Menoufia J. Plant Prod., Vol. 5 April (2020): 91 - 105

EVALUATION AND STABILITY OF SOME EGYPTIAN COTTON VARIETIES UNDER NORMAL AND LATE SOWING CONDITIONS

S. A. Shaker, Y. M. El-Mansy, A.E.I. Darwesh and S. S. M. Badr
Cotton Res. Inst., Agric. Res. Center, Giza, Egypt.

Received: Feb. 9 , 2020 Accepted: Feb. 16 , 2020

ABSTRACT: ***The objective of this study was to determine the effect of sowing dates on cotton yield, its components and fiber quality characters and select the favorable variety for delaying sowing. Cotton growers face a problem of law cotton yield in late sowing (after clover or wheat) at Egypt. The present study was carried out to evaluate six varieties G. 86 , G.94 , G.95 , G.97 , G.92 and G.96 under normal and late sowing dates viz 15th April and 15th May during 2018 and 2019 at Sakha Agriculture Research Station in a randomized complete block design with four replications to study seed cotton yield , lint yield , boll weight , lint percentage, seed index , lint index , fiber length , length uniformity ratio , fiber strength and micronaire reading. All characters showed significant mean squares for varieties in normal and late combined analysis, except fiber strength and micronaire reading and in the combined analysis for normal and late sowing dates. Mean squares for sowing dates were significant for all characters, except fiber length and length uniformity ratio. The main cause of reduction in cotton yield due to that all the Egyptian cotton varieties were needed to grow under full season conditions. It is concluded that varieties G. 97 , G. 95 and G. 94 are response to late sowing date also, G. 96 is somewhat response tolerant but, it had few seed cotton yield to both sowing dates. Fiber quality characters over few affected by late sowing date. Varieties Giza 97, Giza 95 and Giza 94 are average stable and favorable to late sowing date for seed cotton yield according to (Eberhart and Russiell) and GGE- Biplot analyses.***

Key words: ***Evaluation, Stability, GGEbiplot, Normal and late sowing, cotton.***

INTRODUCTION

Field evaluation of different varieties (old or even new varieties) grown under different late sowing dates compared to the optimums sowing dates is considered as starting point to select varietys that can response to culture late sowing and being stable across environmental conditions of usual and late sowing. Furthermore, the adverse conditions of late sowing not only influence the cotton yield, but also mask any genetical improvement in cotton yield and fiber traits Pettigrew and Meredith, (2009).Thus, genotype by environment (GE) interaction complicates the selection of genotypes to be adapted to new environments. Some of Egyptian cotton growers used to delay cotton sowing date after March to have one extra cut from Clover (the preceding crop of cotton from October to March) (Elayan *et al.*, 2015). Most growers may delay sowing dates to late April or early May because of long duration period of winter crops like wheat Abdalla and Abd- El-Zaher, (2012). Various research reports showed that cotton genotypes are greatly affected in both seed cotton yield and fiber quality traits by delaying sowing date, with different magnitudes which vary with cotton genotypes Bange *et al.*, (2008), Gadallah (2002), Baker *et al.*, (2012), Abdalla (2013 and 2014) and Elayan *et al.*, (2015). Gadallah (2002) noticed that seed cotton yield decreased by 38.91 and 63.16% due to delaying cotton sowing to 10 and 25 April, in respective order as compared with first sowing date on 20 March over two

seasons. Therefore, this problem is one of the big challenges to Egyptian cotton breeders nowadays; they should improve and produce new tolerant or adapted genotypes to late sowing. El- Zeky *et al.*, (2007) stated that, the Egyptian cotton cultivar G. 86 gave a significant decrease in number of open bolls per plant, boll weight, lint percentage and cotton yield per plant and Faddan due to late sowing. Elayan *et al,.* (2015) found that delaying sowing pushed cotton plants for an early flowering and maturity, and the seed cotton yields per plant and per Faddan were consistently decrease with each 15-days delay in sowing due to a significant decrease in each of the number of open bolls/plant and boll weight. Iqbal and Khan (2011) found that over decrease in seed cotton yield, but over few decrease in boll weight, fiber length and micronaire reading due to late sowing date. Baker *et al.*, (2012) identified parents and crosses of Egyptian cottons tolerant to late sowing. Deho *et al.*, (2012)and Kakar *et al.*, (2012) cleared that decrease in seed cotton yield, boll weight, seed index, fiber length and micronaire reading due to late sowing date. Mahdy *et al.*, (2017) found that decrease in seed cotton yield, lint yield, lint percentage, boll weight and seed index due to late sowing date.

The objective of this study was to determine the effect of sowing dates on cotton yield, its components and fiber quality characters and select the favorable variety for delaying sowing.

MATERIALS AND METHODS

A sowing date trial of two sowing dates (April 15 and May 15) was laid out to investigate the appropriate sowing time of six Egyptian cotton varieties: two from extra long staple category (Giza 92 and Giza 96) and four long staple category (Giza 86, Giza 94, Giza 95 and Giza 97) at Sakha Agriculture Research Station during 2018 and 2019 seasons. This experiment was conducted in four replications with plot size 52 m^2 (i.e. 10 rows, 8m. Long and 0.65 m. distance between rows) in a randomized complete block design (RCBD). Distance between hills was 25 cm apart and each hill was thinned to two plants per hill after six weeks from planting.

Data were collected for the following characters:

- Seed cotton yield (SCY, K/F) in kentar per faddan.
- Lint yield (LCY, K/F) in kentar per faddan.
- Boll weight (BW, g): average weight of 50 bolls in gram.
- Lint percentage (LP, %): the ratio of lint weight to seed cotton weight in the sample expressed as percentage.
- Seed index (SI, g): Weight of 100 seeds in grams.
- Lint index (LI, g): weight of lint produced by 100 seeds in grams.

Fiber properties were measured by using High Volume Instrument (HVI) according to (A.S.T.M. D-4605-1986) for fiber properties:

- Fiber length (upper half mean mm) (FL,mm).
- Length uniformity ratio (LUR, %).
- Micronaire reading (MR).
- Fiber strength (pressly)
- (FS). Measured by the pressly tester at the zero gage length recorded as pressly index.

Statistical analysis:

- Combined analysis for each character under study was done across the two sowing dates (a) combined analysis for normal sowing date across two years, (b) combined analysis for late sowing date across two years and (C) combined analysis for normal plus late sowing dates across two years. Before calculating the combined analysis, a Bartlett test (1937) was performed for the homogeneity of error mean squares for the six environments. The significant differences between means were carried out using by LSD. All above – mentioned analysis was statistically analyzed as outlined by Snedcor and Cochran (1989). These computations were performed using (SPSS procedure, 1995).

- Stress susceptibility index (SSI): Stress susceptibility index was calculated according to the method of Fischer and Maurer (1978).

Yield of individual variety was determined under stress (Yl) (late sowing) and favorable (Ye) (normal sowing) conditions. Average yield of all varieties under late (X l) and early conditions (X e) were used to calculate stress intensity (D) as: D = 1 - Xl/X e (Fischer and Maurer 1978).

The mean stress susceptibility index (S) of individual variety was calculated as: S = (1 – Y l/Ye)/D (Fischer and Maurer 1978)

Varieties with average susceptibility or resistance to stress have "S" value of 1.0, values less than 1.0 indicate less susceptibility and great resistance to drought. Meanwhile, a value of S = 0.0 indicates maximum possible stress resistance (no effect of stress on yield)

- Stability analysis was computed according to Eberhart and Russell (1966), to detect the phenotypical stability. In the analysis of the data, the genotypes were treated as fixed variables, while environments and replications were considered as random variables. A genotype having unit regression coefficient (b=1), the deviation is not significantly different from zero (S^2d = zero) and above yielding ability is considered to be stable.
- The GGE–biplot methodology, which is composed of two concepts (Gabriel 1971) and the GGE concept (Yan *et al*., 2000) was used to visually analyze the multi-environment yield trails (MEYTs) data. The methodology uses a biplot to show the factors (genotype and genotype by environment interaction) that are also the sources of variation. In this study, genotype–focused scaling was used in visualizing for genotypic comparison with environment-focused scaling for environmental comparison. Besides, the symmetric scaling was preferred in visualizing the which–won–where pattern of the MEYTs yield data (Yan and Rajcan 2002).

RESULTS AND DISCUSSION

Evaluation of six varieties for two seasons, means, variance, reduction % and susceptibility index and mean squares for all the studied characters as shown in Tables (1a, 1b and 1c) indicates:

Significant (p ≤ 0.05 or p ≤ 0.01) differences among varieties in separate [(Normal 2018 + 2019) and (late 2018 and 2019)] and combined analysis (normal and late for two years) under normal and late sowing for all characters, except fiber strength in separate late sowing date and micronaire reading in normal and late sowing. The combined analysis for sowing dates (D) Table (1c) showed significant (p ≤ 0.05 or p ≤ 0.01) for all characters, except fiber length and length uniformity index. These results agreed with those reported by Bozbec *et al*., (2006), Baker *et al*., (2012), Elayan *et al*., (2014 and 2015) and Mahdy *et al*., (2017). The varieties X dates was significant for seed index, lint index and fiber strength, also the interaction of variety x year x date was significantly only for fiber strength. Furthermore, years mean squares under normal and late sowing dates Tables (1a) and (1b) were not significant for fiber quality, fiber length, length uniformity ratio and micronaire reading also, in Table (1c) sowing dates, the interaction between year x date , variety x date and variety x year x date were not significant for fiber length and length uniformity ratio, also variety x date and variety x date x year for the two previous characters and micronaire

Table (1 a): Mean squares of the combined analysis under normal sowing date of the six varieties over two years.

SOV	DF	SCY/kf	LY/kf	BW	LP	SI	LI	FL	LUR	FS g/tex	MR
Years(Y)	1	262.081**	412.427**	0.43039*	8.0688*	9.0133**	1.1519**	0.8614	6.446	287.141**	0.02521
R(Y)	6	0.998	1.95	0.02229	0.6739	0.3554	0.0298	0.2828	1.09	0.39	0.1041
Varieties (V)	5	7.244*	16.7**	0.25053*	23.396**	5.0142**	4.7837**	27.9444**	5.4707*	61.619**	0.44606
V×Y	5	1.137	1.195	0.03703	0.7063*	0.3575	0.2247	0.8369**	0.6334*	2.091**	0.12309**
Error b	30	0.76	1.144	0.01922	0.2443	0.2589	0.1019	0.2161	0.2053	0.456	0.03027

Table (1 b): Mean squares of the combined analysis under late sowing date of the six varieties over two years.

SOV	DF	SCY/kf	LY/kf	BW	LP	SI	LI	FL	LUR	FS g/tex	MR
Years(Y)	1	226.331**	282.464**	0.14741	48.2804**	14.8408**	0.2655	13.2405	1.377	200.901**	0.53763
R(Y)	6	0.139	0.08	0.02993	0.7161	0.2601	0.0666	2.8412	0.8996	0.307	0.3663
Varieties (V)	5	5.349*	11.712*	0.23537*	21.0614**	7.176*	4.4908*	22.2818*	2.691**	39.067	0.2127
V×Y	5	1.031*	2.284**	0.04618**	0.8399	1.1342**	0.6727**	3.0352**	0.151	11.747**	0.18761**
Error b	30	0.375	0.623	0.00786	0.4724	0.1683	0.1048	0.6048	0.3837	0.295	0.03752

reading, indicating that the different characters were stable from year to year either for normal or for late sowing dates.

Table (1 c): Mean squares of the combined analysis under sowing dates of the six varieties over years.

SOV	DF	SCY/kf	LY/kf	BW	LP	SI	LI	FL	LUR	FS g/tex	MR
Years(Y)	1	487.757**	688.76**	0.03721	8.4372**	0.3614	0.156	10.428*	6.8908*	484.202**	0.39784
Dates(D)	1	226.72**	387.287**	2.60371**	21.603**	63.1639**	38.4434**	0.2795	1.2742	2.94*	1.712*
Y× D	1	0.655	6.131*	0.5415**	47.912**	23.4927**	1.2627**	3.6738	0.9322	3.84**	0.165
R(Y D)	12	0.569	1.015	0.02613	0.695	0.3078	0.0482	1.562	0.9948	0.349	0.2352
Varieties (V)	5	11.4**	26.373**	0.44739**	42.9701**	11.0673**	8.776**	49.7223**	7.1944**	95.281**	0.5717**
V×Y	5	1.267	2.517*	0.06384**	1.4029**	1.204**	0.7736**	2.9147**	0.4851**	8.121**	0.25349**
V× D	5	1.193	2.039	0.03856*	1.4873**	1.123**	0.4971**	0.5039	0.9673*	5.405**	0.08706*
V×D×Y	5	0.901	0.961	0.01932	0.1432	0.2876	0.1234	0.9573	0.2993	5.717**	0.05721
Error b	60	0.568	0.884	0.01349	0.3584	0.2136	0.1034	0.4105	0.2945	0.375	0.03389

Mean seed cotton yield and lint yield (Table 2) indicated that late sowing date was reducing normal sowing with (31.40 % and 33.5 %), respectively. Table (3) cleared that, the variety G. 86 showed the lowest seed cotton yield and lint yield in both sowing dates. The varieties G. 94, G. 95 and G. 97 had the highest yielding in both dates for two characters. Seed cotton yield ranged from 8.60 K/F for G. 86 and G. 96 to 10.59 K/F for G. 95 with an average of 9.79 K/F under normal date and from 5.35 K/F for G. 86 to 7.57 K/F for G. 95 with an average 6.71 K/F under late sowing. Also, the same trend for lint cotton yield ranged from 10.39 K/F for G. 86 to 13.45 K/F for G. 95 with an average 11.99 K/F under normal date and from 6.37 K/F for G. 86 to 9.43 K/F for G. 95 with an average 8.04 K/F. Late sowing date caused great reduction 31.40 and 32.94% in combined data. In this concern Bozbek *et al.*, (2006) stated that delay sowing decreased seed cotton yield. In this concern Gadalla (2002) and Elayan *et al.*, (2014 and 2015) found decrease in seed cotton yield with delaying sowing dates. Baker *et al.*, (2012) and Elayan *et al.*, (2014) found that general trend in decreasing lint yield with later dates of sowing.. Mahdy *et al.*, (2017) found decrease in seed cotton yield and lint yield with late sowing date.

The results cleared that stress susceptibility index varied from normal and late sowing date. Data from Table (3) showed that the highest susceptibility index (S) for seed cotton yield were recorded for the varieties G. 86 and G. 92 (1.20 and 1.15) and for lint yield were (1.18,1.11 and 1.14) for the same previous varieties. These, varieties could be considered susceptible to late sowing, while the other varieties G. 95, G. 97 and G. 94 considered tolerant to late sowing because, they recorded stress susceptibility index less than or equal unity, while G.96 recorded stress susceptibility index less than unity, but it had less seed cotton yield in both sowing dates. Mahdy *et al.*, (2017) found that the same conclusion for some cotton varieties under study.

The results in Table (2) cleared that late sowing date was less boll weight than normal sowing with 9.99 %. Table (3), this explained the variety G. 94 variety recorded the highest boll weight, flowed by G. 97, G. 95 and G. 96, respectively in two sowing dates. The variety G. 86 was large affected by susceptibility index. This variety could be considered susceptibility. While G. 92 recorded the lowest boll weight in two sowing dates shared with it significant G. 86 in late sowing. The tolerant varieties were G. 95, G. 97, G. 92, G. 96 and G. 94 which show susceptibility index less than or equal unity (0.87, 0.70, 0.93, 0.89 and 1.05 respectively). El- Sayed and El-Menshawi (2001), Deho *et al.*, (2012), Elayan *et al.*, (2015) and Mahdy *et al.*, (2017) reported that boll weight was decreased with late sowing date.

Table (2): Means of the traits studied of the 6 varieties under sowing dates over two years.

Sowing Date	SCY/kf	LY/kf	BW	LP	SI	LI	FL	LUR	FS g/tex	MR
Normal	9.79	11.99	3.30	38.64	10.99	6.94	33.06	85.60	44.70	4.26
late	6.71	7.97	2.97	37.70	9.37	5.67	32.95	85.37	44.35	3.99
LSD 0.05	0.34	0.45	0.07	0.37	0.25	0.10	NS	NS	0.26	0.22
LSD 0.01	0.47	0.63	0.10	0.52	0.35	0.14	NS	NS	NS	NS

Table (3): Means of the traits studied of the 6 varieties under normal and late sowing dates over two years and stress susceptibility index (s).

Variety	Normal	Late	S	Reduction%	Normal	Late	S	Reduction%
	Seed Cotton Yield, kf				Lint Cotton Yield, kf			
G 86	8.60	5.35	1.20	37.83	10.39	6.37	1.18	38.71
G 94	10.50	7.04	1.05	32.95	13.24	8.41	1.11	36.48
G 95	10.59	7.57	0.91	28.50	13.45	9.43	0.91	29.86
G 97	10.46	7.42	0.93	29.10	13.15	9.14	0.92	30.46
G 92	10.00	6.40	1.15	36.03	11.24	7.03	1.14	37.39
G96	8.57	6.51	0.77	24.04	10.48	7.86	0.76	25.01
Average	9.79	6.71			11.99	8.04		
Reduction%	31.40				32.94			
LSD 0.05	0.89	0.63			1.09	0.81		
LSD 0.01	NS	NS			1.47	NS		
	Boll weight, g				Lint percentage, %			
G 86	3.29	2.78	1.54	15.33	38.09	37.56	0.57	1.40
G 94	3.63	3.25	1.05	10.51	39.85	37.69	2.22	5.44
G 95	3.28	3.00	0.87	8.72	40.02	39.29	0.75	1.83
G 97	3.29	3.06	0.70	7.03	39.72	38.89	0.86	2.11
G 92	3.10	2.82	0.93	9.30	35.52	34.69	0.95	2.33
G96	3.20	2.92	0.89	8.90	38.66	38.07	0.62	1.53
Average	3.30	2.97			38.64	37.70		
Reduction%	9.99				2.45			
LSD 0.05	0.14	0.14			0.50	0.70		
LSD 0.01	NS	NS			0.68	0.95		
	Seed Index, g				lint Index, g			
G 86	10.87	8.21	1.66	24.49	6.69	4.94	1.45	26.20
G 94	12.51	11.00	0.82	12.11	8.28	6.65	1.08	19.65
G 95	10.31	9.01	0.85	12.55	6.86	5.83	0.83	15.04
G 97	10.99	9.79	0.74	10.91	7.23	6.23	0.76	13.84
G 92	10.87	9.28	0.99	14.62	5.98	4.93	0.97	17.62
G96	10.42	8.95	0.96	14.16	6.57	5.50	0.90	16.34
Average	10.99	9.37			6.94	5.68		
Reduction%	14.76				18.12			
LSD 0.05	0.52	0.42			0.33	0.33		
LSD 0.01	0.70	NS			0.44	NS		

Table (3): Cont.

Variety	Normal	Late	S	Reduction%	Normal	Late	S	Reduction%
	Fiber length, mm				Length Uniformity Ratio, %			
G 86	33.34	32.70	9.26	1.92	86.22	85.50	3.09	0.83
G 94	33.97	33.64	1.11	0.23	86.24	85.28	4.16	1.12
G 95	29.59	30.02	-5.89	-1.22	84.06	84.30	-1.05	-0.28
G 97	32.70	32.69	2.10	0.43	85.30	85.39	-0.38	-0.10
G 92	33.67	33.65	-2.18	-0.45	85.81	85.89	-0.34	-0.09
G96	35.07	35.01	0.88	0.18	85.96	85.86	0.45	0.12
Average	33.06	32.95			85.60	85.37		
Reduction%	0.33				0.27			
LSD 0.05	0.47	0.79			0.46	0.63		
LSD 0.01	0.64	NS			NS	0.85		
	Fiber Strength, g/tex				Micronaire Reading			
G 86	46.38	45.20	3.24	2.53	4.23	3.87	2.11	8.68
G 94	44.15	44.00	0.43	0.34	4.30	3.98	0.90	3.72
G 95	39.35	40.65	-4.22	-3.30	4.65	4.18	2.50	10.29
G 97	45.38	43.33	5.77	4.52	4.31	4.19	-1.35	-5.57
G 92	46.23	46.53	-0.83	-0.65	3.98	3.79	0.80	3.28
G96	46.70	46.38	0.89	0.70	4.05	3.93	0.72	2.96
Average	44.70	44.35			4.26	3.99		
Reduction%	0.78				6.28			
LSD 0.05	0.69	NS			NS	NS		
LSD 0.01	0.93	NS			NS	NS		

With respect to lint percentage, the results in Table (3) showed that, the highest values for G. 95 under early and late sowing dates, the means ranged from 35.52 for G. 92 to 40.02 % for G. 95 under normal sowing. The same trend for late sowing to the same varieties 34.69 to 39.29 %. The reduction of late sowing date was 2.45 %. This reduction could be due to that lint percentage a complex character depend on weight of lint and seed cotton and both were affected by late sowing date. These results agreed with Elayan *et al.*, (2013 and 2015) and Mahdy *et al.*, (2017). Stress susceptibility index for lint percentage indicated that only G. 94 variety was the most affected but, the rest varieties were the best tolerant for late sowing date where, they less than unity.

Data in Tables (2 and 3) cleared that the reduction of seed index was 14.76 for late sowing date. The variety G. 94 recorded the highest seed index for normal and late sowing dates, while G. 95 recorded the lowest seed index under normal sowing and G. 86 under late sowing . All varieties, except G. 86 have susceptibility index less than unity so, they tolerant to late sowing for this trait while, G. 86 considered susceptible to delaying sowing. These results are in agreement with Elayan *et al.*, (2015) and Mahdy *et al.*, (2017).

Lint index a complex character where it depend on weight of lint and seed cotton, the reduce with cause late sowing date was 18.12% Tables (2 and 3) The variety G. 94 recorded the highest lint index under both normal and late sowing but, the lowest values were G. 92 under two sowing dates also, G. 86 under late sowing .The varieties G. 95, G. 97, G. 92, G. 96 and G.94 had susceptibility index less than or equal unity, so, they the best response varieties in lint index.

The fiber quality characters, fiber length, length uniformity ratio and fiber strength were affected significantly by sowing date (separate) Table (3), while micronaire reading is non - significant Table (3). The combined of data in Table (2) indicated that fiber length, length uniformity ratio and micronaire reading were non- significant for sowing dates, while fiber strength character affected significantly by sowing dates .The reduction owing late sowing date is over few .These findings are again in accordance with Iqbal and Khan (2011) and Deho *et al.*, (2012).

Analysis of stability for seed cotton yield using Eberhart and Russiell and GGE- Biplot methods.

Yield performance and stability of varieties.

In Table (4); environment + (variety x environment) interaction source of variation was partitioned into environment (linear), variety x environment (linear) interaction (sum of square due to regression, b_i) and unexplainable deviation from regression (pooled deviation mean square; S^2d_i). The data in Table (4) indicated that the variety × environment linear was insignificant for seed cotton yield; indicating that varieties did not response differently to different environments. These results suggested that the major components for differences in stability parameters were due to deviation from the linear function. Therefore, it may be concluded that the relatively unpredictable component is more important than the predictable one (linear response). These results agreed with those reported by Gill and Singh (1982). The pooled deviations were found to be significant for seed cotton yield indicating that the major components for differences in stability were due to deviation from linear function. Change of character over environments due to the change of gene expression under different environments.

Table (4): Mean squares for the studied characters of six Egyptian cotton varieties grown at 4 environments (two normal and two late sowing dates).

SOV	DF	MS
V	5	11.412**
E+(V * E)	(18)	40.66**
E Linear	1	715.16**
V*E Linear	5	0.512
Pooled Dev	12	1.184*
Resid.	72	0.5

Total	95	

It is evident that the variety which exhibited greater production and had regression coefficient and deviation from regression did not significantly differ from unity and zero ($b_i = 1$ and $S^2d = 0$) respectively, is stable variety according to Eberhart and Russel (1966). Therefore, from Table (5) the varieties G.97, G.95 and G.94 had average stability for seed cotton yield, because it had high seed cotton yield greater than grand mean and $b_i = 1$ and $S^2d = 0$). So, it could be recommended as stable varietys for late sowing date (Hassan *et al.,* 2012).

The varieties evaluated by an average environment coordination (AEC) method, on average environment is defined by the average PC1 and PC2 scores of all environments, represented by a small circle (Fig. 1). A line was then drawn to pass through this the average environments and biplot origin this average environment axis serves as the abscissa of the AEC. The ordinate of the AEC is the line that passes through the origin and the direction away from the biplot origin, indicates greater GEI effect and reduced stability. The AEC ordinate separates varieties with below average means from those with above average means.

The results indicated that, the varieties Giza 97, Giza 95 and Giza 94 recorded high seed cotton yield (KF) above average means in normal and late sowing date (Table 3). With respect to (Fig. 1) the length of the average environments vector was sufficient to select varieties based on yield mean performance. So, the varieties Giza 97, Giza 95 and Giza 94 could be selected for late sowing date, while the rest varieties may be discarded. Also, a longer projection to the average environment coordination (AEC) (Fig. 1), regardless of the direction, represents a greater of the GEI varieties which indicates that it is more variable and less stable across environments or *vice versa*. The same results are obvious from estimates of stability analysis. It is evident that the variety which exhibited greater production and had regression coefficient and deviation from regression did not significantly differ from unity and zero, respectively, is stable variety according to Eberhart and Russel (1966). Therefore, the varietirs Giza 97, Giza 95 and Giza 94 had average stability for seed cotton for normal and late sowing dates. These results are in agreement with those reported by El-Shaarawy *et al.,* (2007) and Shaker *et al.,* (2019).

Table (5): Averages of varieties and estimates of stability parameters for seed cotton yield over 4 environments (two normal and two late sowing dates).

Variety	Mean (x)	Regression coefficient (b_i)	Deviation from regression (S^2d_i)
G 86	6.98	1.1041	0.0108
G 94	8.77	0.9126	0.1903
G 95	9.08	0.9619	0.0167
G 97	8.94	1.0345	0.0553
G 92	8.20	1.0035	0.2597*
G 96	7.54	0.9835	0.5463**

Grand mean	**8.25**		
LSD 0.01	**0.71**		

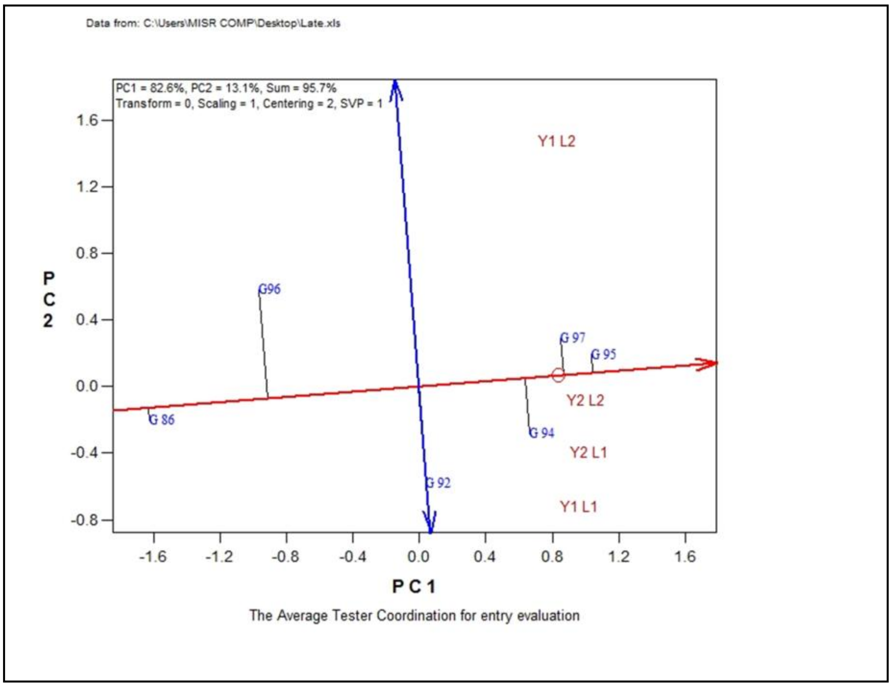

Fig. 1: Average environment coordination (AEC) view of the GGE-biplot for the means performance and stability of varieties.

Ideal varieties analysis.

Ideal varieties concept of GGE biplot clear that the closer varieties located relative to the ideal varieties are given in the (Fig. 2). In addition, using ideal varieties as the center concentric circles were drawn to help envision the distance between each variety and the ideal variety because the units of both PC1 and PC2 for the varieties are the original unit of yield in the variety focused scaling (Fig. 2). Consider of the ranking of the varieties, using the ideal variety understandable of GGE-biplot, Giza 97, Giza 95 and Giza 94 were the best varieties which were into the circle center. These results are in agreement with those obtained by Shaker *et al.,* (2019).

Relationships among varieties.

If the data is sufficiently approximate by the biplot will the cosine of the angle between the vectors of two testers (varieties) approximates the correlation coefficient between them. Also, if the biplot explains a large portion of the total variation more than 50% (95.7% in this case), the angles exactly shows the correlations among the entries (varieties). Two varieties are positively correlated when the angle between their vectors is < 90 a degree, while they are negatively correlated when the angle is > 90 a degree. Two varieties are independent if the angle between them is 90 a degree (Yan *et al.*, 2001). Relationships among the varieties are presented in (Fig. 3) the angles among the vectors of lines varieties Giza 97, Giza 95 and Giza 94 were all acute less than 90 degree cleared that they are positively correlated. While, the other

varieties were not correlated or negatively correlated among the previous varieties because the angles among them were equal > 90 degree, (Hamoud (2008) and Shaker *et al.,* 2019).

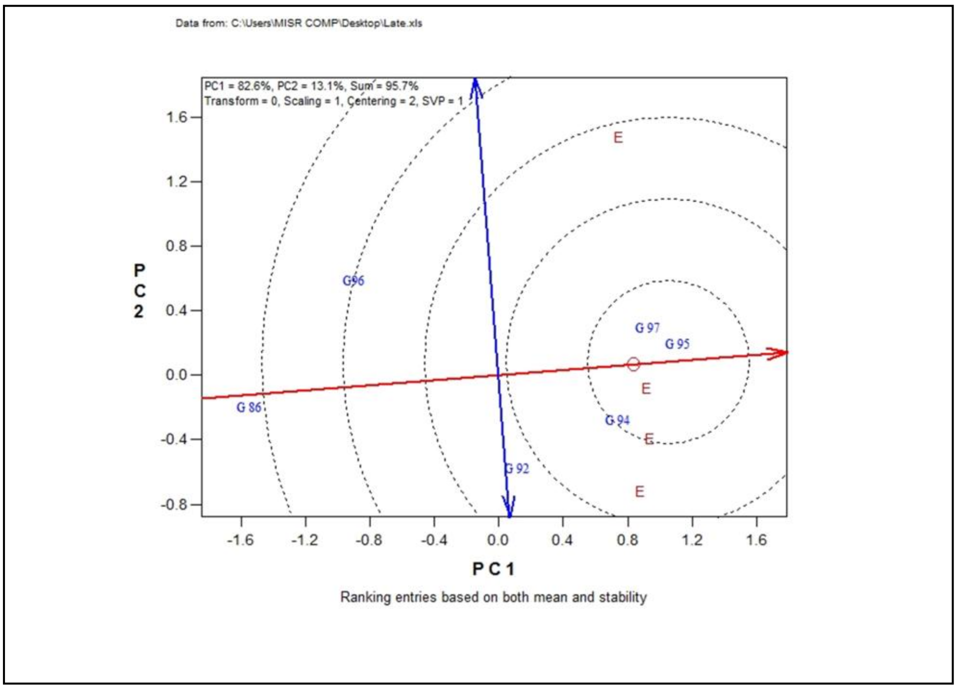

Fig. 2: Ranking of varieties based on both mean and stability refers to ideal varieties.

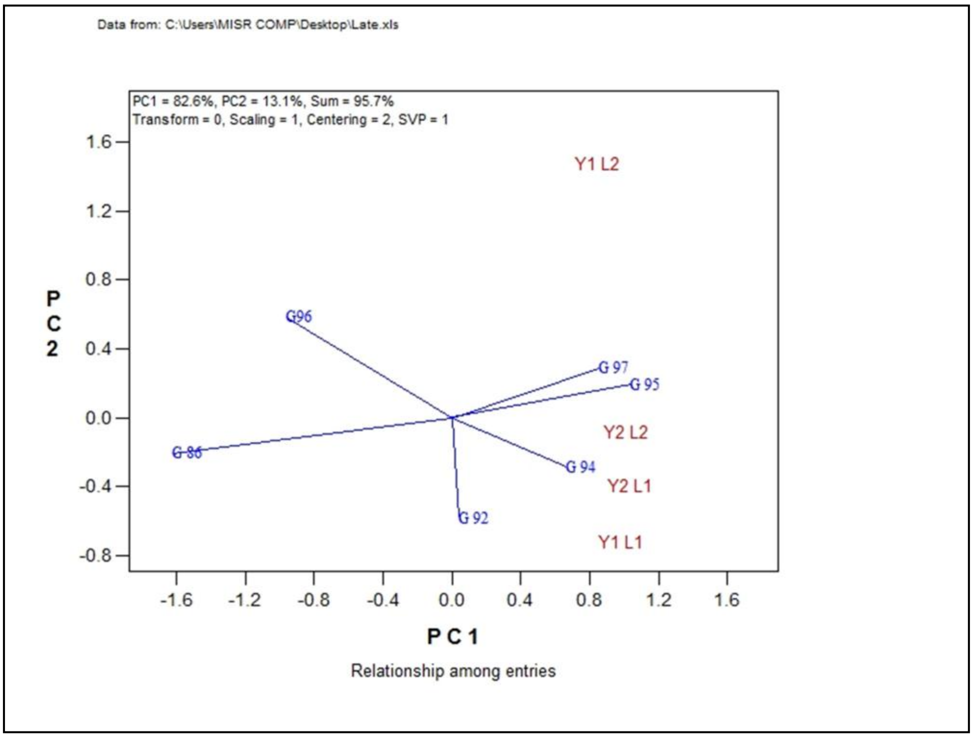

Fig. 3: Biplot of relationships among six varieties in four environments.

Conclusion

The main cause of reduction in cotton yield due to that all the Egyptian cotton varieties were needed to grow under full season conditions. It is concluded that varieties G. 97, G. 95 and G. 94 are response to late sowing date also, G. 96 is somewhat response tolerant but, it had few seed cotton yield to both sowing dates. Fiber quality characters over few affected by late sowing date. Varieties Giza 97, Giza 95 and Giza 94 are average stable and favorable to late sowing date for seed cotton yield according to (Eberhart and Russiell) and GGE- Biplot analyses.

REFERENCES

Abdalla, A. and Sh. R. Abd- El-Zaher (2012). Promoting- Egyptian cotton sustainability over time, space, and agro-economic variables. 2nd Alexandria International Cotton Conference. Fac. Agric. Saba Basha. Alex. Univ. April 10 -11th. pp321-326.

Abdalla, A. (2013). Joint regression and ordination analysis techniques of GXE interaction for the shortening growing season of cotton. Egypt. J. Plant Breed. 17(6): 99-116.

Abdalla, A. (2014). Factorial cross analysis of yield and earliness in *Gossypium barbadense* cottons grown on divergent sowing dates. Egypt. J. Plant Breed.18 (4): 607-628.

A.S.T.M. (1986). American society for testing materials, D- 4605. U.S.A.

Baker, K. M.A., A.B.A. El-Fesheikawy and H.S. Khalifa (2012). Evaluating late planting stress tolerance indices for some cotton genotypes. Egypt. J. Plant Breed. 16 (4):61 – 74.

Bange, M. P., S. J. Caton and S. P. Milroy (2008). Managing yields of high fruit retention in transgenic cotton (*Gossypium hirsutum* L.) using sowing date. Australian Journal of Agricultural Research 59:733-741.

Bartlett, M.S. (1937). Properties of sufficiency and statistical tests. Proceedings of Royal Statistical Society , Series A 160, 268-282.

Bozbek, T., V. Sezener and A. Unay (2006). The effect of sowing date and plant density on cotton yield. J. Agron. 5(1):122-125.

Deho, Z. A., S. Laghari, S. Abro, S. D. Khanzad and Fakhuruddin (2012). Effect of sowing date and picking intervals at boll opening percent, yield and fiber quality of cotton. Sci. Tech and Dev., 31 (3): 288- 293.

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

Elayan, Sohair E.D., A.M.A. Abdalla, Abdel-Gawad, S.D. Nadia and A.E. Faramawy Wageda (2015). Effect of Delaying Planting Date on Yield, Fiber and Yarn Quality Properties in Some Cultivars and Promising Crosses of Egyptian Cotton. American-Eurasian J. Agric. & Environ. Sci., 15 (5): 754-763.

Elayan, Sohair E.D., Amany M. Abdallah, M.A. Elsayed and Rania M. Abdel-Twab (2013). Effect of some growth regulators under different planting dates on growth and yield of cotton Bull. Fac. Agric. Cairo Univ., (64): 116-128.

Elayan, Sohair E.D., Amany M. Abdallah, Nadia S. Abd El-Gawad and Shimaa S.A. Younies (2014). Evaluation of Some Long Staple Cotton Genotypes Cultivated Under Different

Environmental Conditions. American-Eurasian J. Agric. & Environ. Sci., 14 (6): 546-554.

El-Sayed, E.A. and M. El-Menshawi (2001). Response of late sowing cotton cultivar (Giza 88) to time of potassium application under different levels of nitrogen. J. Agric. Sci. Mansoura Univ., 26(9): 5177-5188.

El-Shaarawy, S.A., A.M.R. Abd El-Bary, H.M. Hamoud and W.M.B. Yehia (2007). Use of high efficient AMMI method to evaluate new Egyptian cotton genotypes for performance stability. The world cotton Res. Conf. 4 (September 10-14).

El-Zeky, M.M., S.G. Metwally, Sh. Z. Saleh and I.M.M. Banna (2007). Influence of sowing date, nitrogen and potassium fertilization on cotton yield under saite affected soils in north of Delta. J. Agric Sci. Mansoura Univ., 32(7): 5943-5950.

Fischer, R. A. and R. Maurer (1978). Drought resistance in spring wheat cultivars. Part 1: Grain yield response. Augt J. Agric. Res. 29: 897-912.

Gabriel, K. R. (1971). The biplot graphic display of matrices with application to principal component analysis. Biometrika 58: 453-467.

Gadallah, R.A. (2002). Growing cotton after Faba Bean. Ph.D Thesis Fac. of Agric., Cairo Univ., Giza, Egypt.

Gill, S.S. and T.H. Singh (1982). Stability parameters for yield components in upland cotton (G. hirsutum L.) Indian. J. Gent & Cytol. 11: 9-13.

Hassan, S.A.M., S.S.M. Badr and I.S.M. Hassan (2012). Study of phenotypic stability of some Egyptiaan cotton genotypes under different environments. Egypt. J. of Apple. Sci., 27 (6); 298-315.

Hamoud, H. M. E. (2008). Studies on genotype x environment interaction using GGE–Biplot analysis for seed cotton yield in delta region of Egypt. Egypt. J. Agric. Res, 86 (6): 2351–2364.

Iqbal, M. and M. A. Khan (2011). Response of Cotton genotypes to planting date and planting soacing. Front J. Agric., China 5 (3): 262- 267.

Kakar, N. U., F. C. Oad, S. Tunio, Q-U. Chachar and M. M. Kandhro (2012). Response of sowing time to various cotton. Sahard J. Agric., 28 (3): 379-385.

Mahdy, E. E., A. Abo-Elwafa, G. H. AbdEl-Zaher, M. A. Sayed and M. G. Hosein (2017). Tolerance of Egyptian Cotton Varieties (*G. barbadense* L.) to Late Planting. Agric. Sci., Assiut Univ., 48 (3): 34-53.

Pettigrew, W. T. and W. R. Jr. Meredith (2009). Seed quality and planting date effects on cotton lint yield, yield components, and fiber quality. JCS. 13:37.

Shaker, S.A., M. A. F. Habouh and A. B. A. El-Fesheikwy (2019). Analysis of stability using AMMI and GGE biplot methods for some Egyptian cotton genotypes Menoufia J. Plant Prod., 4 (April): 153– 163.

Snedcor, G. W. and W. G. Cochran (1989). Statistical Methods, 8th ed. Iowa State Univ. Press, ISBN, 978- 0-8138-156-9. U. S. A.

SPSS (1995). SPSS computer user's guide, USA.

Yan, W. and I. Rajcan (2002). Biplot evaluation of test sites and trait relations of soybean in Ontario. Crop Sci. 42 (1): 11-20.

Yan, W., L. A. Hunt, Q. Sheng and Z. Szlavnics (2000). Cultivar evaluation and mega-environment investigation based on GGE biplot. Crop Sci. 40 (3): 597-605.

Yan, W., Q. Sheng, Y. G. Hu and L. A. Hunt (2001). GGE biplot an ideal method for graphical analysis of genotype by environment interaction. Acta Agronomica Sinica 27: 21-28.

Menoufia J. Plant Prod., Vol. 5 April (2020): 91 - 105

تقييم وثبات بعض أصناف القطن المصري تحت ظروف الزراعة العادية والمتأخرة

شاكر عبد العزيز شاكر، ياسر محمد المنسي، أشرف إبراهيم إسماعيل درويش،
سامي سعد محمد بدر
معهد بحوث القطن- مركز البحوث الزراعية- الجيزة- مصر

الملخص العربي

يواجه مزارعي القطن المصري مشكلة نقص المحصول في ميعاد الزراعة المتأخرة (عقب برسيم مسقاوى أو قمح). وقد نفذت الدراسة الحالية لتقييم ستة أصناف وهي جيزة ٨٦ – جيزة ٩٤ – جيزة ٩٥ – جيزة ٩٧ – جيزة ٩٢ – جيزة ٩٦ تحت مواعيد الزراعة العاديه والمتأخرة (منتصف ابريل ومايو) على التوالي خلال موسمي ٢٠١٨ – ٢٠١٩ في محطة البحوث الزراعية بسخا في قطاعات كاملة العشوائية ذات أربع مكررات لدراسة محصول القطن الزهر والشعر – وزن اللوزة – معدل الحليج – معامل البذرة – معامل الشعر – طول التيلة – نسبة انتظام طول التيلة – متانة التيلة – قراءة الميكرونير . يعتبر الهدف من الدراسة هو تقدير تأثير ميعاد الزراعة المتأخرة علي المحصول ومكوناته وصفات جودة الألياف واختيار الصنف المناسب الذي يستجيب للزراعة المتأخرة. أظهرت الأصناف معنوية لكل الصفات تحت الدراسة في التحليل التجميعي (أ) للميعاد العادي (ب) للميعاد المتأخر ماعدا صفتي المتانة وقراءة الميكرونير (ج) للميعادين العادى والمتأخر سويا . اظهر تباين مواعيد الزراعة معنوية لكل الصفات ماعدا صفتي طول التيلة ونسبة انتظام طول التيله وكانت الأصناف جيزة ٩٥ – جيزة ٩٧ – جيزة ٩٤ متحملة للتأخير في الزراعة، أيضا كان الصنف جيزة ٩٦ ذو محصول منخفض لكل من ميعادى الزراعه و معامل الحساسية له اقل من الوحدة مع انه يبدى تحملا للزراعه المتأخره لكنه ابدى عدم ثبات لصفة محصول القطن الزهر . كانت الصفات التكنولوجية اقل تأثرا بالزراعة المتأخرة. كانت الأصناف جيزة ٩٥ – جيزة ٩٧ – جيزة ٩٤ متوسطة الثبات لصفة محصول القطن الزهر طبقا لطريقتى تحليل الثبات (GGE-Biplot) و (Eberhart and Russiell 1966).

السادة المحكمين

أ.د/ السيد حامد الصعيدى   كلية الزراعة – جامعة طنطا

أ.د/ حسان عبدالجيد دوام   كلية الزراعة – جامعة المنوفية