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COMPARATIVE PERFORMANCE OF PIMA AND EGYPTIAN COTTON CULTIVARS: III. TOLERANCE TO LATE PLANTING STRESS

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Abstract

The late planting stress susceptibility index (S) revealed that out of Pima genotypes, Earlipima was more stable followed by G.83 of the Egyptian cotton genotypes. It is worthy to mention that G.83 is characterized with its high yield potential (averaged over environments,) coupled with its high stress tolerance to LP system. Yield-stability statistic (YSi) identified that out of the Egyptian group one parent (G.83) in seed cotton yield and two (G.83 and G.85) in lint yield as superior and stable. However, for Pima cotton all four genotypes in seed cotton yield and three ones (PS-4, PS-6 and PS-7) in lint cotton were stable. Therefore, the two Egyptian cultivars G.83 and G.85 and the three Pima ones PS-4, PS-6 and PS-7 may be considered as stable genotypes for the late planting stress tolerance and may be incorporated in any further breeding programme for breeding short season cotton using the G. barbadense germplasm. Earliness in maturity, stability criteria studies indicated that PS-6 and PS-7 were stable ones judged by earliness index, PS-4 was stable on the basis of mean maturity date and the four Pima genotypes were stable in production rate index. This data support the possible merits or incorporating Ps4, Ps6 and Ps7 in the breeding programmes for late planting stress tolerance.

INTRODUCTION

Fifteen years ago the Department of Agronomy, Fac. Agric., Cairo University, initiated and advocated the need for considering the concept of double cropping of Egyptian cotton with winter crops. Several publications in this topic were published (Abo El-Zahab, 1994; Abo El-Zahab and Amein, 1996a,b and 2000a,b,c,d). These publications are concerned with the different aspects of selection of Egyptian cotton genotypes for tolerance to late planting system in Egyptian cotton germplasm. Nowadays, late planting system is an agricultural practice adopted by farmers in some areas of the Egyptian cotton belt. This is usually done due to changing economics of Egyptian cotton production due to high costs of inputs and low net income of outputs.

Young *et al.* (1980) found in a test of two Upland (*G. hirsutum*) cultivars and one Pima (G. barbadense) cultivar planted on five dates that fewer days were required to produce first true leaf, square, and flower stages as the date of planting was advanced from 1 April to 27 May. Days from planting required to produce open bolls decreased as planting temperatures approached an optimum, then increased for the last planting date, as a consequence of bolls maturing under decreasing minimum (night) temperatures beginning in August. Landivar *et al.* (1993) reported that cultivar selection was the most important factor for successful cotton production in short-season production environments. Selection should be made based on the ability of the cultivar to reach full maturity at a date that maximizes the utilization of available resources during the production season

However, Fry (1985) reported that Pima cotton cultivars were characteristically tall and late maturing, but newly developed Pima genotypes were shorter and earlier. Early season genotypes, when compared to late season genotypes, had i) shorter main stem and sympodial internodal length, ii) less stem weight, iii) lower first sympodium node, iv) lower cut-out node, and v) more bolls on the main stem that developed in the axils of the sympodia.

The Pima cotton plant is later maturing, taller, and more indeterminate than upland cotton (Gossypium hirsutum L.). These growth characteristics make Pima cotton production undesirable in areas where crop maturity coincides with a period of high probability of late-season rainfall. Furthermore, an extended growing season implies increased cost of production associated with pest control and irrigation. Over the years, Pima cotton breeding program in the USA has improved the crop for these traits and lint yield .The S-series of American Pima cotton varieties have been improved not only for yield, but also for earliness, plant height, and heat tolerance (Turcotte *et al.*, 1992). However, even the newest Pima varieties, S-6 and S-7, do not mature as early as the average upland varieties.

For Egyptian cotton, basic studies for the concept of short-season varieties were initiated in 1990 in the Department of Agronomy Fac. Agric. Cairo Univ. Abo El-Zahab (1994) and Abo El-Zahab *et al.* (1996a,b) reported that Egyptian cotton genotyps do differ in their response to the stress of late planting. Out of 11 genotypes tested, G.83, G.85, Dandara and G.80 seemed to be the most tolerant to the stress of the adverse conditions of late planting or alternatively early crop termination..

MATERIALS AND METHODS

Three environments viz.: E_1, conventional planting (CN), on 1^{st} of April 1998 at Giza Agric. Exper. Sta., ARC; E_2, CN planting, on 25^{th} of March 1999 and E3: late planting (LP), on 1^{st} of May, 1999. E2 and were conducted at Sids Agric. Exper. Sta. ARC; Beni-Suef governorate. Eight G. barbadense cultivars were sown in a randomised complete block design with four replications. Each Plot consisted of 7 rows, 4 meters long, 60 cm apart. Plants were sown in 2 plants / hill spaced 20 cm within the row. A section of 4 rows of each plot was used for sampling of cotton plants for growth analysis.

Designations, pedigree, main fiber characteristics of genotypes used, coupled with full detaits of layout of the experiment and the different aspect of management of the maintenance of experiment were mentioned in details by Abo El-Zahab *et al.* (2002 a).

Late planting stress susceptibility index (S) was evaluated as relative reduction in cotton yield from (CN) planting (E2) to (LP) planting (E3) by using the formula developed by Fischer and Maurer, (1978).

$$S = (1-Y/YP) / D$$

Where:

Y = mean yield or any trait of a genotype in a stress environment.

YP = mean yield or any trait of a genotype in a stress free environment

D = Stress Intensity = 1 - X / XP

X = mean Y of all genotypes

XP = mean YP of all genotypes

The "S" was used to characterize the relative late planting stress tolerance of the various genotypes, where S < 0.50 indicated highly stress tolerant (H), S > 0.50 < 1.00 designated moderately stress tolerant (M) and S > 1.00 referred to susceptible (S).

Single selection criterion for integration of yield (any trait) and stability developed by Kang (1993) was used for genotype rating according to their stability of mean performance coupled with their yield potential.

Whenever a genotype x 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.

The mechanism of yield-stability has been analyzed through yield components. Yield-stability (Ysi) statistic was calculated using program STABLE (a basic program for calculating stability and yield-stability statistic) after Kang and Magari (1995). Data of the three environments, (E_1), (E_2) and (E_3) were used for calculating the genotypes stability indices across environments.

RESULTS AND DISCUSSION

Tolerance to Late Planting Stress:

Yield in stress environments is dependent upon stress susceptibility, yield potential, and stress escape. The susceptibility of a plant genotype to stress is the product of many physiological and morphological characters for which effective selection criteria have not been developed yet (Fischer and Maurer, 1978). Therefore, cotton yield and its components remain a major selection criteria for improved adaptation to stress environment of late planting system.

A stress-susceptibility index (S) was used to characterize each genotype in the stress environment (E3). A cotton yield-based, stress-susceptibility index was used to estimate relative susceptibility to stress because it accounts for variation in yield due to differences in genotypic yield potential and environmental stress intensity. Low stress susceptibility ($S \leq 0.50$) is synonymous to higher stress resistance (Fischer and Maurer, 1978). Late planting stress tolerance was evaluated as relative reduction in cotton yield from normal environment (CN) to late planting stress environment, (LP) in Egyptian cotton (Abo El-Zahab and Amein, 2000c).

Late planting susceptibility index (S) was calculated for cotton yields, expressed as seed cotton and lint cotton. The mechanism of yield of late planting stress tolerance has been analyzed by yield components. The yield contributing traits studied were boll weight, lint percentage, seed index and lint index (Table 1a). For earliness in maturity six earliness criteria viz. earliness index (EI), date of first flower (DFF), date of first open boll (DFOB), node of first sympodium (NFS), mean maturity date (MMD) and production rate index (PRI) were used (Table 1b). Fiber properties viz. 2.5 % span length, 50 % span length, uniformity ratio (UR), micronaire reading (MR) and pressley index were also subjected to the analysis of late planting stress tolerance (Table 1c). Out of these 17 traits studied for yield, yield contributing traits, earliness indices and fiber properties, only five traits i.e., seed cotton yield, lint cotton yield, date of first flower, date of first open boll and mean maturity date exhibited significant differences among evaluated cotton genotypes for late planting stress susceptibility. Therefore, only these traits will be discussed and used in differentiating genotypes for their tolerance to late planting stress.

The late planting stress susceptibility index (S) revealed that out of Pima genotypes, Earlipima was more stable followed by G.83 of the Egyptian cotton genotypes. It is worthy to mention that G.83 is characterized with its high yield potential (Abo EL-Zahab *et al.* 2002 a) coupled with its high stress tolerance to LP system (Table 1a).

According to the rating scale of susceptibility, Earlipima and G.83 may be classified as moderately stable ($S>0.50\leq1.00$) in their potentials in terms of both seed and lint cotton. However, the rest of all tested genotypes may be rated as unstable ($S>1.00$). Although wide variation was observed in stress susceptibility of late planting stress of yield components, yet none of these traits reached the level of significance. This means that stability of cotton genotypes under late planting stress (S) was more or less related to different integration of susceptibility indices of the yield component traits. This indicates that non of the studied yield components can be considered as potential selection criteria for cotton yield under late planting stress. In studying the stress susceptibility index for the developmental stages, in which the lower values are desirable, the low susceptibility ($S\geq1.00$) is synonymous to high stress resistance. Therefore, the genotypes G.83 and Pima S-4 in DFF, G.83, G.85 and G.86 in DFOB and G.85 and G.86 and all the Pima genotypes in MMD may be rated as of low stress susceptibility for the stress of late planting, i.e., identified as tolerant to the stress of LP system.

Number of days from planting to flowering and bolling for MMD of each genotype was calculated. The reductions in developmental phases of genotypes observed in late planting system were mainly due to higher temperatures prevailing during LP. Although differences due to genotypes were detected in these developmental phases in stress and non stress environment, however, these variability were of low magnitude and of no predictive value in cotton breeding for earliness. The maturity range of genotypes in non-stress environment (E_2) was 2,6 and 7 days for 1^{st} flower, 1^{st} open boll and MMD. In the stress environment (E_3) genotypes reached maturity practically in the same time, indicating that genotypic difference in stress escape was not a major factor in this study. The reductions in these phonological stages in stress compared to non-stress environment varied according to cultivars and ranged from 11-13, 11-16 and 20-27 days for DFF, DFOB and MMD, respectively.

Table 1a. Means performances (x) and susceptibility index (S) for eight *G. barbadense* genotypes evaluated in conventional planting (E_2) and late planting (E_3) for seed cotton yield and its components.

S	O		S	O		Genotypes
	E3	E2		E3	E2	
Lint cotton yield (K/F)			Seed cotton yield (K/F)			
1.11 a	7.42 ab	13.59	1.11 a	6.36	10.72	G.80
0.88 ab	8.71 a	13.57	0.91 a	7.12	10.64	G.83
1.01 ab	7.38 bc	12.36	1.05 a	6.43	10.39	G.85
1.07 ab	6.70 c	11.78	1.06 a	5.77	9.37	G.86
0.78 b	8.04 ab	11.5	0.62 b	7.39	9.56	Earlipima
1.00 ab	7.50 bc	12.41	1.12 a	6.43	10.13	Pima S-4
1.03 ab	8.00 ab	13.57	1.04 a	6.81	10.93	Pima S-6
1.07 ab	7.69 ab	13.58	1.01 a	6.78	10.77	Pima S-7
0.99	7.68	12.8	0.99	6.63	10.31	Mean
0.29	1.21	NS	0.29	NS	NS	LSD 0.05
Lint Percentage (%)			Boll Weight (g)			
0.97	37.02 ab	40.25 ab	2.52	2.52	2.89	G.80
0.67	38.84 a	40.48 a	2.86	2.86	2.82	G.83
0.55	36.42 bc	37.76 d	2.67	2.67	3.04	G.85
1.13	36.85 ab	39.92 ab	2.89	2.89	2.9	G.86
1.71	34.54 c	38.19 cd	2.82	2.82	2.72	Earlipima
0.73	37.04 ab	38.89 bcd	2.8	2.8	3.09	Pima S-4
0.83	37.30 ab	39.43 abc	2.73	2.73	3.02	Pima S-6
1.39	36.00 bc	40.03 ab	2.74	2.74	3.09	Pima S-7
1	36.75	39.37	2.75	2.75	2.95	Mean
NS	2.27	1.52	NS	NS	NS	LSD 0.05
Lint Index (g)			Seed Index (g)			
0.34	6.48	7.31	3.02	10.94	10.83 c	G.80
1.2	6.43	7.36	-7.71	10.45	10.82 c	G.83
0.29	6.54	6.89	-6.95	11.42	11.35 abc	G.85
1.1	6.54	7.36	-4.21	11.2	11.08 bc	G.86
1.43	5.97	7.09	9.32	11.32	11.49 abc	Earlipima
0.04	6.5	6.93	-6.27	10.07	10.86 c	Pima S-4
1.61	6.61	7.84	1.8	11.14	12.05 a	Pima S-6
1.59	6.38	7.95	15	11.34	11.90 ab	Pima S-7
0.95	6.43	7.95	0.5	11.2	11.3	Mean
NS	NS	NS	NS	NS	0.86	LSD 0.05

Means designated with the same letter(s) are no significantly different at 0.05 level of probability.

Table 1b. Means performances (x) and susceptibility index (S) for eight *G. barbadense* genotypes evaluated in conventional planting (E_2) and late planting (E_3) for earliness criteria.

S	O		S	O		Genotypes
	E3	E2		E3	E2	
Date of forst open boll (day)			Date of first flower (day)			
0.98 b	116.50 bc	130.00 b	0.98 bc	68.00 b	79.75 ab	G.80
1.04 ab	114.50 d	128.75 bc	0.98 bc	68.00 b	79.75 ab	G.83
1.17 a	113.25 e	129.25 bc	1.04 ab	67.25 bc	79.75 ab	G.85
1.13 a	117.75 a	133.75 a	0.90 c	69.25 a	80.75 a	G.86
0.95 bc	115.25 d	128.75 bc	0.98 bc	67.25 bc	79.00 bc	Earlipima
0.83 c	116.75 ab	128.00 c	1.10 a	66.50 c	80.00 b	Pima S-4
0.92 bc	115.25 d	127.75 c	0.95 bc	67.25 bc	78.50 c	Pima S-6
0.98 b	115.50 cd	129.00 bc	1.02 ab	67.25 bc	79.50 bc	Pima S-7
1	115.59	129.34	0.99	67.59	79.6	Mean
0.15	1.25	1.79	0.09	0.83	1.08	LSD 0.05
Earliness index (%)			Node of first symodium			
3.87	38.09 b	42.33 ab	1.37	9.10 a	9.16 a	G.80
7.85	39.72 b	47.29 a	6.81	8.80 ab	8.08 b	G.83
1.2	35.98 b	38.94 ab	1.31	8.15 c	7.75 b	G.85
-15.89	38.30 b	18.33 c	-1.43	8.65 ab	9.16 a	G.86
-0.32	43.13 b	45.50 ab	-1.42	8.75 ab	8.33 ab	Earlipima
-0.51	42.57 b	36.89 b	1.41	8.40 bc	8.30 ab	Pima S-4
2.16	42.30 b	44.81 ab	-1.4	8.85 ab	9.05 a	Pima S-6
0.54	53.71 a	46.72 a	3.01	8.85 ab	8.10 b	Pima S-7
-0.14	41.72	40.1	1.21	8.69	8.49	Mean
NS	8.27	9.48	NS	0.49	0.92	LSD 0.05
Production rate index (g/m2/day)			Mean maturity date (day)			
1.27	1.71 bc	2.5	0.75 c	140.11 a	161.28 bc	G.80
0.89	1.91 ab	2.5	0.93 bc	139.53 a	160.20 c	G.83
1.09	1.72 bc	2.39	1.00 ab	140.41 a	163.01 b	G.85
1.03	1.55 c	2.1	1.19 a	139.83 a	167.35 a	G.86
0.42	2.00 a	2.23	0.98 abc	139.00 a	160.76 c	Earlipima
1.04	1.73 bc	2.33	1.05 ab	139.35 a	163.02 b	Pima S-4
1.12	1.84 ab	2.55	0.99 ab	138.94 a	160.90 c	Pima S-6
1.02	1.85 ab	2.51	1.07 ab	137.11 b	160.75 c	Pima S-7
0.99	1.79	2.39	1	139.29	162.16	Mean
NS	0.25	NS	0.23	1.63	1.76	LSD 0.05

For explanation see Table 1a

Table 1c. Means performances (x) and susceptibility index (S) for eight *G. barbadense* genotypes evaluated in E_2 and E_3 for fiber characteristcs.

S	O		S	O		Genotypes
	E3	E2		E3	E2	
50 % SL.(mm)			2.5 % SL.(mm)			
0.39	16.13 d	16.26	5.15	31.65 c	31.93 b	G.80
1.45	19.27 b	17.26	1.32	32.83 bc	31.75 b	G.83
2.02	19.34 b	17.5	3.74	32.65 bc	31.66 b	G.85
1.58	20.87 a	18.33	1.59	35.34 a	33.98 a	G.86
-0.25	18.17 bc	18.04	-0.23	33.77 ab	34.02 a	Earlipima
8.77	18.89 bc	17.13	-4.36	34.85 a	34.32 a	Pima S-4
0.34	17.81 c	17.26	0.54	34.22 ab	33.65 a	Pima S-6
0.59	18.34 bc	17.54	0.57	34.67 a	34.15 a	Pima S-7
1.86	18.6	17.41	1.04	33.75	33.18	Mean
NS	1.38	NS	NS	1.6	1.52	LSD 0.05
Pressley index (lb/mg)			Uniformity ratio (%)			
6.2	9.66	9.60 bcd	-0.24	50.96 b	50.92	G.80
-3.34	9.1	8.90 d	1.54	58.70 a	54.36	G.83
-6.49	10.38	9.75 abcd	2.21	59.23 a	55.27	G.85
2.06	10.55	10.68 a	1.62	59.05 a	53.94	G.86
6.53	9.85	10.63 a	0.26	53.81 b	53.03	Earlipima
-4.18	10.8	10.45 ab	-20.5	54.20 b	49.91	Pima S-4
2.05	9.73	9.40 cd	0.28	52.05 b	51.29	Pima S-6
0	10.33	10.33 abc	0.63	52.90 b	51.36	Pima S-7
0.35	10.05	9.97	-1.78	55.11	52.51	Mean
NS	NS	0.95	NS	3.34	NS	LSD 0.05
Micronaire reading (unit)						
			5.94	4.15 ab	3.83 bcd	G.80
			-0.7	4.40 a	4.35 a	G.83
			-0.26	3.80 bc	4.03 abc	G.85
			0.97	4.40 a	4.13 ab	G.86
			0.18	3.75 c	3.30 c	Earlipima
			1.15	3.48 c	3.63 cde	Pima S-4
			-1.03	3.58 c	3.80 bcd	Pima S-6
			0.2	3.50 c	3.53 de	Pima S-7
			0.81	3.88	3.87	Mean
			NS	0.36	0.41	LSD 0.05

For explanation see Table 1a

Genotype x environment interaction and stability of mean performance:

Genotype x environment interaction (GEI) and its effect on the predictability of future genotype performance is the essence of the concept of trait stability. A genotype that has stable trait expression across environments contributes little to GEI and its performance should be more predictable from the main effects of genotypes and environments than the performance of an unstable cultivar.

Genotype x environment interaction were significant for all traits and exhibited homogeneous error variance and are listed in Table 2, viz. seed cotton yield, lint cotton yield; earliness index, mean maturity date and production rate index , and for only three traits of studied fiber properties (50 % SL, uniformity ratio and fiber strength). This means that for the aforementioned traits listed in Table 19, the genotypes behaved inconsistently and that the relative ranking of the genotypes was not the same in the three sampled environments.

Significant variance due to genotypes revealed the presence of genetic variability among genotypes for earliness index, production rate index, 50 % span length and fiber strength. Its should be mentioned here that Kang and Magari (1995) basic program for calculating yield stability statistics (STABLE) which was used herein usually test MS of genotypes against G x E interaction and not against error variance which is usually used in such analysis. Therefore, genotypes variations of some traits (seed cotton yields, lint cotton yield, MMD, PRI and UR) did not reach the significance levels although significant genotypic variations were detected in the regular analysis of combined data used before for these traits listed else where in this volume.

Environments differed significantly for all traits listed in Table 2 except fiber strength and earliness index, indicating the presence of a wide range of variation among environments sampled.

The variances due to G x E (linear), i.e., heterogeneity were statistically significant for earliness index, production rate index, 50% span length and pressley index suggesting that linear components of GxE was present. This means that heterogeneity of genotypes in EI, PRI, 50 % SL and PI relative to the environment index was significant (Table 2). This means that regression responses of individual genotypes contributed significantly to overall genotypes ⊥environments for the aforementioned traits.

The variety x environment interactions were significant for the traits seed cotton yield, lint cotton yield, earliness index, mean maturity date, production rate index, 50% SL, uniformity ratio and pressley index Table 2.

The presence of variety x environment interaction indicated that conclusion based solely on cultivar mean was inconclusive. Varieties responded differently to changes in environments, therefore, measures of stability (δ^2i.s^{2}iandYsi) were deemed appropriae Table 3.

For seed cotton yields examination of δ^2 and S^2 values revealed that out of the eight cotton genotypes, the two genotypes G.80 and G.83 were classified unstable ones (significant) before (δ^2) and after (S^2) removing environmental heterogeneity. The YSi -based selection revealed that out of the Egyptian group one parent (G.83) in seed cotton yield and two (G.83 and G.85) in lint yield as superior and stable. However, for Pima cotton all the four genotypes in seed cotton yield and three ones (PS-4, PS-6 and PS-7) in lint cotton were stable. Therefore, the two Egyptian cultivars G.83 and G.85 and the three Pima ones PS-4, PS-6 and PS-7 may be considered as stable genotypes for the late planting stress tolerance and may be incorporated in any further breeding programme for breeding short season cotton using the *G. barbadense* germplasm. In another recent study the two Egyptian cotton cultivars G.83 and G.85 were rated as late planting stress genotypes (Ab El-Zahab and Amein 2000c).

It is worthy to mention here that G.83 was classified as late planting stress tolerant to earliness in maturity as judged by earliness index and production rate index (Table 1b) and is also tolerant to uniformity ratio Table 1c. G.85 was identified as stable in uniformity ratio and pressley index. Therefore, much emphasis must be directed for seed maintenance of these two cultivars, and it is importance to be incorporated in crosses for breeding for stability of mean performance to late planting. Using different earliness in maturity criteria, stability studies indicated that PS-6 and PS-7 were stable ones judged by earliness index, PS-4 was stable on the basis of mean maturity date and the four Pima genotypes were stable in production rate index.

Pima genotypes (PS-4, PS-6 and PS-7) should be incorporated in the breeding programmes for late planting stress tolerance due to their stability in yielding potential plus their stable mean performance in most fiber traits. PS-4 was rated as stable for 50% SL. and UR, PS-6 was identified as stable for 50% SL. However, PS-7 was rated as stable for 50 % SL, unifomity ratio and pressley index Table 3.

Potentiality of this breeding material:

The collected data of this study entitled "comparative performance of Egyptian and Pima cotton cultivars: I, II and III, suggest that future improve-

Table 2. Mean squares of combined analysis of variance across three environments for eight G. barbadense genotypes for seed cotton yield, earliness in maturity and fiber properties.

S.V	d.f.	Traits							
		Seed cotton Yield	lint cotton Yield	EI%	MMD	PRI	50%SL	UR%	Pressley index
Genotypes (G)	7	7.94	13.97	536.48**	18.3	0.53	7.09*	34.1	2.86**
Environments (E)	2	170.80**	329.01**	21.16	4407.98**	7.07**	39.69**	215.28**	1.03
(G _ E)	14	5.09**	7.63**	176.0**	6.77**	0.30*	2.16**	12.90**	0.88*
Heterogeneity	7	5.96	9.16	169.05*	8.33	0.44*	3.91**	23.55	1.35*
Residual	7	2.11	3.05	31.13	2.65	7.68	0.2	1.11**	0.21
Pooled Error	63	1.1	1.62	49.77	1.92	0.06	0.76	4.19	0.45

* $P < 0.05$

** $P < 0.01$

Table 3. Means ($\bar{x}$), stability-variance statistics before (σ_i^2) and after (S_i^2) removing environmental heterogeneity and yield-stability statistic (Ys_i) for eight *G.barbadense* genotypes evaluated at three environments.

Genotypes	$\bar{x}$	δ^2_i	S^2_i	YS_i	$\bar{x}$	δ^2_i	S^2_i	YS_i
	Seed cotton yield (k/f)				Lint cotton yield (k/f)			
G.80	6.60	22.17**	7.98**	-9	8.03	29.96**	11.11**	-8
G.83	9.18	18.69**	9.59**	3√	11.39	28.80**	14.45**	3√
G.85	7.62	-0.74	-0.30	2	8.88	-0.99	-0.42	3√
G.86	6.62	-0.52	-0.13	0	7.90	-0.46	-3.69 E-2	-1
Earlipima	7.87	2.82	-0.20	5√	8.82	-2.53	-0.26	2
Pima S-4	7.75	0.60	0.16	6√	9.19	-0.90	0.38	6√
Pima S-6	7.93	-0.32	-0.34	8√	9.53	-0.66	-0.49	8√
Pima S-7	7.77	3.83 E-2	-0.16	5√	9.22	0.96	-0.35	7√
Mean	7.65			2.50	9.12			2.50
LSD 0.05	0.71				0.86			
	Earliness index (%)				Mean maturity date (day)			
G.80	36.63	232.32*	1.17	-3	152.57	5.79	3.39	4√
G.83	43.66	93.83	-4.62	6√	151.47	5.46	0.25	-1
G.85	39.97	108.82	82.33	3	152.71	3.33	2.86	7√
G.86	28.74	429.71**	-5.18	-10	154.40	35.76**	13.13*	3
Earlipima	44.84	6.29	9.04	8√	151.47	0.61	-0.17	2
Pima S-4	38.74	18.51	-0.43	2	153.16	3.05	1.68	8√
Pima S-6	44.13	8.64	1.13	7√	151.63	0.55	0.37	3
Pima S-7	50.93	27.15	-1.09	11√	150.45	-0.35	-0.41	-1
Mean	30.93			3.00	152.24			3.13
LSD 0.05	5.76				1.13			
	Production rate index (g/m2/day)				50 % S.L. (mm)			
G.80	1.62	1.22**	0.23	-8	15.93	3.20*	0.38	-6
G.83	2.26	1.07**	0.37*	3√	17.40	2.26	-0.02	0
G.85	1.86	-4.11E-2	-5.87 E-3	2	17.45	3.02*	0.02	0
G.86	1.59	-3.81 E-2	-3.90 E-3	-1	18.69	4.17**	0.22	3√
Earlipima	1.95	0.16	3.06 E-2	5√	17.87	2.66*	8.64 E-2	4√
Pima S-4	1.89	2.70 E-2	0.01	5√	17.70	0.95	0.93	7√
Pima S-6	1.95	-0.02	-1.26 E-2	8√	17.23	1.12	-2.40 E-2	1
Pima S-7	1.92	2.24 E-3	-8.63 E-3	6√	17.44	-0.12	3.25 E-2	3√
Mean	1.87			2.50	17.46			1.50
LSD 0.05	0.17				1.20			
	Uniformity ratio (%)				Pressley index (lb/mg)			
G.80	50.48	17.65*	0.37	-5	9.62	8.65 E-2	-2.48 E-2	0
G.83	54.15	19.75*	-8.08 E-2	4√	9.45	1.82*	-2.23 E-4	-5
G.85	54.81	20.67**	0.35	2√	10.25	0.37	0.21	5√
G.86	54.32	18.22*	0.38	5√	10.87	0.29	9.35 E-2	10√
Earlipima	52.43	4.45	0.94	4√	10.46	1.08	0.43	8√
Pima S-4	51.41	7.92**	7.11	3√	10.26	3.42**	3.55 E-2	-2
Pima S-6	51.12	11.58	-4.27 E-2	-1	9.65	-6.50 E-2	-3.48 E-2	1
Pima S-7	51.25	2.81	-0.14	2√	10.32	5.9 E-2	0.97	7√
Mean	52.45			1.75	10.11			3.00
LSD 0.05	2.93				0.55			

√ = Stable genotypes on basis of YS_i.

*,** : Significant at P= 0.05 and 0.01, respectively , also indicates that the genotype performance across environments was unstable.

ments in Egyptian cotton would require an increase in total dry matter and the direction of more dry matter into reproductive organs. The potential of the evaluated breeding materials clearly indicated that the two Egyptian cultivars G.83 and G.85 and the two Pima ones PS-6 and PS-7 would be the foundation for the next yield breeding cycles in Egyptian breeding program via continuos selection for productive partitioning per se.

Results of growth attributes revealed that there is a chance for incorporating G.80 and G.85 of the Egyptian and Earlipima, PS-4 and PS-7 of Pima cotton in future breeding program aming at increasing the efficiency in net assimilation rate (NAR).

Yield-stability statistic (YSi) indicated that the two Egyptian cultivars G.83 and G.85 and the three Pima ones PS-4, PS-6 and PS-7 may be considered as stable genotypes for the late planting stress tolerance and may be incorporated in any further breeding programme for breeding short season cotton using the *G barbadense* germplasm.

Therefore, much emphasis must be directed for seed maintenance of these two cultivars G.83 and G.85, and it is very importance to be incorporated in crosses for breeding for stability of mean performance to late planting. Pima genotypes (PS-4, PS-6 and PS-7) should be incorporated in the breeding programmes for late planting stress tolerance due to their stability in yielding potential plus their stable mean performance in most fiber traits.

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دراسة مقارنة لسلوك أقطان البيما والأقطان المصرية
٣- التحمل للتأخير فى الزراعة - ثبات السلوك

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أشتملت الدراسة على ٨ تراكيب وراثية من القطن اربعة من اقطان البيما)بيما مبكر- بيما س٤-بيما س٦-بيما س٧ (و اربعة اصناف من الأقطان المصرية الطويلة التيلة)جـ٨-جـ٨٣-جـ٨٥-جـ٨٦ (لمقارنة المحصول والتبكير وصفات التيلة لهاتين المجموعتين تحت الظروف المحلية .اجريت هذه الدراسة فى ٣ بيئات وهى الأولى :زراعة فى اول ابريل ١٩٩٨ فى محطة بحوث الجيزة بينما الثانية والثالثة فى ميعادى زراعة الأول عادى فى ٢٥ مارس والثانى فى اول مايو عام ١٩٩٩ فى محطة بحوث سدس (بنى سويف) تم زراعة هذه الأصناف فى تصميم القطاعات الكاملة العشوائية باستخدام ٤ مكررات .وقد تم التحليل الاحصائى لهذه البيانات لاختبار قدرة هذه التراكيب الوراثية على تحمل ظروف الاجهاد للتأخير فى الزراعة .كما تم تقدير التفاعل بين البيئة والتراكيب الوراثية كما تم تقدير صفات الثبات لسلوك هذه الأصناف .ويمكن تلخيص اهم النتائج المتحصل عليها من هذه الدراسة

١-التحمل للتأخير فى ميعاد الزراعة :تشير نتائج معامل الحساسية للتأخير فى ميعاد الزراعة (s)الى ان الصنف جـ٨٣ والسلالة التجريبية بيما مبكر تعد من افضل التراكيب الوراثية تحملا للتأخير فى الزراعة .مع تميز الصنف المصرى جـ٨٣ بالمحصول العالى .

٢- التفاعل بين التراكيب الوراثية والبيئة ومقاييس ثبات السلوك:تم تسجيل معنوية للتفاعل فى بعض الصفات)محصول القطن الزهر- محصول القطن الشعر - معامل التبكير - معامل الإنتاج /وحدة المساحة - متوسط تاريخ النضج - معامل البريسلى .(لذا فان الصنفين المصريين)جـ٨٣ و جـ٨٥ (والثلاثة اصناف البيما) بيما س٤ - بيما س٦ - بيما س يمكن اعتبارهم تراكيب وراثية ثابتة السلوك بالنسبة لصفات المحصول كما تتميز بالقدرة العالية للتحمل للروف القاسية للزراعة المتأخرة ولذا يمكن أن تدخل في برامج التربية مستقبلياً لانتاج اصناف قصيرة العمر مستخدماً جنيوم البار بادنس G.baradense germplasm ولهذا يجب العناية بالإكثار والمحافظة على الصنفين جـ ٨٣ و جـ٨٥ لامكان ادخالهم فى برامج الإنتخاب لثبات السلوك خصوصا فى الزراعة المتأخرة كما ان اصناف البيما (بيما س٤ - بيما س٦- بيما س٧) يجب ادخالها فى برنامج التربية لثبات سلوكها بالنسبة لصفات المحصول وصفات التبكير.