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Parametric Stability and Principal Components Analysis of some Egyptian Cotton Cultivars under Different Environments

Said, A. A.* **and Y.A. M. Hefny**

Agronomy Department, Faculty of Agriculture, Sohag University, Sohag 82749, Egypt

ABSTRACT

The present study was conducted to select cotton stable cultivars with high productivity across various environments. Nine Egyptian cotton cultivars were grown in a split-plot randomized complete block design with three replications consisted of six different environments (2 years × 3 sowing dates) to identify the high yield stability cultivars under these conditions. Pooled analysis of variance for; number of bolls/plant, seed cotton yield and lint yield revealed significant differences due to cultivars, environments and their interactions. Results revealed that the cultivars Dandara and Giza 90 were considered as superior cultivars under different environmental conditions due to their high number of bolls/plant, seed and lint yield traits across different environments when compared with grand mean for these traits beside acceptable stability parameters (bi near to one, S^2d_i non-significant, α stability value not significantly differed from zero and the λ statistic was not significantly differed from one). Therefore, it could be used in breeding programs for development of high yield stable genotypes across environments for future use. Also, principal component analysis (PCA) showed that Dandara and Giza 90 cultivars were located near all studied traits and environments (stable cultivars over different environments). According to our results the two cultivars (Dandara and Giza 90) can be recommended to be uses under a wide range of environmental conditions and use in breeding programs for development of high yield stable genotypes across environments for future use.

Keywords: *Gossypium barbadense*, environments, parametric stability analysis, principal component (PC) and yield.

INTRODUCTION

Cotton (*Gossypium barbadense* L.) is considered one of the important strategic crops in Egypt. It is grown mainly for its fiber, cotton a main raw material of the textile industry which is considered the first important industry in Egypt. Also cotton seeds are used in oil manufacture and animal feed industries, which are fully needed specially to minimize importing these products which cost Egyptian economy a lot by hard currency.

Despite cotton national economic importance, the cultivated area is decreasing year by year, due to the limited area of the agricultural land and better net profits from alternatives crops, especially grains. So, to increase the productivity of cotton, we need to increase the cultivated area. To do so, new reclaimed area can be cultivated. In fact, many of these new lands are suffering from different abiotic stresses, such as heat stress and salinity in which high salinity water is present.

Yield stability depends on plant traits, like resistance or tolerance to various environmental factors. Improving productivity and keeping the cotton crop stable under favorable and stressful conditions are important to meet the growing demand of the world's population (Basu *et al.*, 2016). The use of different sowing dates allows us to expose cotton cultivars to different atmospheric temperatures. Among the abiotic stresses, heat stress is one of the most important limiting factors that affect negatively cotton productivity (Snider *et al.* 2009, 2011 and Ekinci *et al.*, 2017), through affecting the growth and reproductive performances of plant by reducing the efficiency of nutrient use, leading to higher abortion rates of bolls and lint yield (Oosterhuis and Snider, 2011 and Snider and Oosterhuis, 2012).

Stable performance of cultivars under various environments about economic traits like seed and lint yield is one of the focal endeavors of Egyptian cotton. To characterize the stability of yield performance, genotypes are tested under different environments as proposed by Eberhart and Russell (1966), they proposed the most widely used joint linear regression analysis to find the ideal cultivar that has the highest yield over a broad range of environments. They defined a stable cultivar as that with regression coefficient (b_i) equal to one and with mean squares deviation from regression (S^2d_i) equal to zero. Apparently, a cultivar that did not meet both these criteria would be classed as unstable. Also, Tai (1971) suggested dividing the genotype x environment interaction into two components namely: α statistic, which measures the linear response to environmental effect and λ statistic, which measures the deviation from linear response in terms of magnitude of error variance.

Multivariate analysis methods are also useful tool to access stability and there are substantial differences among the groups, but the individuals within a single group are similar (Einstein, 1996). As a multivariate statistical technique, the principal components analysis (PCA) can transform several possibly correlated variables into as miller number of variables and explained the variation among genotypes. A good hybridization breeding program can be initiated by the selection of genotypes from the PCI as it contributed maximum toward diversity with maximum Eigen value.

* **Corresponding author.**
E-mail address: tentawy@gmail.com
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In this study, we are aiming to evaluate stability of nine Egyptian cotton cultivars under different environments (two years and three sowing dates) to identify cultivar with high yield stability under these environments.

MATERIALS AND METHODS

Field experiments

Two field experiments were conducted at the Experimental Farm of Faculty of Agriculture, El-Kawther city, Sohag University, Sohag, Egypt to evaluate nine Egyptian cotton cultivars (*G. barbadense*, L) under six different environments (Table 1); two summer seasons (2017 and 2018) and three sowing dates (March, 20th, April, 10th and May, 1st).

Table 1. Description of environments applied in the experiment.

Environments No.	Season	Sowing date
E1	2017	Early planting, March, 20th
E2	2018	Early planting, March, 20th
E3	2017	Late planting, April, 10th
E4	2018	Late planting, April, 10th
E5	2017	Very late planting, May, 1st
E6	2018	Very late planting, May, 1st

The pure seeds of these cultivars were obtained from Cotton Research Institute, Agricultural Research Center at Giza, Egypt. The name and pedigree of these cultivars are presented in Table 2.

Table 2. The name and the pedigree of the cultivars.

Cultivar name	Pedigree	Cultivar name	Pedigree
Giza 45 (G45)	G. 7 × G. 28	Giza 88 (G 88)	G. 77 x G. 45B
Giza 80 (G80)	G. 66 × G. 73	Giza 90 (G 90)	G. 83 × Dandara
Giza 83 (G83)	G. 67 x G. 72	Giza 90 × Australian	G. 90 × Australian
Dandara	Selected from Giza-3	Giza 92 (G 92)	G. 84(G. 74 x G. 68)
Giza 87 (G87)	G. 77 × G. 45A		

The field experiments were laid out in split-plot design arranged in RCBD design with three replications. The main-plots were devoted to the three sowing dates and the sub-plots were allocated to cotton cultivars. Each sub-plot consisted of three rows, 4 m long, 65 cm apart and 25 cm between hills within a row. After full emergence, seedlings were thinned to two plants per hill. The field experiments were irrigated with groundwater (Chemical parameters of the irrigation water, Table 3).

Data were recorded for; number of bolls/plant (NB/P), seed cotton yield in kentars per feddan (SCY) which was determined from the whole seed cotton yield of each sub-plot in terms of kg/plot and converted to kentar (kentar = 157.5 kg) per feddan, lint yield/plant in kentar/feddan (LY): It was determined from the whole lint yield of each sub plot in terms of kg/plot and converted to kentar (kentar = 50 kg) per feddan (feddan = 0.42 hectare). All recommended cultural practices for cotton production were applied throughout the two growing seasons. Both the trend of temperature as a climatic factor and the soil status (Particle-size distribution, soil texture and chemical analysis) across the two summer growing seasons of 2017 and 2018 as shown in Tables 4 and 5.

Table 3. Chemical parameters of the irrigation water.

Property	Unit	Value
pH	……	7.72
EC	mgl^{-1}	1067
Na	mgl^{-1}	90.36
K	mgl^{-1}	147.06
Ca	mgl^{-1}	87.66
Mg	mgl^{-1}	44.28
HCO_3	mgl^{-1}	208.26
Cl	mgl^{-1}	87.48
SO_4	mgl^{-1}	386.64

Table 4. Mean of meteorological data of the growing seasons 2017 and 2018.

			2017				
Measurement	**March**	**April**	**May**	**June**	**July**	**Aug.**	**Sep.**
Max. Temp. (ºC)	28.7	34.3	39.1	39.7	41.1	41.8	41.4
Min. Temp. (ºC)	11.5	16.5	21.4	22.2	21.2	23.2	20.8
Max. RH (%)	55.6	48.0	50.8	53.2	64.2	65.1	67.1
Min. RH (%)	18.9	13.8	20.7	25.7	21.0	24.4	24.7
			2018				
Measurement	March	April	May	June	July	Aug.	Sep.
Max. Temp. (ºC)	33.1	35.0	38.1	41.3	40.0	38.2	36.8
Min. Temp. (ºC)	15.6	17.70	20.2	22.8	21.9	20.2	17.4
Max. RH (%)	50.3	42.4	43.0	45.3	60.7	62.8	62.7
Min. RH (%)	15.2	14.7	16.6	19.2	17.4	16.8	16.2

Table 5. Physical and chemical properties of the experimental soil.

			Physical properties		
Depth (cm)	**Bulk density (Mg m^{-3})**	**Field capacity (%)**	**Permanent wilting Point (%)**	**Available water(%)**	**Soil texture**
0-15	1.35	23	13	10	Sandy clay loam
15-30	1.28	20	11	9	Sandy clay loam
30-45	1.52	12	5	7	Sandy loam

	Chemical properties	
Properties	Depth (cm)	
	00-30	30-60
Soil pH	7.74	8.07
ECe (dS/m at 25ºC)	2.4	2.9
Available nitrogen (ppm)	64	51
Available phosphorus (ppm)	20	16
Exchangeable potassium (ppm)	74	62
Ca CO_3 %	3.1	3.25
Organic matter %	1.5	1.3

Statistical analyses

The combined analysis was performed on the recorded data of all the studied traits of the 9 cultivars over all environments according to Gomez and Gomez (1984). Genotypes means were compared using Revised Least Significant Differences test (RLSD) according to El-Rawi and Khalafala (1980). Four parametric stability methods including: the joint regression coefficient (b_i) and deviation from regression (S^2d_i) were estimated by using Eberhart and Russell's model (1966) and liner response to environmental effects, which measured by statistic (α) and the deviation from linear response, which measured by statistic (λ) were estimated by using Tai (1971). INDOSTAT software version 9.2 was used to perform the principal component analysis.

RESULT AND DISCUSSION

Analysis of variance

Combined analysis of variance for number of bolls/plant, seed cotton yield and lint yield traits are presented in Table 6.

Table 6. Analysis of variance across cultivars and environments.

S.O. V	d.f	Mean squares		
		Seed cotton yield	Lint yield	Number of bolls/plant
Environments	5	65.19**	95.59**	272.19**
Error (a)	12	1.97	1.71	5.86
Cultivars	8	26.71**	78.64**	317.39**
Cult. × Env.	40	3.41**	4.93**	1.83
Error (b)	96	0.95	1.50	1.87
C.V. (%)		6.62	8.92	9.01

** significant at 0.01 level of probability, respectively.

Differences among environments were highly significant (P<0.01) for all studied traits. The large environmental sum of squares revealed that environments were diverse, with large differences among environmental means causing most of the variation in all the studied traits. The analyzed data also showed that there were highly significant differences among cultivars for all the studied traits across environments. Obviously, all degrees of G×E interactions were highly significant for all the studied traits with exception of number of bolls/plant. The genetic diversity and the significant G×E interactions imply both sensitivity of cultivars and differential responses of these cultivars to various environments, suggesting the importance of stability parameters assessment of these cultivars under these conditions to identify the best stable suitable cultivars under this range of environments. These results were in harmony with Dewdar (2013), Abd El-Aziz (2014), Gibely *et al.* (2015), Ali (2017) and Abro *et al.* (2020). Gibely and Hassan (2018) indicated highly significant differences for the genotypes, environments and G x E interaction indicating the possibility to select the most stable genotypes for quantitative traits across different environments.

Mean performance and stability parameters:

Some methods have been used to determine the stability of potential cultivars over different environments. The first description by Eberhart and Russell (1966), proposed that an ideal genotype is the one which has the highest yield across a broad range of environments, a regression coefficient (b_i) value of 1.0 and deviation mean squares (S^2d_i) from zero, indicates less response to environmental changes, and hence showing more adaptiveness. Another method of genotypic stability analysis was proposed by Tai (1971), in this method the G × E interaction and effect of a genotype are partitioned into two components: Liner response to environmental effects, which measured by statistic (α) and the deviation from linear response, which measured by statistic (λ). A perfectly stable variety has (α, λ) = (-1, 1) and variety with average stability has (α, λ) = (0, 1).

Number of bolls/plant:

There was significant genotypic variation for number of bolls/plant among the nine cotton cultivars used in the stability analysis. Results revealed that G 90*AS had the highest mean number of bolls/plant by 15.85 bolls, while the lowest mean number of bolls/plant was obtained from G 45 by 8.86 bolls with an average 11.57 bolls/plant (Table 7). According to Eberhart and Russell (1966), 6 cotton cultivars (G 45, G 80, G 83, G 86, G 87 and G 88) were stable over all the studied environments *i.e.* their bi and S^2d_i were insignificant. Out of them, two cultivars (G 80 and G 86) had the highest mean number of bolls/plant compared with the grand mean over environments (Table 7 and Figure 1). Moreover, G 88 performed consistently better in favourable environments because the regression coefficient (b_i) was more than one with low number of bolls/plant. Meanwhile, G 45, G 83 and G 87 was relatively better in stress environments because bi was less than one (bi < 1) plus showing low number of bolls/plant compared with mean over all cultivars. Similar results were reported by Dewdar (2013), Abd El-Aziz (2014), Gibely *et al.*, (2015) and Ali (2017). Meanwhile, Tai's stability estimates (α_i, λ_i) are shown in Table 6 and figure 2, the average stability region included four cultivars (G 80, G 86, G 87 and G 88) within these cultivars. Out of them, two cultivars (G 80 and G 86) had the highest mean number of bolls/plant compared with the grand mean over environments.

Table 7. Mean performance and stability parameters of cultivars for number of bolls /plant.

Genotypes	Number of bolls /plant										
	Environments							Stability parameters			
	E1	E2	E3	E4	E5	E6	Mean	b_i	S^2d_i	α	λ
G 45	10.87	10.80	9.94	10.08	8.52	8.07	9.71	0.74*	-0.146	-0.06	5.60**
G 80	12.78	12.84	11.90	11.88	9.06	8.89	11.23	1.15	-0.181	0.04	1.91
G 83	12.33	12.55	11.86	11.77	9.31	8.92	11.12	1.02	-0.182	0.00	0.50
Dandara	13.29	13.18	12.86	12.93	9.96	9.92	12.02	1.04	-0.177	0.01	0.71
G 87	10.22	10.45	9.25	9.73	6.78	6.76	8.86	1.07	-0.158	0.02	1.46
G 88	11.08	11.12	10.77	10.25	8.62	8.16	10.00	1.11	-0.850	-0.04	3.63**
G 90	13.38	13.45	13.15	13.25	9.95	9.97	12.19	0.96	0.341	0.03	2.20
G 90*AS	14.41	14.52	13.92	14.04	10.78	10.91	13.10	1.11	-0.103	0.03	1.67
G 92	10.70	9.95	9.62	10.16	7.48	7.27	9.20	0.88**	-0.004	-0.02	3.00*
Mean	12.12	12.10	11.47	11.57	8.94	8.76	10.83				
RLSD 0.05	0.80	2.72	2.29	1.50	2.11	2.35	1.95				

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

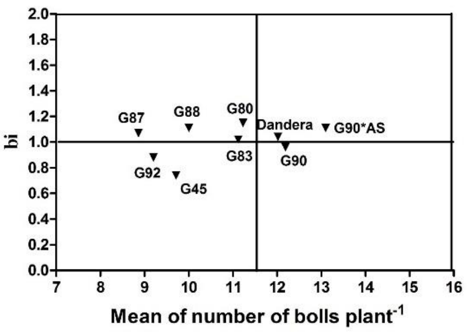


Fig. 1. Present graphically the relationships between the stability parameters (bi) and its mean performance of each cultivar for number of bolls /plant.

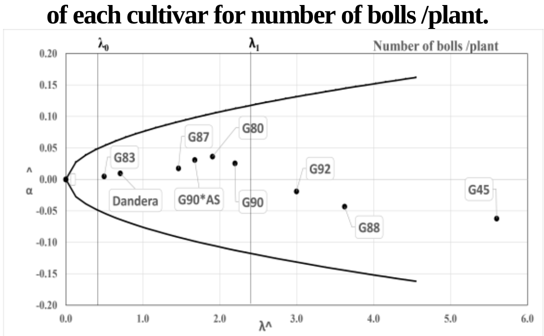


Fig. 2. Genotypic stability parameter in the nine cotton cultivars for bolls number /plant

Seed cotton yield in kentars per feddan:

Means of seed cotton yield ranged from 4.19 for G 87 to 7.77 kentar per feddan for G 90*AS with an average 5.85 kentar per feddan. Concerning the estimated stability parameters (b_i and S^2d_i) for this trait, cultivar G 83 were stable over all the studied environments *i.e.* their bi and S^2di were insignificant and exhibited low seed cotton yield compared with grand mean. Moreover, cultivar G92 were stable and exhibited low average response to different environments (b_i<1.0), they considered relatively better in stressed environments. Meanwhile, cultivar G86 performed consistently better in favourable environments (b_i>1) (Table 8) Similar conclusion was reported by These results were in harmony with Abd El-Aziz (2014), Gibely *et al.*(2015), Ali (2017) and Abro *et al.*(2020). Dewdar (2013) found Giza 90 and Giza 80 cultivars were stable across the studied environments with high seed cotton yield. Gibely and Hassan (2018) found genotype No. 14 for seed cotton yield was good adapted for the most important cotton production locations for extra-long staple cotton varieties using Eberhart and Russell model. According to Tai's (1971), the results revealed that the average stability for seed cotton yield contained cultivars G83, G86, G88 and G92 with α stability values not significantly differed from zero (figure 4). Also, the λ statistics were not significantly differed from λ=1 for the cultivars, indicating that they were of average stable under the studied environments (Table 8). The same results were obtained by Ali *et al.* (2012) and Said *et al.* (2020). Abd EL-Bary (2013) measurements of genotypic stability α and λ for seed cotton yield as estimated by Tai (1971) and found that the genotypes no. 1, 2, 7, 8, 10, 11, 12, 13, 15, 16 and the three promising crosses and Giza 86 showed average level of stability.

Table 8. Mean performance and stability parameters of cultivars for seed cotton yield.

Genotypes	Seed cotton yield in kentars feddan^{-1}										
	Environments							Stability parameters			
	E1	E2	E3	E4	E5	E6	Mean	b_i	S^2d_i	α	λ
G 45	6.32	6.05	5.20	4.98	3.88	3.65	5.01	0.73*	-0.176	-0.13	3.05*
G 80	7.94	8.07	7.08	7.16	4.33	4.06	6.44	1.18**	-0.019	0.09	5.55**
G 83	7.28	7.35	5.42	5.39	3.95	3.78	5.53	1.03	-0.136	0.02	1.62
Dandara	8.20	8.18	7.16	7.20	4.80	4.74	6.71	1.05	-0.131	0.02	1.79
G 87	5.51	5.77	4.01	3.97	3.06	2.82	4.19	0.81*	-0.113	-0.09	3.42*
G 88	6.58	7.03	5.24	5.26	4.05	3.74	5.32	1.20	-0.914	-0.06	1.84
G 90	8.58	8.67	7.29	7.33	4.75	4.69	6.89	1.01	0.437	0.10	2.34
G 90*AS	8.87	8.75	7.45	7.51	4.92	4.93	7.07	1.15**	-0.022	0.09	2.36
G 92	6.09	6.42	4.36	4.43	3.21	3.02	4.59	0.89**	0.014	-0.03	2.55*
Mean	7.26	7.37	5.91	5.92	4.10	3.94	5.75				
RLSD. 0.05	1.54	2.20	2.74	1.76	2.31	2.00	1.39				

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

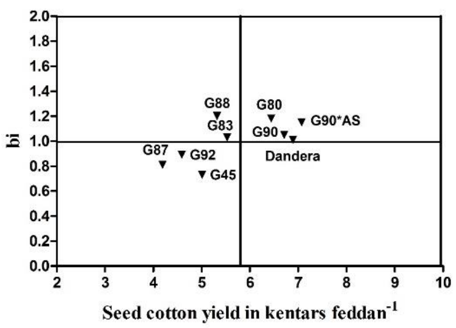


Fig. 3. Present graphically the relationships between the stability parameters (b_i) and its mean performance of each cultivar for seed cotton yield.

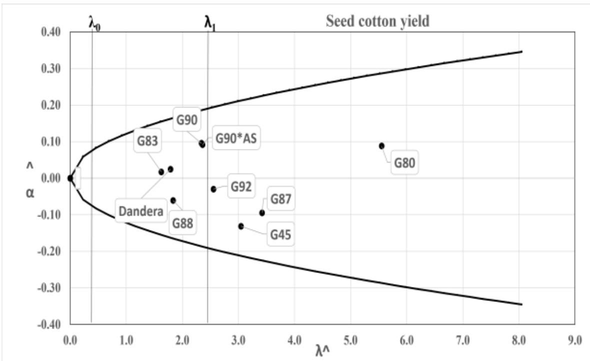


Fig. 4. Genotypic stability parameters of the nine cultivars for seed cotton yield.

Lint yield in kentars per feddan:

The studied cultivars showed a wide range of variability in average lint yield over sowing dates and years. Mean lent yield ranged from 5.49 (G 87) to 11.36 kentars per feddan (G 90*AS) with an average of 8.20 kentars per feddan. The most desired and stable genotypes can be considered when their regression coefficient equal one (bi=1) with lower values of S^2di (Eberhart and Russell, 1966), accordingly in this study one cultivar G 80 were considered as desired and stable for lint yield when compared with grand mean. Moreover, cultivars G 45 and G 83 were stable and exhibited low average response to different environments (b_i<1.0), they considered relatively better in stressed environments. Meanwhile, cultivar G 86 and G 88 performed consistently better in favorable environments (b_i>1), one of them (cultivar G 86) showed a high mean when compared with the mean overall cultivars (Table 9). Similar conclusion was reported by Abd El-Aziz (2014), Gibely *et al.* (2015), Ali (2017) and Gibely and Hassan (2018). Dewdar (2013) indicated that the two cultivars Giza 90 Giza 80 met the two criteria (b_i did not differ significantly from one and S^2d close significantly from zero or equal zero) for lint yield trait. On the other hand, Tai's stability revealed that the average stability region included four cultivars (G 80, G 83, G 88 and G 92), one of them (cultivar G 80) indicated a high mean when compared with grand mean (Table 9). Similar finding was recorded by Rahoumah *et al.* (2008), Ali *et al.* (2012) and Said *et al.* (2020). Abd EL-Bary (2013) showed that the genotypes no. 10, 11, 13, 16 and the two promising crosses observed average level of stability and surpassed mean performance for lint cotton yield.

Table 9. Mean performance and stability parameters of cultivars for lint yield.

Genotypes	Lint yield in kentars feddan^{-1}										
	Environments							Stability parameters			
	E1	E2	E3	E4	E5	E6	Mean	b_i	S^2d_i	α	λ
G 45	8.41	7.32	6.56	6.52	4.70	4.49	6.33	0.90**	0.021	-0.03	5.08**
G 80	10.79	10.73	9.10	9.03	6.69	6.75	8.85	1.09	-0.042	0.03	2.02
G 83	9.23	9.09	8.01	8.04	5.48	5.41	7.54	1.02	-0.042	0.01	1.15
Dandara	10.95	11.02	9.52	9.54	7.10	7.13	9.21	1.05	-0.044	0.01	1.31
G 87	7.05	6.52	5.71	5.69	4.09	3.90	5.49	0.76**	-0.053	-0.07	6.68**
G 88	8.91	8.30	7.50	7.26	4.94	4.88	6.97	1.13	-0.448*	0.01	1.01
G 90	11.17	11.14	9.82	9.91	7.36	7.28	9.45	0.96	0.268	0.01	1.18
G 90*AS	11.95	12.05	10.26	10.30	7.78	7.86	10.03	1.10	0.071	0.04	3.59**
G 92	8.55	7.96	7.08	6.80	4.77	4.61	6.63	0.93	0.110	-0.01	0.87
Mean	9.67	9.35	8.17	8.12	5.88	5.81	7.83				
RLSD 0.05	1.04	1.99	1.96	1.47	1.55	1.45	1.75				

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

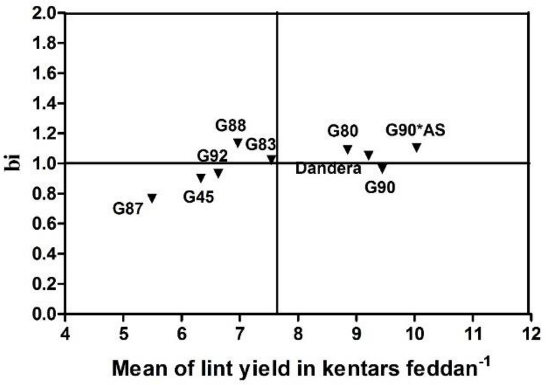


Fig. 5. Present graphically the relationships between the stability parameters (bi) and its mean performance of each cultivar for lint yield.

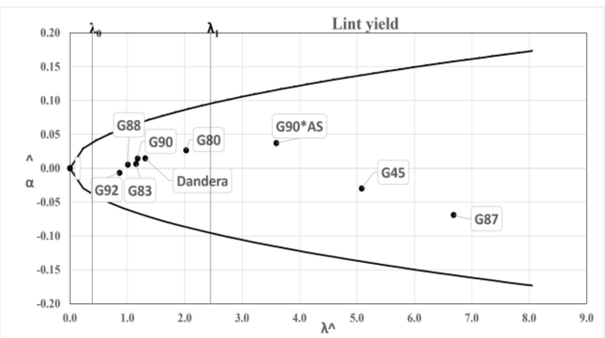


Fig. 6. Genotypic stability parameters of the nine cultivars for lint yield.

Principle components analysis

Principal component analysis (PCA) simplifies the complex data by transforming the number of correlated variables into a smaller number of variables called principal components. In Table 10 and Figure 7, PCA gives two important view of association among traits and classification of tested cultivars under different environments (2 years x 3 sowing dates). The result displayed that the Eigen value of PCA1 was higher than PCA2, highly related to all studied traits in Table 6. However, the PCA1 had the Eigen value 5.722 and contributed in 98.349% of the total variation with G 80, G 90, Dandera and G 90*AS cultivars. Meanwhile, the PCA2 had the Eigen value of 0.076 and explained 1.30% of the total variability with G92, G88, G87, G45 and G83. The biplot diagram showed that G90 and Dandera cultivars were located among all studied traits (Fig. 7). A very strong association was recorded between SCY and LY, increasing LY was associated with increasing SCY under different environments.

Table 10. Contribution of Principal Component Axis (PCA) to the variation of the traits in cotton cultivars.

Traits	PC 1	PC 2
Number of bolls/plant (NB/P)	0.61	-0.79
Seed cotton yield kentars feddan^{-1} (SCY)	0.44	0.23
Lint yield kentars feddan^{-1} (LY)	0.66	0.57
Eigenvalue	5.722	0.076
% variance	98.349	1.300
Cumulative variance	98.349%	99.65%

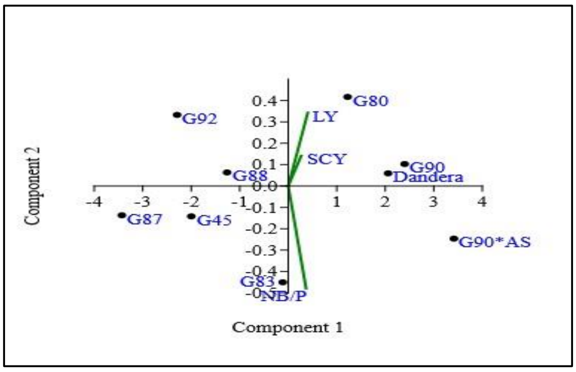
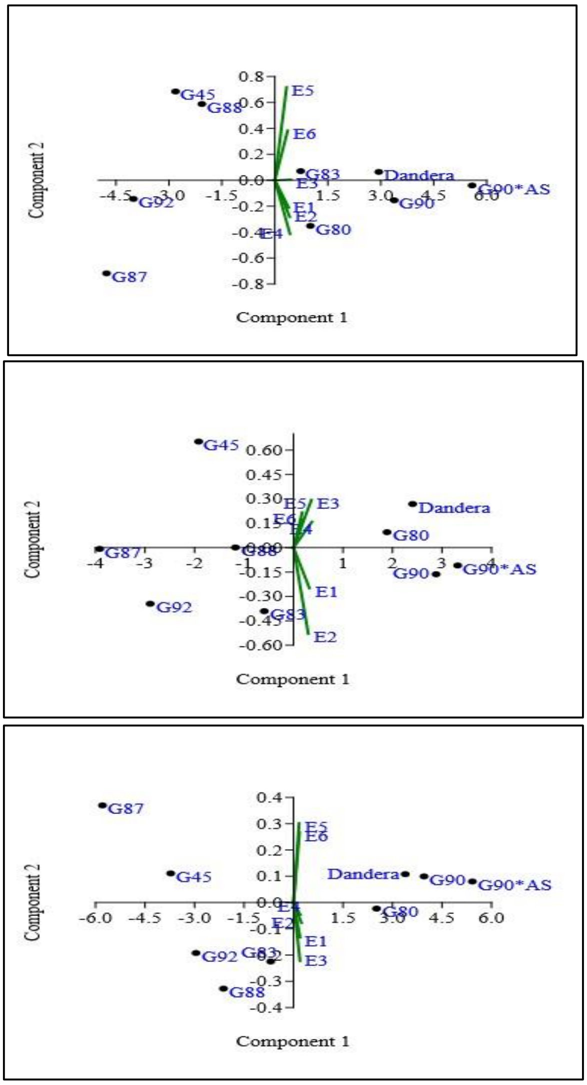


Fig. 7. Biplot diagram based on first two principal components (PCA1, PCA2) axes of the nine Egyptian cotton cultivars according to mean measured of studied traits in six environments.

Figures 8, 9 and 10, PCA gives two important pictures of association among environments and Classification of tested cultivars.Cultivars were classified into four groups based on biplots of PC1 vs. PC2 (Figures 8, 9 and 10).



Figs. 8, 9 and 10. A biplot of number of bolls/plant, seed cotton yield and lint yield for nine Egyptian cotton cultivars over six environments.

According to biplot analysis, the correlation coefficients between different environments were positive and highly significant with four cultivars for NB/P, SCY and LY, whereas these environments were located near G 80, Dandara, G 90 and G 90*AS cultivars for these traits (Stable genotypes over environments). Therefore, Dandera was located near E5 and E6 (Heat stress treatments) for all studied traits (Stable genotype for these condition). Kaya *et al.* (2002), Abdolshahi *et al.* (2010), Dadbakhsh *et al.* (2011) and Shivramakrishnan *et al.* (2016) were able to reveal that the genotypes with larger PCA1 and lower PCA2 scores gave high yields (Stable genotypes). Moreover, Chahal and Gosal (2002) cleared those characters with largest absolute value closer to unity within the first principal component influence the clustering more than those with lower absolute value closer to zero.

CONCLUSION

Characterizing the stability of nine Egyptian genotypes yield performance under different environments (Two growing seasons and three planting dates) according to Eberhart and Russell (1966) and Tai (1971), revealed that cultivars Dandara and Giza 90 were considered superior under the different environmental conditions as they showed high mean performance for NB/P, SCY and LY traits over these environments when compared with grand mean beside acceptable stability parameters (b_i near to one, S^2d_i non-significant,α stability value not significantly differed from zero and the λ statistic was not significantly differed from one). In addition, principal component analysis showed that Dandera and Giza 90 cultivars were located near all studied traits and environments (Stable genotypes over different environments). Therefore, Dandera cultivar was located near E5 and E6 (Heat stress treatments) for all studied traits (Stable genotype for these condition). According to our results the two cultivars (Dandera and Giza 90) can be recommended to be uses under a wide range of environmental conditions and use in breeding programs for high yielding ability in Upper Egypt conditions.

REFERENCES

Abd EL-Bary, A. M. R. (2013). Evaluation of some Egyptian cotton genotypes under different environments. J. Plant Production, Mansoura Univ., 4 (6), 957 – 972.

Abdelaziz S. Eman. (2014). Biometrical evaluation of some promising Egyptian cotton genotypes under different environmental conditions. M. Sc. Thesis Fac., Agric., Cairo University, Egypt.

Abdolshahi, R., Omidi, M., Talei, A.R. and YazdiSamadi, B. (2010). Evaluation of bread wheat genotypes for drought tolerance. Electron. J. Crop Prod., 3(1), 159-171.

Abro, S., Rajput, M.T., Sial, M.A., Deho, Z.A. and Rizwan, M. (2020). Stability analysis for seed cotton yield of newly developed upland cotton genotypes. Pak. J. Agri., Agril. Engg., Vet. Sci., 36(2), 97-100.

Ali, E. S. (2017). Stability and genetic diversity for yield and yield components in some Egyptian cotton genotypes. Egypt. J. Agric. Res., 95(4), 1613-1629.

Ali, E. Samia; Saleh, M.R.M. Eman and Srour, M.S.M. (2012). Evaluation of some long staple cotton strains under different environments. Egypt J. Plant Breed. 16(1),41-50.

Basu S, Ramegowda V, Kumar A and Pereira, A. (2016). Plant adaptation to drought stress. F1000 Research,5, F1000facultyrev–1554. https://doi.org/10.12688/f1000research7678.1.

Chahal, G.S. and S. S. Gosal (2002). Principal and procedures of plant breeding. Biot. Conventional approaches, New Delhi.

Dadbakhsh, A., Yazdansepas, A. and Ahmadizadeh, M. (2011). Study drought stress on yield of wheat (Triticum aestivum L.) genotypes by drought tolerance indices. Adv. Environ. Biol., 5(7), 1804-1810.

Dewdar, M. D. H. (2013). Stability analysis and genotype x environment interactions of some Egyptian cotton cultivars cultivated. Afr. J. Agric. Res., 8(41), 5156-5160.

Eberhart, S. A. and Russell,W. A. 1966. Stability parameters for comparing varieties', Crop Sci. (6), 36-40.

Einstein, A.R. (1996). Multivariable analysis. New Haven, CT: Yale University Press.

Ekinci R, Sema B, Emine K, Çetin K 2017. The effects of high temperature stress on some agro-nomic characters in cotton. Pak. J. Bot., 49, 503–508.

El Rawi, K., and A.M. Khalafalla (1980). Design and Analysis of Agricultural Experiments. El Mousel Univ., Iraq.

Gibely, H. A. Reham, Aziza M. Soultan, H. A. El-Hoseiny and E. A. Amer. (2015). Assessment of genetic variability and stability for some cotton genotypes. Egypt. J. Plant Breed., 19(6), 1783-1801.

Gibely, R.H.A. and Hassan, S. S. (2018). Estimating of stability parameters among some extra-long staple cotton genotypes under different environments. J. Plant Production, Mansoura Univ., 9 (5), 459-468.

Gomez, K. A. and Gomez, A. A. (1984). Statistical Procedures for Agricultural Research', 2nd Ed., John Wiley and Sons, New York, USA.

Kaya, Y., Plta, C and S. Taner, (2002). Additive main effects and multiplicative interaction analysis of yield performance in bread wheat genotypes across environments. Turk. J. Agric. For, 26, 257-259.

Oosterhuis DM and Snider JL (2011). High temperature stress on floral development and yield of cotton. In: Oosterhuis DM (ed) Stress physiology in cotton, vol 7. The Cotton Foundation, Cordova, pp 1–24.

Rahoumah, M. R. A.; A.M.R. Abd El-Bary; H.M.E. Hamoud; and Yehia., W.M.B. (2008). Assessment of genetic diversity and stability for yield trails of some Egyptian long-stable cotton genotypes. Egypt. J. Agric. Res., 86 (4), 1447-1462.

Said, A.A., Motawea, M.H., Hassan, M.S. and Roshdy, R. (2020). Mean performance and stability parameters for comparing some bread wheat cultivars under different environments. SVU-Inter. J. of Agri. Sci., 2 (2), 484-497.

Shivramakrishnan, R., Ajayarora, V., SINGH2, G.P., KUMAR3AND, B. and SINGH, V.P. (2016). Characterization of wheat genotypes for stay green and physiological traits by principal component analysis under drought condition. Inter. J. of Agri. Sci., 12(2), 245-251.

Snider JL and Oosterhuis DM (2012). Heat stress and pollen-pistil interaction. In: Oosterhuis DM, Cothren JT (eds) Flowering and fruiting in cotton. The Cotton Foundation, Cordova, pp 59–78.

Snider JL, Oosterhuis DM and Kawakami EM (2011). Diurnal pollen tube growth rate is slowed by high temperature in field-grown Gossypium hirsutum pistils. J. Plant Physiol., 168, 441–448.

Snider JL, Oosterhuis DM, Skulman BW and Kawakami EM (2009). Heat stress-induced limitations to reproductive success in Gossypium hirsutum. Physiol. Plant, 137, 125–138.

Tai, G. C. (1971). Genotype stability analysis and its application to potato regional trails. Crop Sci., (11), 184-190.

عوامل الثبات وتحليل المكونات الرئيسية لبعض أصناف القطن المصرية تحت ظروف بيئية مختلفة

علاء علي سعيد وياسر أحمد محمد حفني
قسم المحاصيل – كلية الزراعة – جامعة سوهاج – سوهاج – مصر

أجريت الدراسة الحالية بمحافظة سوهاج بمصر وذلك لاختبار الثبات الوراثى لبعض أصناف القطن المصرية عبر بيئات مختلفة باستخدام تحاليل الثبات تبعاً لاابيرهارد وراسيل (١٩٦٦) وتاي (١٩٧١) وتحليل المكونات الاساسية. حيث تم زراعة تسعة أصناف قطن مصري و في تصميم القطاعات الكاملة العشوائية في ثلاث مكررات تحت ٦ بيئات مختلفة (موسمان للزراعة ×٣ مواعيد زراعة). وتم دراسة صفات؛ عدد اللوز/نبات ومحصول القطن الزهر ومحصول القطن الشعر خلال موسمين متتاليين ٢٠١٧ و٢٠١٨. أظهر تحليل التباين للصفات المدروسة تباينًا كبيرًا بين الاصناف والبيئات وتفاعلاتها، مما يشير إلى أنها تباينت في استجاباتها للبيئات المتنوعة. كما أظهرت النتائج تفوق الصنفين دندرا وجيزة ٩٠ تحت الظروف البيئية المختلفة لإظهارهما أداءً عاليًا لصفات عدد اللوز/نبات ومحصول القطن الزهر ومحصول القطن الشعر عبر هذه البيئات عند مقارنتها بالمتوسط العام للأصناف للصفات المدروسة بجانب معايير الثبات المقبولة (b_i بالقرب من واحد، S^2d_i غير معنوية، قيمة α لا تختلف اختلافًا كبيرًا عن الصفر وλ لم تختلف اختلافًا كبيرًا عن واحد). ايضا أظهر تحليل المكونات الرئيسية ان الصنفين دندرا وجيزة ٩٠ موجودين بالقرب من جميع الصفات والبيئات المدروسة (كأصناف ثابتة عبر البيئات المختلفة). علاوة على ذلك كان الصنف دندرا يقع بالقرب من بيئات الزراعة المتأخرة (معاملات الإجهاد الحراري) لجميع الصفات المدروسة، مما يدل على ثبات هذا الصنف تحت هذه الظروف.