99	1.344**	0.0009	24.04**	6.179**	++	+	+
Giza 90	2.70	0.18	1.39	1.180	0.0034	15.337**	2.351**	++	++	++
Giza 91	2.64	-0.04	3.36	0.967	0.0163*	5.239**	-0.195	+	+	+
G. 89X pima S6	2.50	-0.11	1.70	0.892	0.0048	9.602**	-1.151	++	++	++
Mean	2.69									
LSD 0.05	0.06									
	Lint percentage (%)									
Giza 80	39.67	-0.24	2.64	0.759	0.1905	0.290	-0.089	+	+	+
Giza 83	39.82	0.09	2.19	1.086	0.1101	0.497	0.038	+	+	+
Giza 85	36.87	0.47	5.01	1.438*	0.5307**	0.290	0.090	+	+	+
Giza 90	38.60	-0.03	0.90	0.967	-0.0247	1.08	-0.031	++	++	++
Giza 91	38.06	-.0.28	3.35	0.742	0.2302*	0.216	-0.082	+	+	+
G. 89X pima S6	37.57	0.001	4.48	1.007	0.3839**	0.225	0.0002	+	+	+
Mean	38.43									
LSD 0.05	0.27									
	Seed Index (g)									
Giza 80	10.33	0.07	1.02	1.065	-0.0039	2.584**	0.158	++	++	++
Giza 83	9.61	-0.35	1.46	0.655**	0.0193	1.09	-0.576	++	++	++
Giza 85	10.26	0.21	1.31	1.205	0.0145	2.270**	0.391	++	++	++
Giza 90	9.93	0.13	2.21	1.133	0.0562*	1.267	0.145	+	+	+
Giza 91	9.22	-0.09	0.46	0.904	-0.0322	4.908**	-0.527	+	+	+
G. 89X pima S6	9.41	0.04	1.52	1.038	0.0216	1.702*	0.065	++	++	++
Mean	9.79									
LSD 0.05	0.18									
	Seed cotton yield (k/f)									
Giza 80	10.08	-0.01	10.09	0.995	1.7714**	0.058	-0.0003	+	+	+
Giza 83	11.10	-0.06	2.13	0.943	0.0974	0.262	-0.016	++	++	++
Giza 85	9.87	0.08	4.97	1.079	0.7020*	0.129	0.009	+	+	+
Giza 90	10.88	-0.10	5.02	0.905	0.7139*	0.107	-0.011	+	+	+
Giza 91	10.77	0.15	4.06	1.144	0.5087	0.166	0.021	+	+	+
G. 89X pima S6	9.65	-0.07	1.90	0.934	0.0480	0.290	-0.021	++	++	++
Mean	10.39									
LSD 0.05	0.36									
Genotypes	Lint yield (k/f)							Degrees of stability		
	X		λ	bi	S^2d	$t_b=0$	$t_b=1$	0.99	0.95	0.90
Giza 80	12.60	0.05	10.32	1.054	2.6451**	0.041	0.002	+	+	+
Giza 83	13.93	0.005	2.52	1.014	0.1239	0.160	0.0008	+	+	+
Giza 85	11.47	0.02	5.27	1.012	1.1459*	0.077	0.0012	+	+	+
Giza 90	13.25	-0.02	4.99	0.980	1.0495*	0.079	-0.001	+	+	+
Giza 91	12.89	0.11	4.90	1.102	0.7163	0.110	0.010	+	+	+
G. 89X pima S6	11.40	-.0.17	1.40	0.839	-0.0449	0.236	-0.044	++	++	++
Mean	12.59									
LSD 0.05	0.42									
	Earliness percentage (%)									
Giza 80	72.02	0.07	10.43	1.064	36.5463**	0.003	0.0002	+	+	+
Giza 83	78.11	0.06	0.94	1.058	-1.6886	0.035	0.002	++	++	++
Giza 85	72.52	0.14	3.14	1.138	7.2119	0.011	0.001	+	+	+
Giza 90	80.73	-0.10	3.83	0.902	9.9948	0.007	-0.0008	+	+	+
Giza 91	82.87	-0.05	2.96	0.952	6.4593	0.010	-0.0005	+	+	+
G. 89X pima S6	80.89	-0.12	3.10	0.885	7.1548	0.003	-0.0004	++	++	++
Mean	77.86									
LSD 0.05	1.56									
	Number of opening bolls per plant									
Giza 80	10.39	0.13	4.59	1.122	1.1982**	0.081	0.009	+	+	+
Giza 83	12.49	-0.08	2.52	0.928	0.4226	0.123	-0.009	+	+	+
Giza 85	10.78	-0.21	2.64	0.802	0.4597	0.101	-0.024	+	+	+
Giza 90	12.24	0.13	3.30	1.121	0.7134	0.113	0.012	+	+	+
Giza 91	12.30	0.34	3.40	1.315	0.7756	0.127	0.030	+	+	+
G. 89X pima S6	11.54	-0.31	1.16	0.713*	-0.6737	0.198	-0.080	++	++	++
Mean	11.62									
LSD 0.05	0.47									

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

\+ Below average stability ++ Average stability

A perfectly stable genotype will not change its performance from one environment to another. This is equivalent to stating that α=-1 and λ =1. While genotype that has only average stable might have an estimates of α = 0.0 and λ =1. The estimates of genotypic stability parameters and means of all genotypes were presented in Table (5) and Figurers (1 and 7), illustrated the α and λ distribution of six genotypes in all characters.

The estimated statistics were not significant different from α = 0 for all genotypes at all of the probability levels characters, except the genotypes G.85, G.90 and promising strain (G89 - Pima S6) in boll weight, genotype G.90 in lint percentage, genotypes G.80, G.83, G.85 and (G89 - Pima S6) in seed index, genotypes G.83 and (G.89 - Pima S6) in seed cotton yield (k/f), the promising strain (G.89 - Pima S6) in lint yield (k/f) and number of opening bolls per plant and genotype G.83 in earliness %,which showed statistics that significantly different from α = 0.0, (at p=0.90 and p= 0.99) at levels significant genotype-environment interactions.

The estimated λ statistics were significantly different from λ =1, for all genotypes, except G.85 in boll weight, G.90 in lint percentage, G.91 in seed index and (G.89 - Pima S6) in earliness %. These finding are in agreement with those reported by Abdel-Hakim and Gad El-Karim (1994), Badr (1999) and Hassan *et al* (2000).

According to the interpretation of Tai (1971), these results indicated that the relative unpredictable component of variance (the deviation from the linear response) of genotype × environment interaction may be more important than the relative predictable component (the coefficient of the linear response).

As for the degrees of stability, genotypes G.90, and (G89 - Pima S6) in boll weight showed average degree of stability (at p= 0.90, p= 0.95 and P= 0.99 levels), while genotype G.85 showed average degree of stability, (at p=0.99 level), genotype G.90 in lint percentage, genotypes G.80, G.83, G.85 and (G.89 × pima S6) in seed index, genotypes G.83, and (G.89 - Pima S6) in seed cotton yield (k/f), genotype (G.89 - Pima S6) in lint yield (k/f) and number of opening boll and genotype G.83 in earliness % showed average degree of stability (at p= 0.90, 0.95 and 0.99 levels), respectively. The other genotypes were considered unstable.

Genotypic stability
(Boll weight)

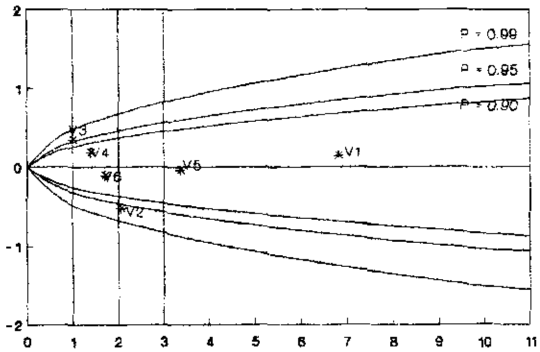

Fig.(1):Distribution of stability statistic of some cotton varieties

Genotypic stability
(Lint percentage)

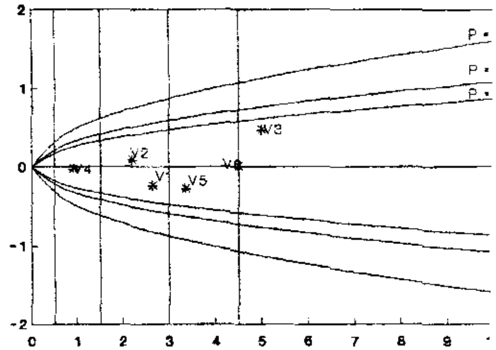

Fig.(2):Distribution of stability statistic of some cotton varieties

Genotypic stability
(Seed index)

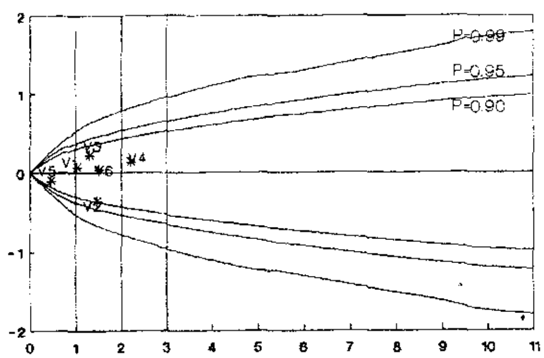

Fig.(3):Distribution of stability statistic of some cotton varieties

Genotypic stability
(Seed cotton yield)

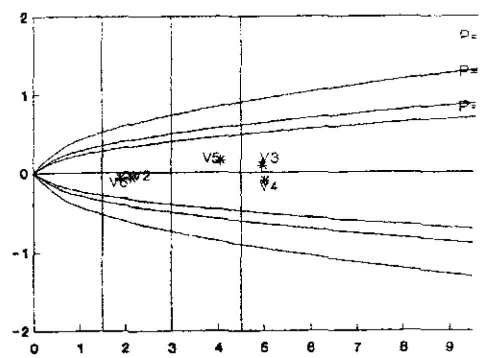

Fig.(4):Distribution of stability statistic of some cotton varieties

Genotypic stability
(Lint yield)

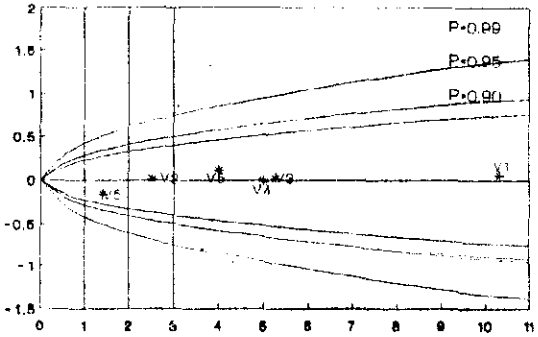

Fig.(5):Distribution of stability statistic of some cotton varieties

Genotypic stability
(Earliness)

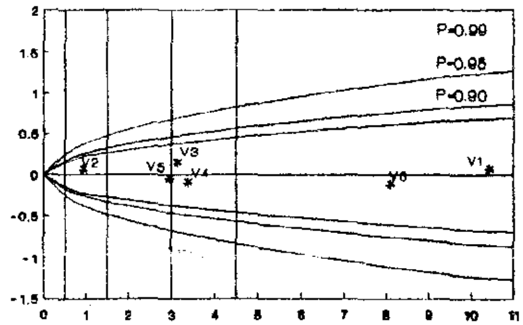

Fig.(6):Distribution of stability statistic of some cotton varieties

Genotypic stability
(Number of open bolls)

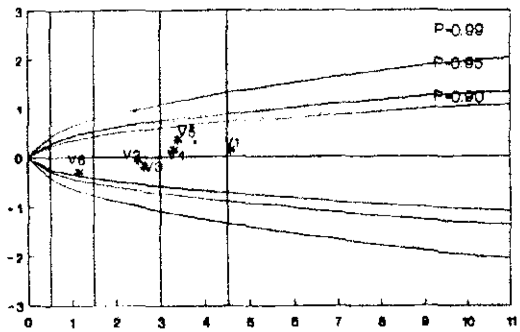

Fig.(7):Distribution of stability statistic of some cotton varieties

The presence of genotype × environment interaction indicated that conclusion based on genotype mean was inconclusive. Genotype responded differently to changes in environments, therefore, measures of stability (^{2}i, S^2i and Ysi) were presented in Table (6). For boll weight, examination of ^{2}i and S^2i values revealed that out of the six cotton genotypes, the four genotypes G.80, G.83, G.85 and the new cultivar G.91were classified unstable ones (significant) before (^{2}i) and two genotypes G. 80 and G.91 were classified unstable ones (significant) after (S^2i) removing environmental heterogeneity. The Ysi- based selection identified genotypes G.80, G.85 and G.90 for boll weight and stability. Therefore, the three genotypes G.80, G.83 and G.90 may be considered as stable genotypes for lint percentage. Two genotypes G.80 and G.85 may be considered as stable genotypes for seed index.

The Ysi – based selection-identified genotypes G.83 and G.90 for seed cotton yield and lint yield (k/f) was stable. Therefore, the four Egyptian genotypes G.80, G.90, G.91 and the promising strain (G.89 - Pima S6) may be considered as stable genotypes for earliness % and number of opening bolls per plant and may be incorporated in any future breeding program for short season cotton using the *G. barbadense* germplasm.

Table 6. Mean performance of yield and yield components, Stability statistical (Ysi)- variance statistic analysis Kang and Magrai stability measurements for six-cotton genotype over ten environments.

Genotypes	Mean	^{2}	S^2	Yield Rank	Adjusted	Stability Rating	YS(I)
		Boll weight (g)					
Giza 80	2.91	0.2302**	0.1822**	6	9	-8	1
Giza 83	2.64	0.1816**	0.0466	2	1	-8	-7
Giza 85	2.75	0.0591*	0.0139	5	6	-4	2
Giza 90	2.70	0.0392	0.0249	4	5	0	5
Giza 91	2.64	0.0951**	0.0815**	3	2	-8	-6
G. 89 X Pima S6	2.50	0.0389	0.0325	1	-2	0	-2
							-1.1667
		Lint percentage (%)					
Giza 80	39.67	1.7634**	1.1020*	5	8	-8	0
Giza 83	39.82	0.9000	0.7424	6	9	0	9
Giza 85	36.87	4.6451**	2.5270**	1	-2	-8	-10
Giza 90	38.60	0.1389	0.1753	4	5	0	5
Giza 91	38.06	2.0507**	1.2752*	3	1	-8	-7
G. 89 X Pima S6	37.57	2.3221**	1.9285**	2	-1	-8	-9
							-2.00
		Seed index (g)					
Giza 80	10.33	0.1998	0.1650	6	9	0	9
Giza 83	9.61	0.6252**	0.2595	3	1	-8	-7
Giza 85	10.26	0.3834	0.2287	5	8	0	8
Giza 90	9.93	0.5543**	0.4199*	4	5	-8	-3
Giza 91	9.22	0.05880	0.04104	1	-2	0	-2
G. 89 X Pima S6	9.41	0.3237	0.2698	2	-1	0	-1
							0.6667
		Seed cotton yield (k/f)					
Giza 80	10.08	10.2562**	8.2287**	3	2	-8	-6
Giza 83	11.10	1.3697	1.0658	6	9	0	9
Giza 85	9.87	4.6550**	3.6437**	2	0	-8	-8
Giza 90	10.88	4.7650**	3.6873**	5	7	-8	-1
Giza 91	10.77	3.9393**	2.8307**	4	6	-8	-2
G. 89 X Pima S6	9.65	1.1394	0.8629	1	-2	0	-2
							-1.6667
		Lint cotton yield (k/f)					
Giza 80	12.60	15.3253**	12.2212**	3	4	-8	-4
Giza 83	13.93	1.7764	1.4490	6	9	0	9
Giza 85	11.47	7.2642**	5.8410**	2	-1	-8	-9
Giza 90	13.25	6.7577**	5.4288**	5	7	-8	-1
Giza 91	12.89	5.2857**	4.0061**	4	5	-8	-3
G. 89 X Pima S6	11.40	1.7027	0.7532	1	-2	0	-2
							-1.6667
		Earliness percentage (%)					
Giza 80	72.02	203.9883**	162.358**	1	-2	-8	-10
Giza 83	78.11	-0.08950	-0.6422	3	4	0	4
Giza 85	72.52	54.0622**	37.2253*	2	-1	-8	-9
Giza 90	80.73	64.6775**	49.0265**	4	6	-8	-2
Giza 91	82.87	42.6490**	22.9265*	6	9	-8	1
G. 89 X Pima S6	80.89	157.9654**	122.386**	5	7	-8	-1
							-2.8333
		Number of opening bolls per plant					
Giza 80	10.39	8.0803**	6.3727**	1	-2	-8	-10
Giza 83	12.49	3.7792*	3.0712	6	8	-4	4
Giza 85	10.78	4.5983**	3.2361*	2	0	-8	-8
Giza 90	12.24	4.4987**	4.3116**	4	6	-8	-2
Giza 91	12.30	7.3427**	4.5725**	5	7	-8	-1
G. 89 X Pima S6	11.54	2.5637	0.9874	3	2	0	2
							-2.5

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

REFERENCES

Abdel-Hakim, A. M. and Gh. A. Gad El-Karim (1994). Estimates of genotypic and phenotypic stability parameters in cotton (*Gossypium barabadense*). J. Agric.Sci. Mansoura Univ. 19(7): 2181-2189.

Abo El- Zahab, A.A., H.Y.Awad and K.A. Baker (2003). Comparative performance of Pima and Egyptian cotton cultivars: 111. Tolerance to late planting stress. Egypt. J.Agric.Res., 81(1): 205-220.

Ashmawy, F., A. A. A. Al-Akhadar, A. M. S. A. El-Taweel and Hanem A. Mohmed (2003). Stability statistics of some Egyptian cotton genotypes. Egypt. J. Plant Breed. 7(2): 143-164.

Badr, S. S. M. (1999). Genotypic stability for the new Egyptian cotton varieties Giza 85,Giza 86, Giza 89, Giza 87 and Giza 88. Egypt. J. Agric. Res. 77(1): 331-342.

Bartlett, M.S. (1937). Properties of sufficiency and statistical tests. Proc. Roy. Soc. London, Series A. 160; 268 – 282.

Eagles, H. A. and K. J. Frey (1977). Repeatability of the stability-variance parameter in Oats. Crop Sci. 17: 253-256.

Eberhart, S. A. and W.A. Russell. (1966). Stability parameters for comparing varieties, Crop Sci. 36-40.

El-Feki, T. A. and F. S. Moustafa (1990). Genotypic stability parameters for several genotypes of two species of cotton. Egypt. J. Appl. Sci. 5(7): 39-49.

El-Feki, T. A., Hanna. F. Fahmy, H. A. Abd Al-Naby and Sayeda. S. El-Helow (1994). Stability parameters of Egyptian extra- long genotypes for yield and yield components. Proc. 6th Conf. Agron. Al-Azhar Univ., Cario, Egypt, Vol. I: Sept.1994, pp: 73-89

El- Kadi, D.A.A., A.Abo El – Zahab and S.A.El – Shaarwy (1978). Genotypic stability parameters for comparing Egyptian cotton cultivars. Res. Bul. 873 July 1978 Fac. of Agric. Ain Shams University.

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

Hassan, I. S. M., A. M. Abdel-Aziz and E. M. Ghoneim (2000). Balanced response for genotypes. Agric. Sci. Mansoura Univ. 25(1): 23-32.

Kang, M.S. (1993). Simultaneous selection for yield and stability in performance trails: consequences for growers. Agron. J. 85: 754 – 757.

Kang, M. S. and J. D. Miller (1984). Genotypes x environmental interaction for cane and sugar yield and their implications in sugarcane breeding. Corp Sci. 24: 435-440.

Kang, M. S. and R. Magari (1995). Stable a basic program for calculating stability and yield- stability statistics. Agron. J. 87(2): 276-277.

Shukla, G. K. (1972). Some statistical aspects of partitioning genotype-environmental components of variability. Heredity 29:237-245.

Snedicor, G. W and W. G. Cochran. (1969). Statistical methods, 6[th] Ed. Iowa State Unv. Press, Ames. Iowa, U. S. A.

Tai,G.C.C.(1971). Genotypic stability analysis and its application to potato regional traits. Corp Sci. 11: 184-190.

تقدير معالم الثبات لمقارنة بعض التراكيب الوراثية في القطن المصري

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تم تقييم ستة أصناف من القطن المصري منها خمسة أصناف تجارية منزرعة هي جيزة ٨٠، جيزة ٨٣، جيزة ٨٥، جيزة ٩٠ ، جيزة ٩١ مع سلالة مبشرة في الجيل السابع عشر (جيزة ٨٩ × بيما س٦) خلال موسمي ٢٠٠٣و ٢٠٠٤ في تصميم قطاعات كاملة العشوائية في أربعة مكررات وخمسة بيئات مختلفة في مصر الوسطى ومصر العليا هي سوهاج ، أسيوط ، المنيا ، بني سويف والفيوم لدراسة معالم الثبات الوراثي والمظهري من خلال الاستجابة المتوازنة للتفاعل الوراثي والبيئي لتلك التراكيب الوراثية لصفات وزن اللوزة ، معدل الحليج ، معامل البذرة ، محصول القطن الزهر (قنطار / فدان) ، محصول القطن الشعر (قنطار / فدان) ، والنسبة المئوية للتبكير % وعدد اللوز المتفتح / نبات واستخدمت ثلاث طرق لتقدير الثبات الوراثي والمظهري للصفات تحت الدراسة هي :-

Eberhart and Russell (1966), Tai (1971) and Kang and Magari (1995)

وذلك بهدف استخدام المعلومات المتاحة من هذه التقديرات لتوجيه برامج التربية وقد أظهرت النتائج الآتي :-

١. أظهر التحليل التجميعي معنوية عالية للتفاعل الوراثي والبيئي لجميع الصفات تحت الدراسة .

٢. أشارت تقديرات الثبات المظهري أن الصنفين التجاريين المنزرعين جيزة ٨٣ ، جيزة ٩١ قد أظهرا ثباتا مظهريا لصفات المحصول الزهر والمحصول الشعر قنطار/فدان والنسبة المئوية للتبكير% وعدد اللوز المتفتح على النبات – وأظهر الصنف جيزة ٨٠ ثبات مظهري في صفتي معدل الحليج ومعامل البذرة – بينما أظهر الصنف جيزة ٩٠ ثباتا مظهريا لصفتي وزن اللوزة ومعدل الحليج – كذلك أظهر الصنف جيزة ٨٥ ثباتا مظهريا في صفة معامل البذرة فقط –بينما أظهرت السلالة المبشرة (جيزة ٨٩ × بيما س ٦) ثباتا مظهريا في صفة النسبة المئوية للتبكير.

٣. أظهرت نتائج الثبات الوراثي أن السلالة المبشرة (جيزة ٨٩ × بيما س ٦) قد أظهرت ثباتا وراثيا لمعظم الصفات تحت الدراسة عدا صفة معدل الحليج فقط - وكذلك أظهر الصنف التجاري جيزة ٨٣ ثباتا وراثيا لصفات معامل البذرة والمحصول الزهر قنطار / فدان والنسبة المئوية للتبكير بينما أظهر الصنف التجاري جيزة ٩٠ ثباتا وراثيا لصفتي وزن اللوزة ومعدل الحليج.

٤. - يمكن اعتبار الصنفين التجاريين جيزة ٨٣ ، جيزة ٩٠ تراكيب وراثية ثابتة السلوك بالنسبة لمعظم الصفات تحت الدراسة.

٥. - أوضحت النتائج أن السلالة المبشرة (جيزة ٨٩ × بيما س٦) والصنف التجاري جيزة ٨٣ قد أظهرا ثباتا وراثيا ومظهريا باستخدام طرق الثبات الثلاثة تحت الدراسة وذلك لصفة النسبة المئوية للتبكير% وكذلك أظهر الصنف التجاري جيزة ٨٣ ثباتا وراثيا ومظهريا باستخدام طرق الثبات الثلاثة في صفتي المحصول الزهر والشعر قنطار / فدان- وعليه ينصح باستعمال تلك التراكيب الوراثية في برامج التربية كأصل وراثي حيث تتمتع بالقدرة المحصولية العالية والتبكير في النضج وذات درجة ثبات مرتفعة.

* تم زراعة الصنف جيزة ٩١ اعتبارا من موسم ٢٠٠٥ كصنف تجارى في مركزي سمالوط ومطاى - محافظة المنيا ولذلك اعتبر صنفا جديدا في هذا البحث عند النشر.