RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

The results reported in this study include the evaluation, heritability and genotypic stability of eight commercial Egyptian cotton varieties, along with seven promising crosses, that may serve as alternatives of these commercial Egyptian cotton varieties.

This study was determined to:

A. Earliness characters.

B. Yield and its components.

C. Fiber properties.

The purpose of this study is to obtain information on the variability which has to be inferred from measurements on phenotypes. Moreover, screening of genotypes for stability under varying environmental conditions has thus become as essential part of modern breeding programme. Moreover, studying the genotypic variation and genotype-environment interaction are essential in evaluating the available genetic material. Therefore, the effect of environment on the genetic variation was investigated as a part of this study.

Analysis of variance on a plot mean basis, Table (1) showed that genotypes, environments and genotype X environment interaction detected highly significant differences for each trait which indicated that detaled analyses of stability parameters could be persued of each.

Table (1) : The MS values for the combined analysis of variance over the five environments for all studied characters.

Source of variance	d.F	Position of the first sympodium	Earliness %	No. of fruiting branches	Seed cotton yield/plant (in gm)	Seed cotton yield/F. (in kentar)	Lint cotton yield/F. (in kentar)
Environments (E.)	4	19.511**	7585.34**	285.71**	3703.72**	280.027**	381.384**
Reps/E	15	0.9199**	104.98**	5.775**	60.37	6.9665**	9.754**
Genotypes (G)	14	13.0046**	328.104**	6.9335**	339.529**	23.777**	54.697**
G x E	56	0.7402**	134.586**	6.558**	100.91**	4.949**	7.331**
Error	210	0.4269	61.277	2.7966	38.102	1.234	1.748

*, ** significant and highly significant at 0.05 and 0.01 of probability, respectively.

Table (1): Continued

Source of variance	d.F	Boll weight (in gm)	Seed index (in gm)	Lint %	Staple length	Hair weight	Micronaire reading	Yarn strength
Environments (E.)	4	4.327**	38.879**	8.7214**	9.862**	4505.067**	3.1694**	239451.73*
Reps/E	15	0.0409	1.573**	7.5558**	7.793**	86.334	0.0605	113159.25
Genotypes (G)	14	0.747**	2.670**	111.245**	45.354**	1350.732**	0.9599**	414636.34**
G x E	56	0.1003**	0.719**	7.1224**	2.849**	208.879**	0.1537**	231502.87**
Error	210	0.0446	0.373	1.5581	1.639	112.525	0.0773	113414.01

A. Earliness characters:

1. Days of the first flower:

Results illustrated in Table (2) for single plants trial, indicated that days of the first flower ranged from 70 to 90 days from planting date, with an average value of 81.58 days and ranged from 73 to 90 days with an average value of 81.14 days for the promising cross G-68 x C.B-58 in 1991 and 1992 seasons, respectively, while it ranged from 78 to 90 days with an average of 82.72 days for the alternative variety G-70. Whereas, the first flower trait ranged from 74 to 89 days with an average of 80.88 days for the alternative variety G-77 in 1991 season. Moreover, in 1992 season it ranged from 78 to 93 days with an average of 82.90 days for G-70 and ranged from 76 to 84 days with an average of 80.72 days for G-77 variety. These results indicated that this cross was earlier than G-70 variety, while it was later compared with G-77 variety.

With regard to the promising cross G-77 x G-45 type (A), the days to the first flower ranged from 75 to 89 days from sowing date with an average of 83.42 days in 1991 season and ranged from 82 to 91 days with an average of 84.84 days in 1992 season. On the other hand, the days to the first flower for the two alternative varieties, G-45 and G-76 ranged from 74 to 89 days and from 79 to 91 days with an average of 81.16 and 82.72 days in 1991 season, respectively. Moreover, in 1992 season it ranged from 75 to 89 days with an average of 81.44 days for G-45 variety and ranged from 78 to 90 days with an average of 83.0 days for G-76 variety. It could be noticed from these results that the promising cross G-77 x G-45 type (A) was later in flowering date compared with its alternative varieties G-45 and G-76.

Concerning, the promising cross G-77 x G-45 type (B), the days to first flower ranged from 76 to 94 days with an average of 84.48 days in 1991

Table (2) : Statistical constants of days of the first flower and position of the first symbodium estimated from single plants.

Genotypes	No. of plant	Days of the first flower						Position of the first symbodium					
		1991			1992			1991			1992		
		Range	Mean	C.V	Range	Mean	C.V	Range	Mean	C.V	Range	Mean	C.V
G.68 x C.B 58	50	70-90	81.58±0.46	5.77	73-90	81.14±0.59	5.00	6-10	7.96±0.14	13.32	6-11	8.14±0.17	14.68
G.77 x G.45 (A)	50	75-89	83.42±0.66	3.94	82-91	84.84±0.47	3.63	7-10	8.18±0.12	10.68	7-12	8.52±0.16	12.24
G.77 x G.45 (B)	50	76-94	84.48±0.56	4.68	78-91	82.42±0.60	4.24	6-12	8.80±0.12	10.68	6-12	8.96±0.17	12.67
G.45	50	74-89	81.16±0.59	5.19	75-89	81.44±0.52	4.91	7-12	9.20±0.14	11.62	6-11	8.84±0.16	12.46
G.70	50	78-90	82.68±0.50	4.32	78-93	82.90±0.52	4.43	8-12	9.26±0.12	9.21	7-13	9.14±0.20	15.32
G.76	50	79-91	82.72±0.47	3.90	78-90	83.00±0.49	4.20	7-11	9.06±0.14	11.24	7-12	8.94±0.16	13.56
G.77	50	74-89	80.88±0.33	2.91	76-84	80.72±0.27	2.35	7-10	8.38±0.12	10.20	6-11	8.56±0.16	12.96
G.67 x C.B 58	50	76-95	84.82±0.70	5.80	78-94	82.58±0.62	5.29	6-11	8.32±0.11	9.05	6-12	8.80±0.18	13.78
G.75 x G.81	50	83-95	88.36±0.45	3.63	80-92	85.32±0.46	3.92	6-11	8.56±0.18	15.09	7-12	8.76±0.16	11.68
G.75	50	79-88	83.84±0.36	3.07	78-89	83.46±0.43	3.62	7-11	8.42±0.20	13.86	6-13	8.30±0.20	14.58
G.81	50	80-90	87.10±0.38	3.10	81-90	86.88±0.38	3.07	8-12	9.78±0.14	10.18	8-13	10.10±0.16	11.36
G.72 x G.67	50	75-86	80.58±0.49	4.31	76-84	79.80±0.26	2.28	4-9	7.44±0.14	13.62	4-10	7.68±0.15	13.69
G.83 x (G72 x Delcero)	50	69-84	73.02±0.59	5.66	69-76	72.36±0.31	2.99	4-8	6.22±0.16	13.60	4-10	6.64±0.14	15.52
Dandara	50	70-79	74.10±0.39	3.54	70-80	75.02±0.40	3.74	5-9	7.26±0.13	12.69	5-10	7.12±0.18	15.38
G.80	50	75-85	81.20±0.30	2.64	78-87	81.56±0.38	3.28	6-11	8.58±0.16	13.13	6-12	8.18±0.17	14.35

season and ranged from 78 to 91 days with an average of 82.42 days in 1992 season, while the alternative variety G-77 had a range from 74 to 89 days with an average of 80.88 days and ranged from 76 to 84 days with an average of 80.72 days in 1991 and 1992 seasons, respectively. These results mean that G-77 variety was earlier than the promising cross G-77 x G-45 type (B).

With respect to the promising cross G-67 x C.B-58, days of the first flower ranged from 76 to 95 days and 78 to 94 days with an average of 84.82 and 82.58 days in 1991 and 1992 seasons, respectively, while the alternative variety G-81 ranged from 80 to 90 days with an average of 87.10 days in 1991 season and ranged from 81 to 90 days with an average of 86.88 days in 1992 season. These results showed that the promising cross G-67 x C.B-58 was earlier than its alternative variety G-81.

Moreover, the days to first flower of the promising cross G-75 x G-81 ranged from 83 to 95 days with an average of 88.36 days (1991 season) and ranged from 80 to 92 days with an average of 85.32 days in 1992 season, while the alternative variety G-75 ranged from 79 to 88 days and from 78 to 89 days with an average of 83.48 and 83.46 days in 1991 and 1992 seasons, respectively. These results indicated that the variety G-75 was earlier than the alternative cross in both seasons.

With respect to the promising cross G-72 x G-67, which showed a range from 75 to 86 days with an average of 80.58 days in 1991 season, whereas in 1992 season it ranged from 76 to 84 days with an average of 79.80 days, while the alternative varieties Dandara and G-80 had days to first flower from 70 to 79 and 75 to 85 days with an average of 74.10 and 81.20 days in 1991 season and ranged from 70 to 80 and 78 to 81 days with an average of 75.02 and 81.56 days in 1992 season. This illustrated that the

promising cross G-72 x G-67 was earlier than G-80 variety and later than Dandara variety for this trait.

Concerning the promising cross G-83 x (G-72 x Delcero), the days to the first flower results showed a range of 69 to 84 and 69 to 76 days with an average of 73.02 and 72.36 days in 1991 and 1992 seasons, respectively. Whereas, the alternative variety Dandara recorded a range from 70 to 79 and from 70 to 80 days with an average of 74.10 and 75.02 days in 1991 and 1992 seasons, respectively. These results indicated that the promising cross G-83 x (G-72 x Delcero) was earlier than its substitue variety Dandara.

The coefficient of variability (C.V) for the first flower, as presented in Table (2), revealed that it ranged from 2.94 to 5.77% in the first season and ranged from 2.35 to 5.29% in the second one.

2. Position of the first sympodium:

Evaluation of phenotypic variation :

Results of the position of the first sympodium in single plants and a plot mean basis are presented in Tables (2 and 3), respectively, while the percentage excess of this trait for the promising crosses over their alternative varieties is shown in Table (4). Data presented in Table (2) indicated clearly that the promising cross G-68 x C.B-58 gave the first sympodium at nodes ranging from 6 to 10 nodes with an average of 7.96 nodes in 1991 season and ranging from 6 to 11 with an average of 8.14 nodes in 1992 season, while the alternative varieties G-70 and G-77 recorded a range from 8 to 12 and from 7 to 10 nodes with an average of 9.26 and 8.38 nodes, respectively, in 1991 season and they recorded a range from 7 to 13 and from 6 to 11 nodes with an average of 9.14 and 8.56 nodes, respectively

Table (3) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for position of the first symbodium over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability		
		$\hat{\alpha}_i$	$\hat{\lambda}_i$	0.90	0.95	0.99
G.68 x C.B 58	8.18	-0.418	1.182	++	++	++
G.77 x G.45 (A)	8.66	0.128	1.018	++	++	++
G.77 x G.45 (B)	8.10	0.593	0.595	++	++	++
G.45	9.04	-0.845	0.279	+	+	+
G.70	9.02	-.0144	0.676	++	++	++
G.76	8.54	-0.241	1.171	++	++	++
G.77	8.37	-0.293	0.128	+	+	+
G.67 x C.B 58	8.24	0.132	0.163	+	+	+
G.75 x G.81	8.62	0.107	0.101	+	+	+
G.75	8.48	0.742	0.703	+	++	++
G.81	8.38	0.750	1.403	++	++	++
G.72 x G.67	6.86	0.654	3.952	+	+	+
G.83 x (G.72 x Delcero)	6.00	0.027	1.273	++	++	++
Dandara	7.48	0.035	2.449	+	+	+
G.80	8.36	0.049	1.459	++	++	++
L.S.D 0.05	0.41					
0.01	0.54					
Heritability value		94.31%				

++ Genotypes with average degree of stability.

\+ Unstable genotypes.

Table (4): The percentage excess of the promissing crosses overtheir alternative varieties

Genotypes	AV	PFS	E%	#FB/P	SCY/P	SCY/F	LCY/F	BW	SI	L%	MR	HW	YS
G. 68 x CB 58	G. 70	-9.31	-0.06	-5.58	11.16	18.40	23.88	7.27	2.62	4.62	-2.38	-4.53	0.47
	G.77	-2.27	0.79	16.87	38.92	16.12	18.59	9.29	5.85	7.36	2.00	-4.08	-3.84
G. 77 x G. 45 (A)	G. 45	-4.20	-5.61	9.95	60.06	60.34	61.69	13.04	-0.74	0.68	0.64	-3.50	6.44
	G. 76	1.40	-4.84	8.02	25.16	33.70	29.12	3.48	0.11	-10.54	-0.63	0.11	5.35
G. 77 x G. 45 (B)	G.77	-3.22	-1.06	18.19	13.72	1.20	2.35	5.12	2.38	6.93	8.00	-0.67	-5.42
G. 67 x C.B. 58	G. 81	-1.67	4.83	-4.79	3.55	.59	1.29	-10.45	-2.10	-2.57	-2.05	-2.09	1.38
G. 75 x G. 81	G.75	1.65	3.48	1.24	-6.90	-0.70	-3.27	-9.60	-2.33	0.00	0.29	2.40	-1.33
G. 72 x G. 67	Dandara	-8.29	2.10	5.16	34.42	24.16	44.08	14.22	-9.30	13.28	1.14	5.77	2.03
	G. 80	-17.94	5.99	7.85	28.41	15.88	22.28	3.75	-7.51	5.29	0.00	-0.89	2.81
G. 83 x (G. 72 x Delc.)	Dandara	-19.79	5.81	-5.96	7.52	4.16	14.15	-1.15	-8.53	7.01	5.96	7.18	-2.71

Abbreviations :- AV = Alternative varieties, PFS = Position of firest symbodium, E% = Earliness percentage #FB/P = Number of fruiting branches/Plant, SCY/P = Seed cotton yield/plant, SCY/F = Seed cotton yield/F, LCY/F = Lint cotton yield/F, BW = Boll weight, SI = Seed index, L% = Lint percentage MR = Micronaire reading, HW = Hair weight and YS = Yarn strength.

in 1992 season. This results indicated that the promising cross G-68 x C.B-58 was earlier than its alternative varieties G-70 and G-77 because it produced the first sympodium at lower nodes compared with its alternative varieties.

Regarding the promising cross G-77 x G-45 type (A), the position of the first sympodium ranged from 7 to 10 and from 7 to 12 nodes with an average of 8.18 and 8 52 nodes in 1991 and 1992 seasons, respectively. While the alternative varieties G-45 and G-76 ranged from 7 to 12 and from 7 to 11 nodes with mean values of 9.20 and 9.06 nodes, respectively in 1991 season, however, they ranged from 6 to 11 and from 7 to 12 nodes with an average of 8.84 and 8.94 nodes in 1992 season. These results showed that this cross may be earlier than its alternative varieties G-45 and G-76.

With respect to the promising cross G-77 x G-45 type (B), the position of the first sympodium ranged from 6 to 12 nodes with a mean value of 8.80 nodes, whereas, its alternative variety G-77 recorded a range from 7 to 10 nodes with a mean value of 8.38 nodes in 1991 season. Similar results were obtained in 1992 season as shown in Table (2). These results illustrated that the promising cross G-77 x G-45 type (B) may be later than its alternative variety G-77 in both seasons.

With regard to the promising cross G-67 x C.B-58, the position of the first sympodium (Table 2) ranged from 6 to 11 and from 6 to 12 nodes with mean values of 8.32 and 8.80 nodes in 1991 and 1992 seasons, respectively, while the first sympodium in the alternative variety G-81 ranged from 8 to 12 and from 8 to 13 nodes with mean values of 9.78 and 10.10 nodes in 1991 and 1992 seasons, respectively. These mean that the promising cross was earlier than its substituted variety in both seasons.

Concerning, the promising cross G-75 x G-81, the node of the first sympodium ranged from 6 to 11 nodes with an average of 8.56 nodes in 1991 season and ranged from 7 to 12 nodes with a mean value of 8.76 nodes in 1992 season. While, the alternative variety G-75 had the first sympodium range from 7 to 11 nodes with a mean value of 8.42 nodes in 1991 season and from 6 to 13 nodes with a mean value of 8.30 nodes in 1992 season. These results indicated that this cross was later than its alternative variety G-75.

Concerning the promising cross G-72 x G-67, its first sympodium was recorded on nodes ranging from 4 to 9 nodes with a mean value of 7.44 nodes in 1991 season and from 4 to 10 nodes with a mean value of 7.68 nodes in 1992 season. Although, its alternative varieties Dandara and G-80 recorded the first sympodium on nodes ranging from 5 to 9 nodes and from 6 to 11 nodes with mean values of 7.26 and 8.56 nodes, respectively in 1991 season. However, in 1992 season, varieties Dandara and G-80 recorded the first sympodium on the 5 to 10 nodes and 6 to 12 nodes with mean values of 7.12 and 8.18 nodes, respectively. These results indicated that the promising cross G-72 x G-67 could be earlier than its alternative variety G-80 and may be later than its alternative variety Dandara in both seasons.

Moreover, the promising cross G-83 x (G-72 x Delcero), had its first sympodium at nodes ranging from 4 to 8 and from 4 to 10 nodes with mean values of 6.22 and 6.64 nodes in 1991 and 1992 seasons, respectively. Whereas, its alternative variety Dandara recorded the first sympodium at nodes ranging from 5 to 9 and from 5 to 10 nodes with mean values of 7.26 and 7.12 nodes in 1991 and 1992 seasons, respectively. It could be concluded that this cross might be earlier than its alternative variety Dandara in both seasons.

Results illustrated in Tables (3 and 4) showed remarkably that the mean value of position of the first sympodium was 8.18 nodes for the promising cross G-68 x C.B-58; while the mean values for its alternative varieties G-70 and G-77 were 9.02 and 8.37 nodes, respectively. The percentage decreases of the promising cross (Table 4) of this trait below the alternative varieties G-70 and G-77 were 9.31 and 2.27%, respectively, indicating that this cross was earlier than its alternative varieties.

The promising cross G-77 x G-45 type (A) recorded a mean value of 8.66 nodes, while its substitute varieties G-45 and G-76 gave mean values of 9.04 and 8.54 nodes, respectively. The percentage excesses for G-45 and G-76 over the promising cross (as shown in Table 4) were -4.20 and 1.4% respectively, indicating that earliness performance varied in different varieties.

The promising cross G-77 x G-45 type (B) showed a mean value of 8.10 nodes for position of the first sympodium (Table 3), while its alternative variety G-77 recorded a mean value of 8.37 nodes. This cross may be earlier than its substitute variety G-77 by 3.22%.

The promising cross G-67 x C.B-58 results showed a mean values of 8.24 nodes, while its alternative variety G-81 recorded mean value of 8.38 nodes for this trait. G-81 variety recorded percentage excess of 1.67% over the promising cross for this trait. Whereas, the cross G-75 x G-81 showed a mean value of 8.62 nodes for the position of the first sympodium, while its alternative variety G-75 gave a mean value of 8.48 nodes. This result indicated that this cross was later than its alternative variety G-75 by 1.65% (Table 4). Meanwhile, the promising cross G-72 x G-67 recorded mean value of 6.86 nodes for this trait, while the mean values for its alternative varieties Dandara and G-80 were 7.48 and 8.36 nodes, respectively. The percentage

excess for this trait as shown in Table (4) revealed that the promising cross was earlier than its alternative varieties Dandara and G-80 by 8.29 and 17.94%, respectively. Sallam *et al* (1992) reported similar results. Whereas, the promising cross G-83 x (G-72 x Delcero) showed a mean value of 6.00 nodes, while its alternative variety Dandara had a mean value of 7.48 nodes for position of the first sympodium (Table 3). This cross could be earlier and had a percentage excess of 19.79% over its alternative variety Dandara (Table 4).

The coefficient of variability (c.v) for the position of the first sympodium calculated for single plant trial as presented in Table (2) revealed that it ranged from 9.05 to 13.62% in 1991 season and from 11.36 to 15.56% in 1992 season. However, heritability estimates in broad sense for position of the first sympodium as shown in Table (3) showed a reliable value of 94.13%, which indicated that this trait was slightly affected by the changes in the environmental conditions. These results are in agreement with those stated by El-Kilany *et al* (1985) and Awaad (1989). On the other hand, Ismail *et al* (1988b)and Mohamed (1991) reported that heritability value was low for this trait.

The genotypic stability for position of the first sympodium:

The results of the combined analysis of the genotypes grown in the five different environments, presented in Table (1), revealed that the environment, genotype and environment-genotype interaction mean squares were significant. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

The estimates of the parameters $\hat{\alpha}$ and $\hat{\lambda}$ for the genotypes with their degrees of stability and position of the first sympodium mean values are shown in Table (3), while the distribution of the $\hat{\alpha}$ and $\hat{\lambda}$ values of these genotypes are presented in Fig (1). From the results illustrated in Table (3) and Fig (1), it should be noticed that the vertical axis is $\hat{\alpha}$ which ranges from -1 to +1. The curves are prediction limits for $\hat{\alpha} = 0$ at levels of probability of 0.90, 0.95 and 0.99 and the horizonal axis is λ_i. Otherwise, the two vertical lines are the confidance intervals for $\hat{\lambda}_i = 1$. The area between the two vertical lines and inside curve ($\hat{\alpha}_i = 0$ and $\hat{\lambda}_i = 1$) includes the average stable genotypes and the area between the two vertical lines and under the curve ($\hat{\alpha}_i < 0$ and $\hat{\lambda}_1 = 1$) includes above average stable genotypes.

The genotypes which had the lowest position of the first sympodium are the promising cross G-83 x (G-72 x Delcero) followed G-67 x G-72, Dandara, G-77 x G-45 type (B), G-68 x C.B-58, G-67 x C.B-58, Giza-80, Giza-77, Giza-81, Giza75, Giza-75 x G-81, Giza-77 x G-45 type (A), Giza-45 and Giza-70. The later two varieties had the first sympodium on the highest node number.

Results presented in Table (3) and Fig (1) indicated clearly that the abscence of the genotype x environment interaction affected the distribution of the estimated $\hat{\alpha}$ and $\hat{\lambda}$ statistics where:

a- The estimated $\hat{\alpha}$ statistics were not significantly different from $\hat{\alpha} = 0$ for all studied genotypes, except G-75 and G-77 (at P = 0.90) and G-45 (at P = 0.90 and 0.95).

b- The estimated $\hat{\lambda}$ statistics were not significantly different from $\hat{\lambda} = 1$ for G-80, G-75, G-81, G-76, G-70, G-68 x C.B-58, G-77 x G-45 types (A) and (B) and G-83 x (G-72 x Delcero). The other genotypes showed $\hat{\lambda}$ statistics that were significantly less than one.

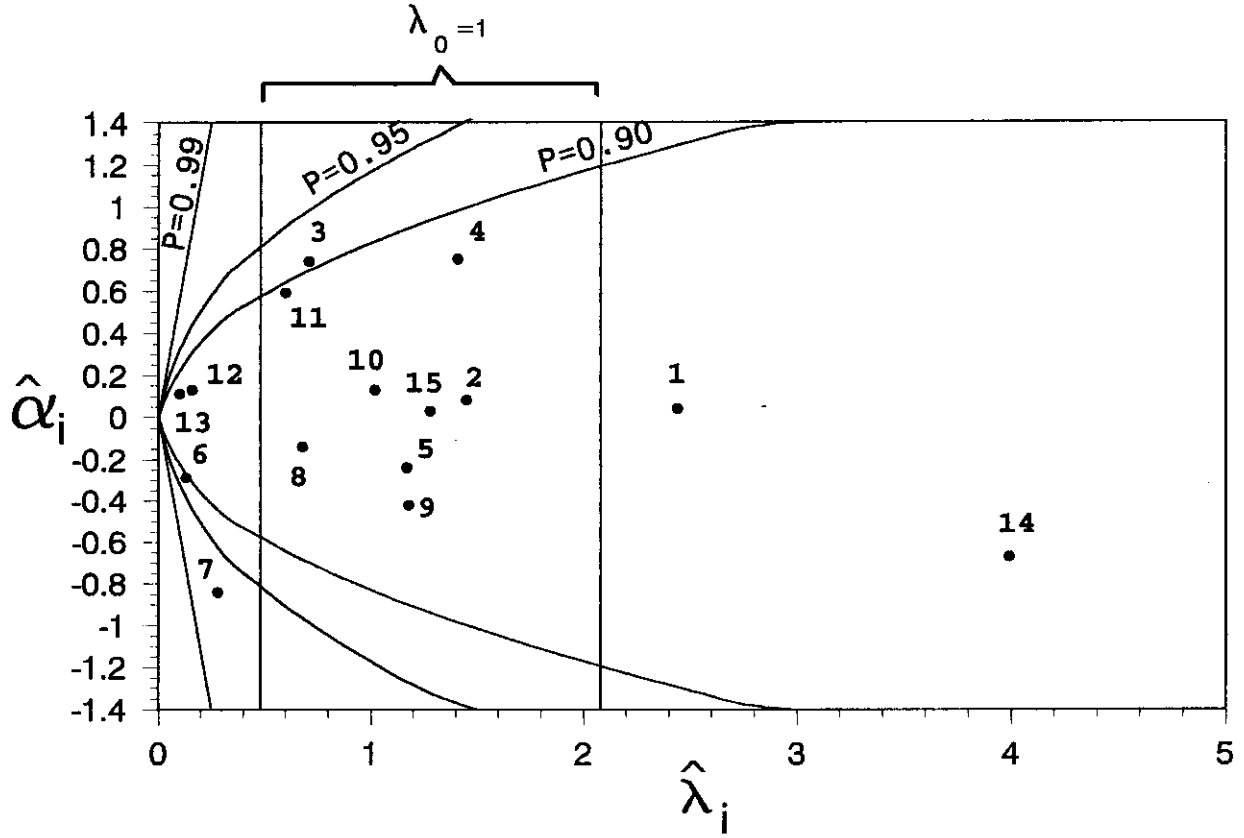


Fig.(I): Stability curves for position of first fruiting branch.

I- Danda ra	6- G. 77	II-G.77XG.45(B)
2- G. 80	7- G. 45	I2-G.67XC.B 58
3- G. 75	8- G. 70	I3-G.75XG.8I
4- G. 8I	9-G.68XC.B 58	I4-G.72XG.67
5- G. 7 6	I0-G.77 XG.45(A)	I5-G.83X(G.72XDelcero)

It could be stated that the average stability area in Fig (1) contained nine stable genotypes, i.e. G-80, G-81, G-76, G-70, G-68 x C.B-58, G-77 x G-45 types (A) and (B) G-83 x (G-72 x Delcero) and G-75 that showed average degree of stability at all probability levels, except G-75 variety which was unstable at $P = 0.90$ level of probability. Moreover, the great variations in the estimated $\hat{\lambda}$ statistics for genotypes, suggests that the relatively unpredictable component of the genotype x environment interaction variance may be much more important than the relatively predictable component. These results are in harmony with those reported by El-Markaby *et al* (1986b)Awaad (1989) and Shafshak *et al* (1993a).

3. Earliness percentage:

Evaluation of phenotypic variation :

Results for earliness percentage and the percentage excess of this trait for the promising crosses over their alternative varieties are presented in Table (4 and 5). Results revealed clearly that the promising extra-long staple cross G-68 x C.B-58 gave a mean value of 61.52%, while its alternative varieties G-70 and G-77 gave means of 61.56 and 61.04%, respectively, showing significant differences between them.

The promising cross G-77 x G-45 type (A) recorded a mean value of 60.74% for earliness percentage, while its substitute varieties G-45 and G-76 gave the higher means of 64.35 and 63.83% (Table 5). The percentage excess of this trait for the G-45 and G-76 over the promising cross as shown in Table (4) were 5.61 and 4.84%, respectively, which means that the promising cross G-77 x G-45 Type (A) was later than the two alternative varieties G-45 and G-76.

Moreover, the promising cross G-77 x G-45 type (B) showed mean value of 60.39%, whereas, its alternative variety G-77 recorded a mean value of 61.04% for earliness percentage trait. This variety was slightly earlier than its promising cross by 1.06 as shown in Table (4).

Moreover, the promising cross G-67 x C.B-58 exhibited a mean value of 65.45%, while the alternative variety G-81 recorded mean value of 62.43% for earliness percentage trait. These results showed that the promising cross G-67 x C.B-58 gave a percentage excess of 4.81% (Table 4) over the alternative variety G-81.

Moreover, the promising cross G-75 x G-81 showed a mean value of 62.62% for earliness percentage, while the alternative variety G-75 gave a mean value of 60.51% for this trait. The promising cross G-75 x G-81 may be earlier than its alternative variety G-75 by 3.48% as presernted in Table (4).

For the promising cross G-72 x G-67, it recorded mean value of 70.39% for this trait, while the mean values of its alternative varieties Dandara and G-80 were 68.94 and 66.41%, respectively. The percentage excess for this trait as shown in Table (4) suggested that the promising cross may be earlier than its alternative varieties Dandara and G-80 by 2.10 and 5.99%, respectively. Abou Zahra *et al* (1986a) and (1989a) reported similar results.

Moreover, the promising cross G-83 x (G-72 x Delcero) recorded a mean value of 72.95%, whereas, the alternative variety Dandara gave lower mean of 68.94% for this trait. This promising cross could be earlier and showed an percentage excess of 5.81% over its alternative variety Dandara as shown in Table (4). These results are in agreement with those obtained by El-Gharbawy *et al* (1983).

Table (5) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for earliness percentage over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability		
		$\hat{\alpha}$	$\hat{\lambda}$	0.90	0.95	0.99
G.68 x C.B 58	61.52	-0.231	0.992	++	++	++
G.77 x G.45 (A)	60.74	-0.015	2.227	+	+	+
G.77 x G.45 (B)	60.39	-0.036	1.610	++	++	++
G.45	64.35	0.318	0.542	++	++	++
G.70	61.56	0.058	3.358	+	+	+
G.76	63.83	0.288	1.205	++	++	++
G.77	61.04	0.39[illegible]	0.861	++	++	++
G.67 x C.B 58	65.45	-0.127	0.875	++	++	++
G.75 x G.81	62.62	0.152	0.589	++	++	++
G.75	60.51	0.023	0.156	+	+	+
G.81	62.43	0.348	1.650	++	++	++
G.72 x G.67	70.39	-0.373	4.754	+	+	+
G.83 x (G.72 x Delcero)	72.95	-0.657	1.598	+++	++	++
Dandara	68.94	0.037	2.064	++	++	++
G.80	66.41	-0.17[illegible]	0.502	++	++	++
L.S.D 0.05	4.90					
0.01	6.48					
Heritability value		58.98%				

+++ Genotypes with above average degree of stability
++ Genotypes with average degree of stability.
+ Unstable genotypes.

Heritability estimates in broad sense for earliness percentage as shown in Table (5) presented a reliable value of 58.98% indicating the effect of environmental fluctuation on this character. Similar results were obtained by Abou Zahra *et al* (1986a)Sallam *et al* (1987), Awaad (1989) and Hanaa *et al* (1994).

The genotypic stability for earliness percentage trait:

The results of the genotypic stability for this trait of the combined analysis of the genotypes grown in the five environments are presented in Table (1). Results revealed that the environments, genotypes and environment x genotype interaction mean squares were significant. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

Table (5) shows the average means of genotypes for earliness percentage along with the estimates of the parameters $\hat{\alpha}$ and $\hat{\lambda}$ for each genotype and their degrees of stability. While, Figure (2), illustrates the distribution of $\hat{\alpha}$ and $\hat{\lambda}$ values for this character. The promising cross G-83 x (G-72 x Delcero) was the earliest genotype over all the sampled environments, followed in a descinding order by G-67 x G-72, Dandara, G-80, G-67 x C.B-58, G-45, G-76, G-75 x G-81, G-81, G-70, G-68 x C.B-58, G-77, G-77 x G-45 (A), G-75 and G-77 x G-45 (B).

It could be stated from Table (5) and Fig. (2) that:

a. The estimated $\hat{\alpha}$ statistics were not significantly different from $\hat{\alpha} = 0$ for all genotypes at all of the probability levels except promising cross G-83 x (G-72 x Delcero) at P = 0.90.

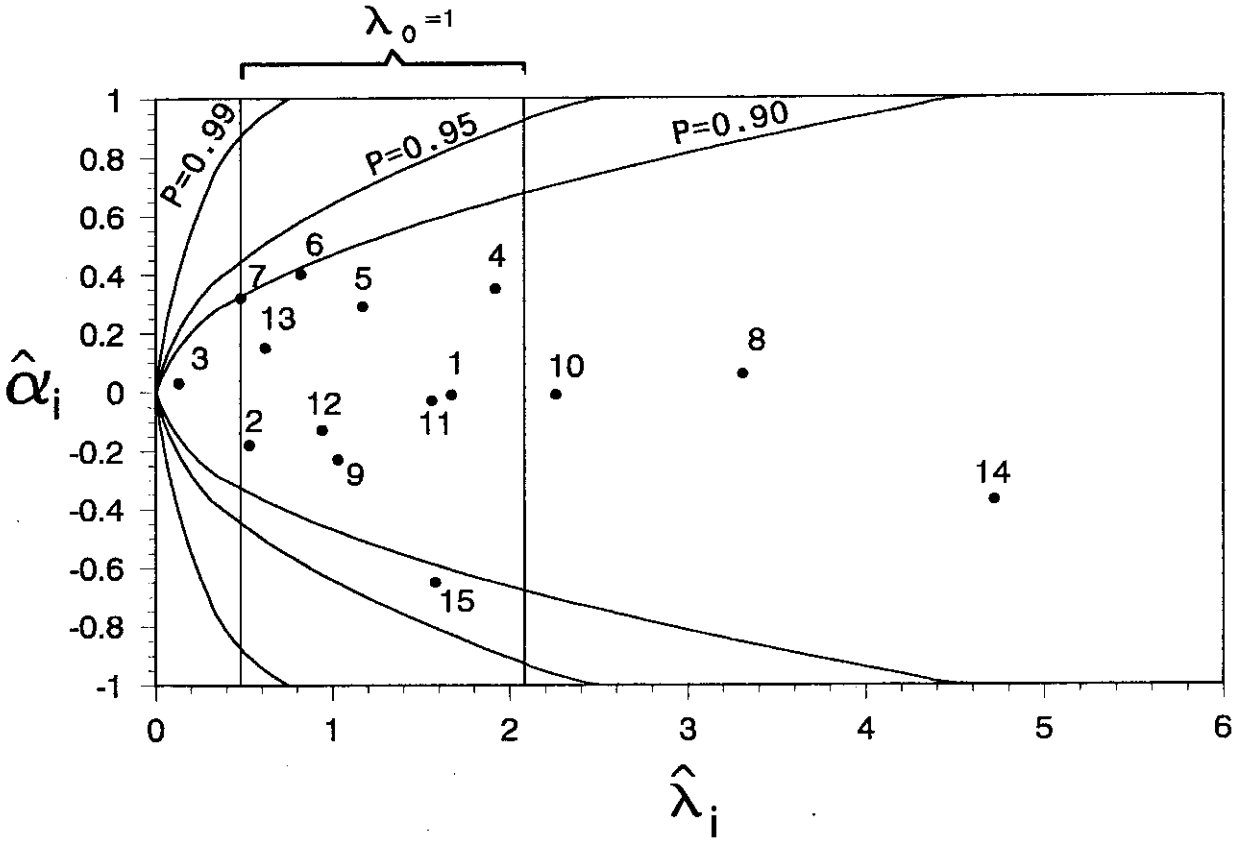


Fig.(2): Stability curves for earliness percentage.

I- Dandara	6- G. 77	II-G.77XG.45(B)
2- G. 80	7- G. 45	I2-G.67XC.B 58
3- G. 75	8- G. 70	I3-G.75XG.8I
4- G. 8I	9-G.68XC.B 58	I4-G.72XG.67
5- G. 76	IO-G.77XG.45(A)	I5-G.83 X(G.72Xdelcero)

b. The estimated $\hat{\lambda}$ statistics were not significantly different from $\hat{\lambda} = 1$ for all genotypes except four genotypes; G-75, G-70, G-77 x G-45 type (A) and G-67 x G-72, which were significantly lower than one, and one line out of them, (G-67 x G-72) was significantly larger than one.

It could be stated that the promising cross G-83 x (G-72 x Delcero) showed above average degree of stability (at P = 0.90), Dandara, G-80, G-81, G-76, G-77, G-45, G-68 x C.B-58, G-77 x G-45 type (B), G-67 x C.B-58 and G-75 x G-81 showed the average degree of stability at all probability levels for earliness percentage trait.

The great variation noticed among genotypes in the estimated $\hat{\lambda}$ statistics suggests that the relative unpredictable component (the deviation from the linear response) of the genotype-environment interaction variance, might be more important than the relatively predictable component (the coefficient of linear response). These results are similar to the findings of Quisenberry and Kohel (1970), El-Markaby *et al* (1986a)Awaad (1989) and Shafshak *et al* (1993a).

B. Yield and yield components:

1. Number of fruiting branches/plant:

Evaluation of phenotypic variation:

Results of the mean genotypes for number of fruiting branches/plant over five environments and the percentage excess of these trait for the promising crosses over their alternative varieties are presented in Tables (4 and 6), respectively. These results showed that the promising cross G-68 x C.B-58 gave a mean value of 11.5 branches, Moreover, its alternative varieties G-70 and G-77 recorded mean values of 12.84 and 9.84 branches, respectively. The percentage excess of the promising cross in this trait was

16.87% over the alternative variety G-77, while the substitute variety G-70, surpassed this cross by 5.58% in number of fruiting branches/plant (Table 4).

Moreover, the promising cross G-77 x G-45 type (A) recorded a mean value of 11.71 branches, while the mean values for its substitute varieties G-45 and G-76 were 10.65 and 10.84 branches, respectively. The percentage excess of this cross in number of fruiting branches/plant were 9.95 and 8.02% over the alternative varieties G-45 and G-76, respectively (Table 4).

The promising cross G-77 x G-45 type (B) showed a mean value of 11.63 branches for number of fruiting branches/plant, while its alternative variety G-77 recorded a mean value of 9.84 branches (Table 6). These results indicated that, this cross surpassed its alternative variety G-77 by 18.19% for this trait.

Concerning, the promising cross G-67 x C.B-58, it gave a mean value of 10.74 fruiting branches/plant, while the alternative variety G-81 recorded a mean value of 11.28 branches G-81 variety recorded a percentage excess of 4.79% over the promising cross G-67 x C.B-58 for number of fruiting branches/plant (Table 4).

Meanwhile, the promising cross G-75 x G-81 showed a mean value of 11.40 fruiting branches/plant, while its alternative variety G-75 gave a mean value of 11.26 branches (Table 6). These results indicated that the promising cross exceeded its alternative variety G-75 by 1.24% as presented in Table (4).

With regard to , the promising cross G-72 x G-67 mean value of fruiting branches/plant was 11.82 branches, while the mean values of its alternative varieties Dandara and G-80 were 11.24 and 10.96 branches/plant, respectively (Table 6). The percentage excess of the promising cross were

Table (6) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for number of fruiting branches/ plant over five environments.

Genotypes		Mean	Stability parameters		Degrees of stability	
			$\hat{\alpha}$	$\hat{\lambda}$	0.90	0.95
G.68 x C.B 58		11.50	-0.087	2.991	+	+
G.77 x G.45 (A)		11.71	0.008	1.929	++	++
G.77 x G.45 (B)		11.63	0.007	0.764	++	++
G.45		10.65	0.597	5.661	+	+
G.70		12.18	0.001	1.346	++	++
G.76		10.84	0.192	0.519	++	++
G.77		9.84	-0.553	0.667	++	++
G.67 x C.B 58		10.74	-0.393	0.615	++	++
G.75 x G.81		11.40	-0.002	3.296	+	+
G.75		11.26	-0.012	0.600	++	++
G.81		11.28	0.128	1.949	++	++
G.72 x G.67		11.82	0.006	3.417	+	+
G.83 x (G.72 x Delcero)		10.57	0.226	0.320	+	+
Dandara		11.24	-0.059	1.378	++	++
G.80		10.96	-0.059	3.036	+	+
L.S.D	0.05	1.05				
	0.01	1.38				
Heritability value			5.41%			

++ Genotypes with average degree of stability.

+ Unstable genotypes.

5.16 and 7.85% over the alternative varieties Dandara and G-80, respectively.

The promising cross G-83 x (G-72 x Delcero) showed a mean value of 10.57 branches, while its alternative variety Dandara gave a mean value of 11.24 branches. These results indicated that the number of fruiting branches in the promising cross decreased by 5.96% than its alternative variety Dandara, Table (4).

Heritability estimates in broad sense for number of fruiting branches/plant presented in Table (6) showed a very low value of 5.41%, which indicated that this result may be due to the major effects of the changes in the environmental conditions on this trait.

The genotypic stability for number of fruiting branches/plant.

The results of the combined analysis of the genotypes grown in the five different environments presented in Table (1) revealed that the environments, genotypes and environment-genotype interaction mean squares were significant. The significance of environment x genotype interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

The estimates of $\hat{\alpha}$ and $\hat{\lambda}$ parameter for the genotypes together with their degrees of stability and average performances of genotypes for number of fruiting branches/plant are presented in Table (6). G-70 variety gave the highest number of fruiting branches/plant followed in the descending order by the cross G-72 x G-67, G-77 x G-45 (A), G-77 x G-45 (B), G-68 x C.B-58, G-75 x G-81, G-81, G-75, Dandara, G-80, G-76, G-76 x C.B-58, G-45, G-83 x (G-72 x Delcero) and G-77.

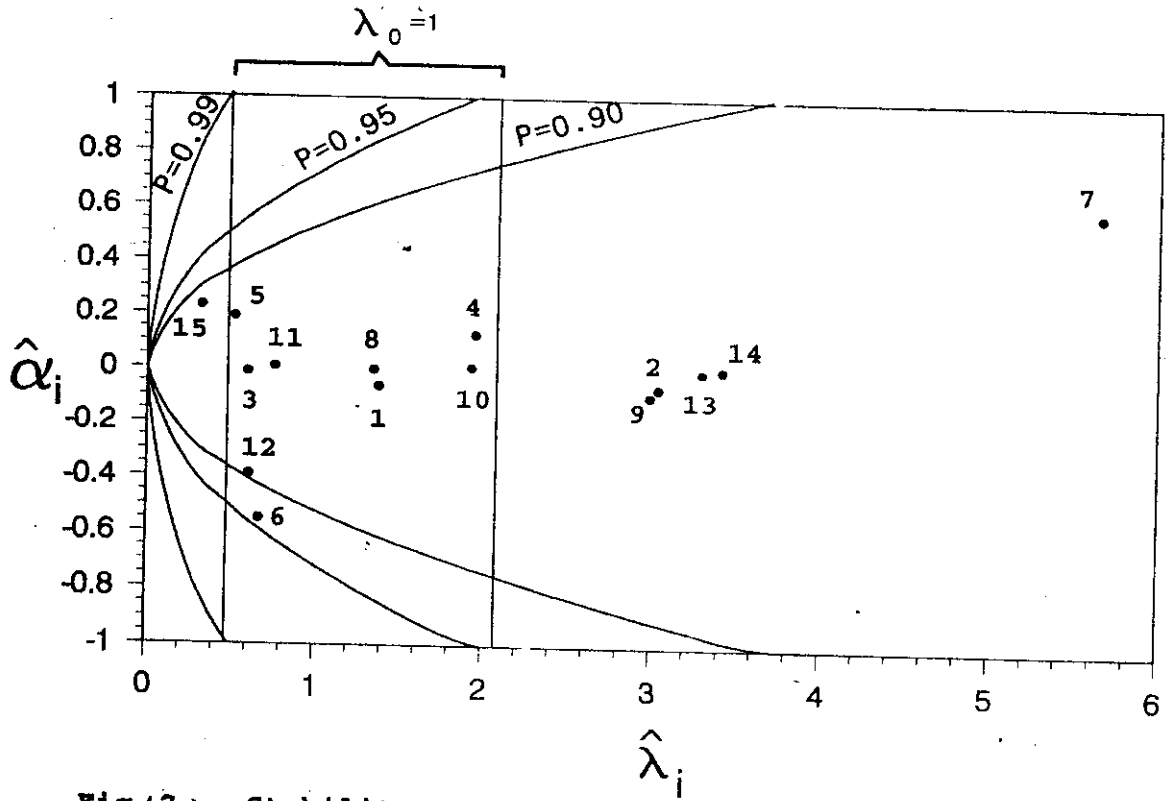


Fig.(3): Stability curves for number of fruiting branch.

I- Dandara	6- G. 77	II- G.77 X G.45(B)
2- G. 80	7- G. 45	I2- G.67 X C.B.58
3- G. 75	8- G. 70	I3- G.75 X G.81
4- G. 81	9- G.68 X C.B.58	I4- G.72 X G.67
5- G. 76	I0- G. 77XG.45(A)	I5- G.83X(G.72XDelcero)

It could be seen from Table (6) and Figure (3) which showed the distribution of the $\hat{\alpha}$ and $\hat{\lambda}$ estimates that;

a. The estimated $\hat{\alpha}$ statistics were not significantly different from $\alpha = 0$ for all genotypes at all of the probability levels except for G-77 (at P = 0.90).
b. The estimated $\hat{\lambda}$ statistics were not significantly different from $\hat{\lambda} = 1$ for the lines; Dandara, G-75, G-81, G-76, G-77, G-70, G-77 x G-45 (A), G-77 x G-45 (B) and G-67 x C.B-58 and were significantly greater than one for the other genotypes. The great variation in the estimated $\hat{\lambda}$ statistics for genotypes suggests that the relatively unpredictable component of the genotype-environment interaction variance may be more important than the relatively predictable component.

Finally, it could be stated that G-77 variety was above the average degree of stability (P = 0.90) and that Dandara, G-75, G-81, G-76, G-70, G-77 x G-45 (A), G-77 x G-45 (B) and G-67 x C.B-58 showed the average degree of stability at all probability levels.

2. Seed cotton yield/plant:

Evaluation of phenotypic variation:

Results of the mean genotypes for seed cotton yield/plant over five environments and the percentage excess of this trait for the promising crosses over their alternative varieties are illustrated in Tables (7 and 4), respectively. These results showed that the promising cross G-68 x C.B-58 gave a mean value of 30.48gm; whereas, its alternative varieties G-70 and G-77 recorded mean values of 27.42 and 21.94g, respectively. These results indicated that this cross surpassed its alternative varieties G-70 and G-77 by 11.6 and 38.92%, respectively, in seed cotton yield/plant (Table 4).

Moreover, the seed cotton yield/plant in the promising cross G-77 x G-45 type (A) recorded a mean value of 25.02g, while the mean values of its alternative varieties G-45 and G-76 were 15.6 and 19.99g, respectively. The percentage excess of this cross (Table 4) in seed cotton yield/plant were 60.08 and 25.16% over the alternative varieties G-45 and G-76, respectively.

The promising cross G-77 x G-45 type (B) showed a mean value of 24.95g for seed cotton yield/plant (Table 7). While its alternative variety G-77 recorded a mean value of 21.94g. These results indicated that this cross exceeded its alternative variety G-77 by 13.72% for this trait.

Concerning, the promising cross G-67 x C.B-58, the seed cotton yield/plant was 28.54g, while the alternative variety G-81 recorded a mean value of 27.56g. The percentage excess of this cross of seed cotton yield/plant was 3.55% over the alternative variety G-81 (Table 4).

Meanwhile, the promising cross G-75 x G-81 gave a mean value of 26.14g, while its alternative variety G-75 gave a mean value of 28.08g. With a percentage excess of 6.90% over the promising cross G-75 x G-81 for seed cotton yield/plant.

Regarding, the promising cross G-72 x G-67, it recorded a mean value of 32.18g, while the mean values of its alternative varieties Dandara and G-80 were 23.94 and 25.06g, respectively. These results indicated that, this cross surpassed its alternative varieties Dandara and G-80 by 34.42 and 28.41%, respectively.

The promising cross G-83 x (G-72 x Delcero) showed a mean value of 25.74g, while its alternative variety Dandara gave a mean value of 23.94g (Table 7). These results indicated that the seed cotton yield/plant of the promising cross G-83 x (G-72 x Delcero) increased than its alternative variety Dandara by 7.52% (Table 4).

Table (7) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for seed cotton yield/plant over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability	
		$\hat{\alpha}$	$\hat{\lambda}$	0.90	0.95
G.68 x C.B 58	30.48	-0.233	2.229	+	+
G.77 x G.45 (A)	25.02	0.046	1.861	++	++
G.77 x G.45 (B)	24.95	0.099	2.072	++	++
G.45	15.63	-0.328	0.642	++	++
G.70	27.42	0.178	0.678	+	+
G.76	19.99	-0.244	0.294	+	+
G.77	21.94	-0.105	1.696	++	++
G.67 x C.B 58	28.54	0.044	0.863	++	++
G.75 x G.81	26.14	0.555	6.024	+	+
G.75	28.08	0.110	3.202	+	+
G.81	27.56	0.620	0.792	++	++
G.72 x G.67	32.18	-0.021	3.144	+	+
G.83 x (G.72 x Delcero)	25.74	-0.200	0.684	++	++
Dandara	23.94	-0.218	0.908	++	++
G.80	25.06	-0.306	7.191	+	+
L.S.D 0.05	3.86				
0.01	5.11				
Heritability value		70.28%			

++ Genotypes with average degree of stability.

+ Unstable genotypes.

Heritability estimates in broad sense for seed cotton yield/plant as shown in Table (7) showed a reliable value of 70.28% which indicated the effect of environmental fluctuation on this character. These results are in harmony with those obtained by Forisa *et al* (1986) and Salama *et al* (1992).

The genotypic stability for seed cotton yield/plant:

The results of the combined analysis of the genotypes grown in the five different environments presented in Table (1) revealed that the environments, genotypes and environment-genotype interaction mean squares were significant. The significance of environment x genotype interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

The estimate of the parameters $\hat{\alpha}$ and $\hat{\lambda}$ for the genotypes with their degrees of stability and seed cotton yield/plant average are presented in Table (7). The promising cross G-72 x G-67 showed the highest mean of seed cotton yield/plant as an average over all of the environments and it was followed in a descending order by G-68 x C.B-58, G-67 x C.B-58, G-75, G-81, G-70, G-75 x G-81, G-83 x (G-72 x Delcero), G-80, G-77 x G-45 (A), G-77 x G-45 (B), Dandara, G-77, G-76 and G-45.

The distributions of the $\hat{\alpha}$ and $\hat{\lambda}$ values are shown in Fig (4). The average stability area at different probability levels in the figure contained the genotypes Dandara, G-77, G-45, G-77 x G-45 (A), G-67 x C.B-58, G-83 x (G-72 x Delcero) and G-81 (with exception of P = 0.90); while the below average stability area of the figure contained the promising cross G-68 x C.B-58 which was close to average stability in addition to the unstable genotypes G-75, G-77 x G-45 (B) and G-72 x G-67.

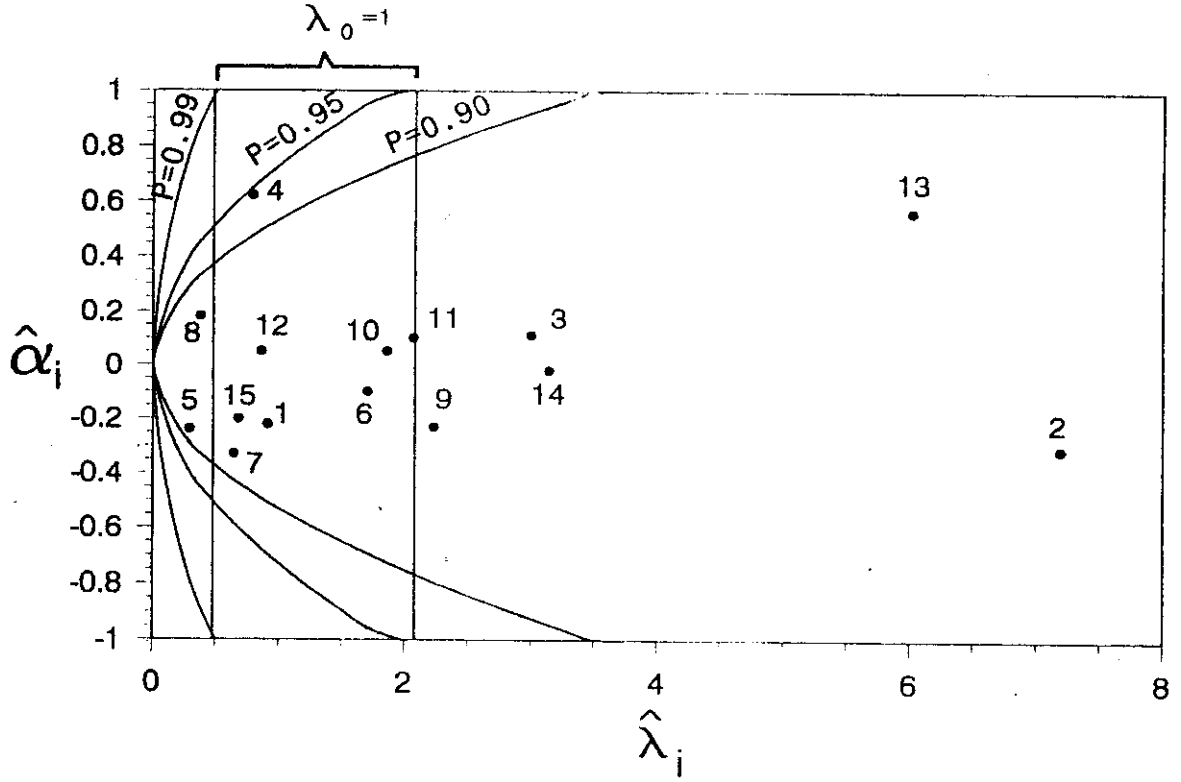


Fig.(4): Stability curves for seed cotton yield / Plant.

I- Dandara	6- G. 77	II-G.77XG.45(B)
2- G. 80	7- G. 45	I2-G.67XC.B.58
3- G. 75	8- G. 70	I3- G.75XG.8I
4- G. 8I	9- G.68XC.B.58	I4- G.72XG.67
5- G. 76	IO- G.77XG.45(A)	I5-G.83X(G.72XDelcero)

From Table (7) and Figure (4), it can be seen that only one line (G-81) showed a linear response to the environmental effects ($\hat{\alpha}$) which was significantly different from $\hat{\alpha} = 0$ at P = 0.90. The genotypes varied in the amount of the deviation from linear response ($\hat{\lambda}$), genotypes; Dandara, G-81, G-77, G-45, G-77 x G 45 (A), G-67 x C.B-58 and G-83 x (G-72 x Delcero) showed $\hat{\lambda}$ statistics significantly do not differ from $\hat{\lambda} = 1$, while the estimated $\hat{\lambda}$ statistics was significantly less than one for the genotypes G-76 and G-70 and it was larger than one for the genotypes G-68 x C.B-58, G-77 x G-45 (B), G-72 x G-67, G-75, G-75 x G-81 and G-80.

The great variation of the genotypes in the estimated $\hat{\lambda}$ statistics did suggest that the relatively unpredictable component (the deviation from the linear response) of the genotype-environment interaction variance may be more important than the relatively predictable component (the linear response). This result, is in agreement with the findings of Awaad (1989).

3. Seed cotton yield in kentar per feddan:

Evaluation of phenotypic variation :

Results of seed cotton yield trait and excess of this trait for the promising crosses over their alternative varieties are shown in Tables (8 and 4) respectively. The results revealed clearly that the promising extra-long staple cross G-68 x C.B-58 produced an average seed cotton yield of 9.65 k/f, whereas, its alternative varieties G-70 and G-77 gave a lower means of 8.15 and 8.31 k/f, respectively. The percentage excess of seed cotton yield of the cross over the two alternative varieties G-70 and G-77 were 18.40 and 16.12%, respectively. These results indicated that the seed cotton yield of the promising cross exceeded significant its alternative varieties G-70 and G-77, Sallam *et al* (1990) reported similar results.

Moreover, the promising extra-long staple cross G-77 x G-45 type (A), showed a mean value of 8.53 k/f, while the alternative varieties G-45 and G-76 gave mean values of 5.32 and 6.38 k/f, respectively (Table 8). These results showed that the promising cross gave a significant percentage excess of 60.34% over G-45 variety and 33.70% over G-76 variety for seed cotton yield trait (Table 4). These results coincide with those obtained by Sallam ***et al*** (1992).

With regard to the promising cross G-77 x G-45 type (B) its showed a mean value of 8.41 k/f, while its alternative variety G-77 recorded an average seed cotton yield of 8.31 k/f. The percentage excess in the yield of this cross was 1.20% over G-77 variety, however, this increase in yield was not significant.

With regard to the promising cross G-67 x C.B-58, it gave a mean value of 8.56 k/f, whereas, the alternative variety G-81 of this cross recorded mean value of 8.51 k/f (Table 8) without significant difference between them.

The seed cotton yield of the promising cross G-75 x G-81 was 8.61 k/f. Whereas, its alternative variety G-75 gave 8.67 k/f showing the percentage excess of 0.70% over the promising cross G-75 x G-81 without significant difference.

Results showed that the promising cross G-72 x G-67 produced 9.56 k/f seed cotton yield, whereas its alternative varieties Dandara and G-80 gave lower mean values of 7.70 and 8.25 k/f, respectively (Table 8). The percentage excess of seed cotton yield of this cross over the two alternative varieties was 24.16% and 15.88% for Dandara and G-80 varieties, respectively (Table 4). These results indicated that seed cotton yield of this

cross exceeded significantly its alternative varieties Dandara and G-80. This result is agreement with the finding of Sallam *et al* (1992a).

Concerning, the promising cross G-83 x (G-72 x Delcero), it gave a mean value of 8.02 k/f, while the alternative variety Dandara gave a lower mean of 7.70 k/f with 4.16% decrease than the promising cross G-83 x (G-72 x Delcero).

Heritability estimate in broad sense (Table 8) gave a reliable value of 79.19% indicating the effect of environmental fluctuation on the seed cotton trait. These result could be confirmed by the finding of Khalifa *et al* (1982), Forisa *et al* (1986), Abou Zahra *et al* (1989b), Salama *et al* (1992) and Hanaa *et al* (1994). On the other hand, El-Gharbawy *et al* (1983), Abou Zahra *et al* (1986a) and Mohamed (1991) found that the heritability value was low for this trait.

The genotypic stability for seed cotton yield trait:

The results of the combined analysis presented in Table (1) showed that mean squares of the environment, genotype and interaction between them were highly significant. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

The estimates of the parameter $\hat{\alpha}$ and $\hat{\lambda}$ and degree of stability for seed cotton yield trait of the commercial varieties along with their alternaive promising crosses are presented in Table (8). The distribution of the $\hat{\alpha}$ and $\hat{\lambda}$ values of these lines are shown in Figure (5). From results shown in Table (8) and Fig (5). It could be noticed that the average stability area in the figure, contained five lines. These lines, were G-80, G-81, G-76, G-45 and promising cross G-67 x G-72. Among them, the promising cross G-72 x G-

Table (8) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for seed cotton yield K/F., over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability		
		$\hat{\alpha}$	$\hat{\lambda}$	0.90	0.95	0.99
G.68 x C.B 58	9.65	-0.171	2.960	+	+	+
G.77 x G.45 (A)	8.53	0.168	7.522	+	+	+
G.77 x G.45 (B)	8.41	-0.002	4.151	+	+	+
G.45	5.32	0.098	1.202	++	++	++
G.70	8.15	0.317	3.623	+	+	+
G.76	6.38	-0.209	1.490	++	++	++
G.77	8.31	-0.130	6.010	+	+	+
G.67 x C.B 58	8.56	-0.246	4.165	+	+	+
G.75 x G.81	8.61	0.327	3.896	+	+	+
G.75	8.67	0.584	0.038	+	+	+
G.81	8.51	-0.233	2.047	++	++	++
G.72 x G.67	9.56	-0.163	0.940	++	++	++
G.83 x (G.72 x Delcero)	8.02	-0.196	0.177	+	+	+
Dandara	7.70	-0.274	6.619	+	+	+
G.80	8.25	0.131	0.770	++	++	++
L.S.D 0.05	0.69					
0.01	0.92					
Heritability value		79.19%				

++ Genotypes with average degree of stability.

\+ Unstable genotypes.

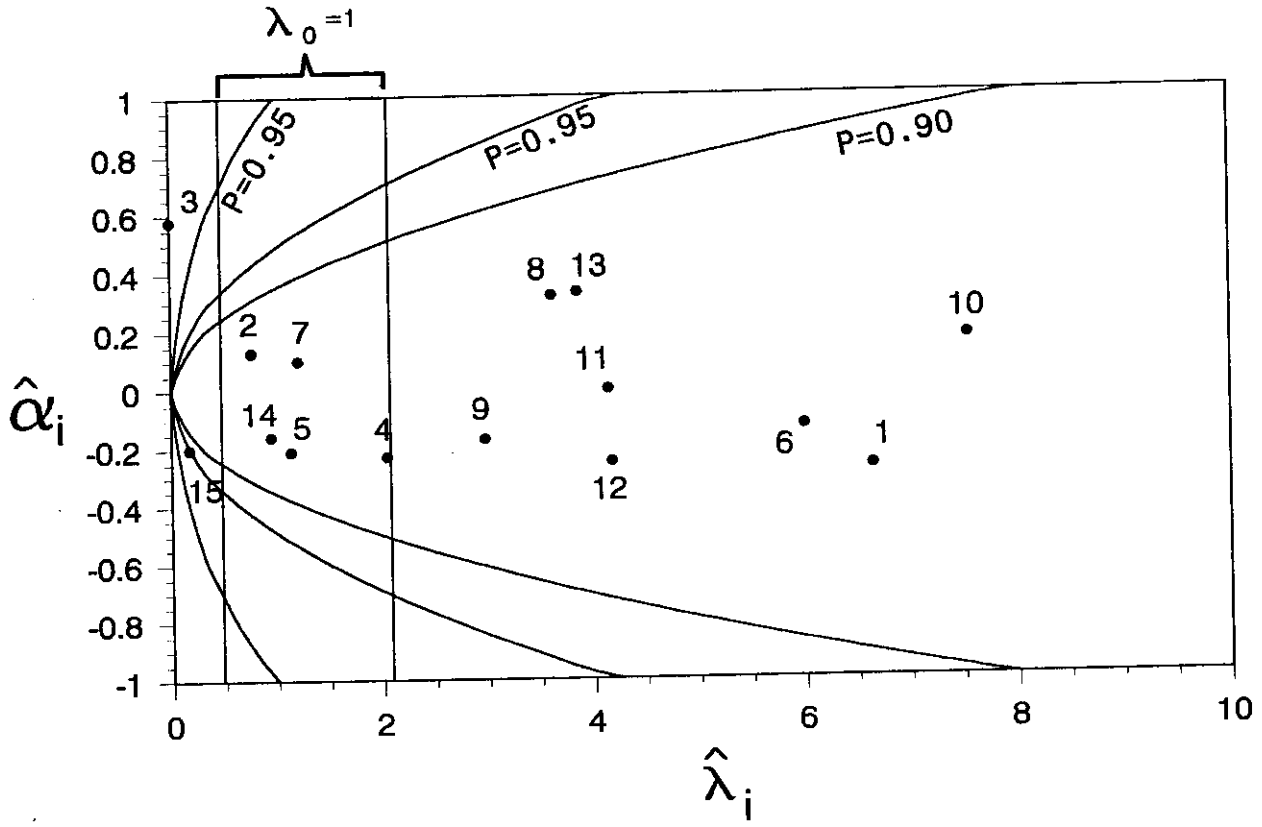


Fig.(5): Stability curves for seed cotton yield / fedan.

I- Dandara	6- G. 77	II-G.77XG.45(B)
2- G. 80	7- G. 45	I2-G.67XC.B 58
3- G. 75	8- G. 70	I3-G.75XG.8I
4- G. 8I	9- G.68XC.B 58	I4-G.72XG.67
5- G. 76	IO-G.77XG45(A)	I5-G.83X(G.72XDelcero)

67, Giza-81 and Giza 80 gave satisfactory seed cotton yield per feddan, 9.56, 8.51 and 8.25 k/f, respectively. The highest yield (9.65 k/f) was obtained for the promising cross G-68 x C.B-58, however, it gave unstable performance. Moreover, the remaining nine lines were considered to be unstable and three lines, out of them, G-77, Dandara and G-77 x G-45 type (A) were obviously more unstable than the others. Although, among those unstable lines, there were five promising crosses, G-68 x C.B-58, G-77 x G-45 type (A) and (B), G-67 x G-72, G-75 x G-81 and G-83 x (G-72 x Delcero) along with three commercial varieties, G-70, G-77 and G-75 that had relatively high seed cotton yield.

Only five lines showed different linear response to the environmental effects. The small number of sampled environments and large deviation variance of some lines Table (8), resulted in estimated $\hat{\alpha}$ statistics which were not significantly different from $\hat{\alpha} = 0$. However, the great variation in the $\hat{\lambda}$ statistics suggested that the relatively unpredictable component (the deviation from the linear response) of the genotype-environment interaction variance may be much more important than the relatively predictable component (linear response). Baker (1969) reported similar results in wheat.

It could be stated that, only of the high yielding promising cross (G-72 x G-67) that had satisfactory stability, while four cultivars were stable. This promising cross is likely to be candidate to replace the present alternative varieties only if it has superior characteristics, not related to yield and stability of performance. The lack of association of high seed cotton yield and stable performance of the other promising crosses which have reached an advanced trial stage suggest the necessity of further research to determine the nature of stability of seed cotton yield trait. Similar results are in harmony with those obtained by Simpson and Duncan (1953), Kalsy and Sing (1974),

El-Shaarawy (1977), El-Kadi *et al* (1978), El-Hariry (1968), El-Marakby *et al* (1986a), Abd El-Rahman and El-Mazar (1987), Abou Alam *et al* (1988), El-Shaarawy *et al* (1988), Abou Zahra *et al* (1989b), Awaad (1989), Abo El-Zahab *et al* (1992b) and Shafshak *et al* (1993b).

4. Lint cotton yield in kentar per feddan:

Evaluation of phenotypic variation :

Results of lint cotton yield over five environments and the percentage excess of this trait for the promising crosses over their alternative varieties are presented in Tables (9 and 4), respectively. These results revealed that the promising extra-long staple cross G-68 x C.B-58 gave a mean value of 11.1 k/f, whereas, its alternative varieties G-70 and G-77 gave lower mean values of 8.96 and 9.36 k/f, respectively. The percentage excess of lint cotton yield of the cross over the two varieties G-70 and G-77 were 23.88 and 18.59%, respectively (Table 4). These results indicated that the lint cotton yield of the promising cross G-68 x C.B-58 significantly surpassed its alternative varieties G-70 and G-77. Sallam *et al* (1990) reported similar results.

Moreover, the promising cross G-77 x G-45 type (A) gave a mean value of 8.78 k/f, whereas its alternative varieties G-45 and G-76 gave means 5.43 and 6.80 k/f (Table 9), respectively. These results pointed that this cross gave a significant percentage excess of 61.69% over G-45 and 29.12% over G-76 (Table 4) for lint cotton yield trait. Similar results were obtained by Sallam *et al* (1992b).

With regard to the promising cross G-77 x G-45 type (B), which showed an average lint cotton yield of 9.58 k/f, while the alternative variety

G-77 gave a little lower mean value of 9.36 k/f with a decrease of 2.35% than the promising cross G-77 x G-45 type (B) (Table 4).

Concerning, the promising cross G-67 x C.B-58, it exhibited mean value of 10.24 k/f, lint cotton yield (Table 9), wheras, the alternative variety G-81 gave 10.11 k/f. These results showed that the promising cross G-67 x C.B-58 surpassed the alternative variety G-81 in lint cotton yield with an excess of 1.28%.

Moreover, the promising cross G-75 x C.B-81 showed a mean value of 9.74 k/f, compared with its alternative variety G-75 which gave a higher mean of 10.08 k/f lint yield (Table 9) with a significant percentage excess of 3.37% over the promising cross (Table 4).

With regard to the promising cross G-72 x G-67, it recorded a mean value of 12.42 k/f lint cotton yield, while the mean values of its alternative varieties Dandara and G-80 were 8.62 and 10.16 k/f, respectively. The percentage excess of lint cotton yield of this cross over the two varieties Dandara and G-80 were 44.08 and 22.24%, respectively. These results indicated that the lint cotton yield of this cross increased significantly over its alternative varieties Dandara and G-80. Similar results were reported by Abou Zahra *et al* (1989b) and Sallam *et al* (1992a).

The promising cross G-83 x (G-72 x Delcero) gave a mean value of 9.84 k/f lint cotton yield with an excess of 14.15% over the alternative variety Dandara which gave a mean of 8.62 k/f (Table 9).

Heritability estimates in broad sense for lint cotton yield illustrated in Table (9) showed that this trait was somewhat constant and had a reliable value of 86.60% indicating the effect of environmental fluctuation on this character. Similar results were obtained by Abou Zahra *et al* (1989b). On

the other hand, Mohamed (1991) reported that the heritability value was low for lint cotton yield trait.

The genotypic stability for lint cotton yield trait:

The results of the combined analysis of the genotypes grown in the five environments presented in Table (1) showed that the environment, genotype and genotype x environment interaction mean squares were significant. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

The genotypes means of the lint cotton yield (in kentar/feddan) are presented in Table (9) and the estimates of $\hat{\alpha}$ and $\hat{\lambda}$ parameters for each genotype and its degree of stability are presented in Table (9). The distribution of the estimated values for α and λ are shown in Fig (6).

It is clear shown from Table (9) that the promising cross G-67 x G-72 recorded the highest mean for lint cotton yield followed in the descending order by promising crosses and varieties; G-68 x C.B-58, G-67 x C.B-58, G-80, G-81, G-75, G-83 x (G-72 x Delcero), G-75 x G-81, G-77 x G-45 (B), G-77, G-70, G-77 x G-45 (A), Dandara, G-76 and G-45.

From both Table 9 and Fig 6, it can be seen that the absence of the genotype-environment interaction affected the distribution of the estimated values for $\hat{\alpha}$ and $\hat{\lambda}$ where:

The estimated $\hat{\alpha}$ statistics were not significantly different from $\hat{\alpha} = 0$ for all genotypes at all of the probability levels except for the promising cross G-83 x (G-72 x Delcero) (at $P = 0.90$ and $P = 0.95$). Moreover, the estimated $\hat{\lambda}$ statistics were not significant for G-80, G-81, G-76, G-45 and cross G-72 x G-67. The average stability area in the figure, contained five genotypes i.e.

Table (9) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for lint cotton yield over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability		
		$\hat{\alpha}$	$\hat{\lambda}$	0.90	0.95	0.99
G.68 x C.B 58	11.10	-0.155	4.274	+	+	+
G.77 x G.45 (A)	8.78	-0.063	8.113	++	++	++
G.77 x G.45 (B)	9.58	0.019	3.116	+	+	+
G.45	5.43	-0.038	0.795	++	++	++
G.70	8.96	0.250	3.685	++	++	++
G.76	6.80	-0.264	0.718	+	+	+
G.77	9.36	-0.295	3.536	++	++	++
G.67 x C.B 58	10.24	0.096	3.894	+	+	+
G.75 x G.81	9.74	0.398	6.219	+	+	+
G.75	10.08	0.631	0.001	+	+	+
G.81	10.11	-0.247	2.225	+	+	+
G.72 x G.67	12.42	-0.028	1.531	+	+	+
G.83 x (G.72 x Delcero)	9.84	-0.199	0.117	+	+	+
Dandara	8.62	-0.303	7.192	++	++	++
G.80	10.16	0.197	1.711	+	+	+
L.S.D 0.05	0.293					
0.01	0.388					
Heritability value		86.60%				

++ Genotypes with average degree of stability.

\+ Unstable genotypes.

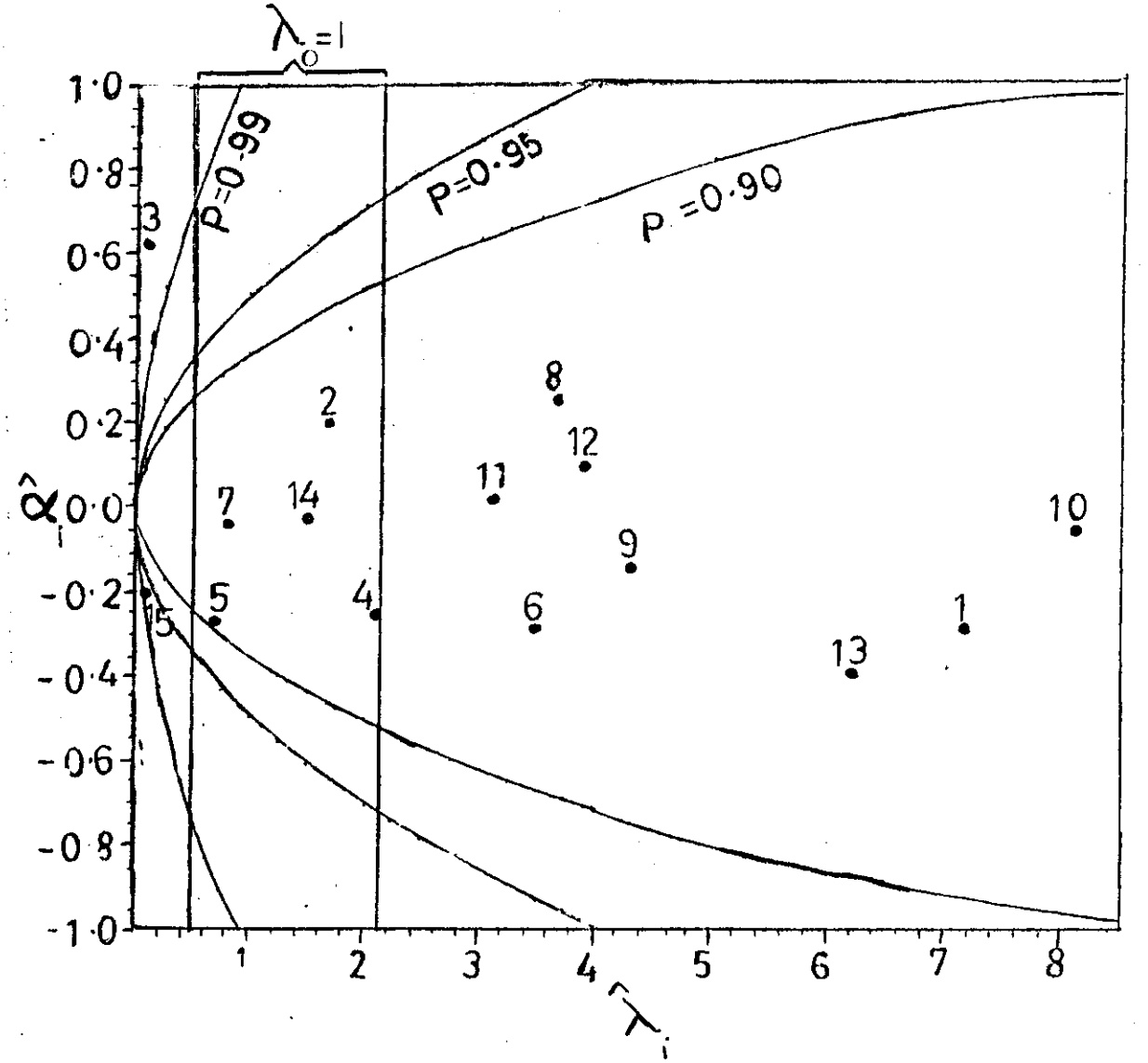


Fig. (6) : Stability curves for lint cotton yield / fedan.

I- Dandara	6- G. 77	II-G.77xG.45(B)
2- G. 80	7- G.45	I2-G.67XC.B 58
3- G. 75	8- G. 70	I3-G.75xG.8I
4- G. 8I	9-G.68xC.B 58	I4-G.72xG.67
5- G.76	IO-G.77xG.45(A)	I5-G.83x(G.72xDelcero)

G-80, G-81, G-76, G-45 and the promising cross G-72 x G-67. Among them, the cross G-72 x G-67, G-80 and G-81 gave satisfactory lint cotton yield per feddan; 12.42, 10.16 and 10.11 k/f, respectively. Moreover, the remaining nine genotypes were considered to be unstable and three lines out of them, Dandara, G-77 x G-45 type (A) and G-75 x G-81, were obviously more unstable than the others. Only five lines showed different linear response to the environmental effects. The great variation in the $\hat{\lambda}$ statistics suggested the relatively unpredictable component (the deviation from the linear response) of the genotype-environment interaction variance may be much more important than the relatively predictable component (linear response).

Finally, it could be stated that, only one of the high yielding promising crosse in the trial; (G-72 x G-67), that had satisfactory stability. This cross is likely to be candidate to replace the present alternative varieties only if it has superior characteristics, not related to yield and stability of performance. The lake of association of high lint cotton yield and stable performance of the other promising crosses which have reached an advanced trial stage suggests the necessity of further research to determine the nature of stability of lint cotton yield trait. Similar results were reported by El-Shaarawy (1977), Abou Zahra *et al* (1989b) and Awaad (1989).

5. Boll weight (in gm):

Evaluation of phenotypic variation:

Results of boll weight in single plants and a plot mean basis trials are presented in Tables (10) and (11), respectively, while the percentage excess of this trait for the promising crosses over their alternative varieties is shown in Table (4).

Results illustrated in Table (10) indicated that the promising cross G-68 x C.B-58 gave a boll weight ranging from 1.8 to 2.9g with an average of 2.41g, in 1991 season and from 1.4 to 2.9g with an average of 2.45g in 1992 season. While the alternative varieties G-70 and G-77 recorded a range from 1.4 to 3.0 and from 1.9 to 3.1g, with mean values of 2.14 and 2.35g, respectively, in 1991 season and it recorded a range from 1.2 to 3.0 and 1.6 to 3.1g with mean values of 2.07 and 2.40g, respectively, in 1992 season. These results indicated that the cross G-68 x C.B-58 showed a slight increase in boll weight over its alternative varieties G-70 and G-77.

Regarding the promising cross G-77 x G-45 type (A), the boll weight ranged from 1.6 to 3.0 and from 1.6 to 2.9g with mean values of 2.29 and 2.27g in 1991 and 1992 seasons, respectively. However, the alternative varieties G-45 and G-76 ranged from 1.5 to 2.5 and from 1.6 to 3.09g with mean values of 2.00 and 2.18g, respectively, in 1991 season, while they ranged from 1.3 to 2.9 and from 1.3 to 3.09g with mean values of 2.06 and 2.11g, respectively, in 1992 season. These results indicated that this cross surpassed the two varieties G-45 and G-76 in boll weight in both seasons.

With respect to the promising cross G-77 x G-45 type (B), the boll weight ranged from 1.3 to 2.9g with a mean value of 2.10g, whereas its alternative variety G-77 recorded a range from 1.9 to 3.1g with an average of 2.35g in 1991 season. Nearly, similar results were obtained in 1992 season as shown in Table (10). These results revealed that this cross showed a slight decrease in boll weight than its alternative variety G-77 in both seasons.

Regarding, the promising cross G-67 x C.B-58, its boll weight ranged from 1.3 to 2.7 and from 1.7 to 2.8g with an average of 2.12 and 2.20g in 1991 and 1992 seasons, respectively. While, the alternative variety G-81

Table (10) : Statistical constants of boll weight and seed index in single plants of different genotypes in 1991 and 1992 seasons.

Genotypes	No. of plant	Boll weight						Seed index					
		1991			1992			1991			1992		
		Range	Mean	C.V	Range	Mean	C.V	Range	Mean	C.V	Range	Mean	C.V
G.68 x C.B 58	50	1.8-2.9	2.41±0.06	14.14	1.4-2.9	2.45±0.02	10.56	7.2-10.7	9.83±0.13	10.40	7.0-10.6	9.79±0.91	10.36
G.77 x G.45 (A)	50	1.6-3.0	2.29±0.02	6.82	1.6-2.9	2.27±0.01	3.75	6.9-11.6	8.79±0.15	11.76	7.0-11.0	8.83±0.14	11.53
G.77 x G.45 (B)	50	1.3-2.9	2.10±0.04	16.50	1.6-2.9	2.26±0.04	16.06	7.3-10.4	8.91±0.09	7.24	7.2-10.2	8.94±0.10	7.72
G.45	50	1.5-2.5	2.00±0.04	14.36	1.3-2.9	2.06±0.04	15.15	7.7-11.6	9.30±0.13	9.76	7.7-11.5	9.29±0.14	10.30
G.70	50	1.4-3.0	2.14±0.02	5.04	1.2-3.0	2.07±0.03	8.74	8.0-11.4	9.66±0.12	9.20	8.0-11.1	9.61±0.12	8.85
G.76	50	1.6-3.0	2.18±0.05	15.47	1.3-3.0	2.11±0.05	16.20	7.0-11.0	9.38±0.13	10.16	7.0-11.0	9.25±0.14	10.38
G.77	50	1.9-3.1	2.35±0.04	11.82	1.6-3.1	2.40±0.05	13.80	7.5-11.0	9.49±0.13	9.91	7.7-11.2	9.43±0.13	9.86
G.67 x C.B 58	50	1.3-2.7	2.12±0.05	11.94	1.7-2.8	2.20±0.03	10.28	6.9-11.6	9.34±0.16	12.20	7.1-11.2	9.40±0.15	11.26
G.75 x G.81	50	1.3-2.7	2.13±0.02	9.40	1.6-3.0	2.20±0.06	17.40	6.2-10.7	8.19±0.17	12.21	6.2-10.7	8.27±0.17	12.30
G.75	50	1.3-3.0	2.5±0.02	8.75	1.5-2.9	2.38±.0.05	18.30	8.4-12.5	10.23±0.14	10.03	8.4-12.5	10.18±0.15	10.30
G.81	50	1.8-2.9	2.43±0.04	18.71	1.6-3.2	2.42±0.06	19.20	8.0-11.1	9.66±0.16	7.41	7.5-11.2	9.61±0.12	9.11
G.72 x G.67	50	1.8-3.2	2.76±0.05	15.50	1.4-3.2	2.64±0.05	16.42	6.5-11.5	8.94±0.17	13.42	6.5-11.5	9.02±0.16	12.65
G.83 x (G72 x Delcero)	50	1.5-2.7	2.10±0.04	13.90	1.4-3.0	2.17±0.07	20.40	7.5-11.5	9.34±0.14	10.85	7.2-11.2	9.42±0.13	9.31
Dandara	50	1.8-3.0	2.39±0.05	18.14	1.5-3.2	2.33±.0.06	18.25	8.0-12.0	10.22±0.14	9.92	8.0-12.0	10.14±0.13	9.93
G.80	50	1.9-2.9	2.36±0.04	17.37	13.-2.9	2.13±0.05	14.20	8.0-11.9	10.22±0.13	8.92	8.1-11.9	10.15±0.12	8.60

ranged from 1.8 to 2.9 and from 1.6 to 3.2g with an average of 2.43 and 2.42g in 1991 and 1992 seasons, respectively.

Concerning, the promising cross G-75 x G-81, the boll weight ranged from 1.3 to 2.7g with an average of 2.13g in the first season and it ranged from 1.6 to 3.0g with an average of 2.20g in the second one. While, the alternative variety G-75 had a range of boll weight of 1.3 to 3.0g with a mean value of 2.5g, in the first season and a range of 1.5 to 2.9g with a mean value of 2.38g in the second one.

With regard the promising cross G-72 x G-67, the boll weight ranged from 1.8 to 3.2g with a mean value of 2.67g in the first season and ranged from 1.4 to 3.2g with a mean value of 2.64g in the second season. However, its alternative varieties Dandara and G-80 recorded boll weight ranging from 1.8 t 3.0 and 1.9 to 2.9g with mean values of 2.39 and 2.36g, respectively in the first season. While in the second season, the alternative varieties Dandara and G-80 recorded boll weight ranging from 1.5 to 3.2g and 1.3 to 2.9g with an average of 2.33 and 2.13g, respectively. These results indicated that the promising cross G-72 x G-67 surpassed its alternative varieties Dandara and G-80 in boll weight.

The boll weight of the promising cross G-83 x (G-72 x Delcero) ranged from 1.5 to 2.7 and from 1.4 to 3.0g with mean values of 2.10 and 2.17g in 1991 and 1992 seasons, respectively. Whereas, its alternative variety Dandara recorded boll weight estimates ranging from 1.8 to 3.0 and from 1.5 to 3.2g with an average of 2.39 and 2.33g in 1991 and 1992 seasons, respectively. These results suggested that Dandara variety was heavier in boll weight than the promising cross G-83 x (G-72 x Delcero) in both seasons.

Results illustrated in Tables (11) and (4) showed remarkably that the promising cross G-68 x C.B-58 gave a mean boll weight value of 2.36g, while the alternative varieties G-70 and G-77 gave lower mean values of 2.20 and 2.15g, respectively. The percentage excess of boll weight for this cross over the alternative varieties G-70 and G-77 were 7.27 and 9.77%, respectively.

The promising cross G-77 x G-45 type (A) recorded a mean value of boll weight of 2.08g, while its alternative varieties G-45 and G-76 gave mean values of 1.84 and 2.01g, respectively. The percentage excess for this cross over its alternative varieties G-45 and G-76 were 13.04 and 3.48%, respectively (Table 4), which means that the promising cross G-77 x G-45 type (A) was heavier in boll weight than its alternative varieties G-45 and G-76.

The promising cross G-77 x G-45 type (B) showed a mean value of 2.26g for boll weight, while its alternative variety G-77 recorded a mean value of 2.15g. This cross was heavier in boll weight than its alternative variety G-77 by 5.12% as shown in Table (4).

The mean value of boll weight of the promising cross G-67 x C.B-58 was 2.06g, while its alternative variety G-81 gave a high mean value of 2.30g. These results indicated that the boll weight of G-81 variety exceeded significantly the boll weight of its promising cross G-67 x C.B-58.

The promising cross G-75 x G-81 gave bolls with a mean weight of 2.26g, while its alternative variety G-75 produced bolls heavier than the promising cross (2.50g). The boll weight of this cross was significantly lower than its alternative variety G-75 by 9.6%.

Concerning the promising cross G-72 x G-67, the mean boll weight was 2.49g, while the mean values for its alternative varieties Dandara and G-

80 were 2.18 and 2.40g, respectively (Table 11). The boll weight of the promising cross surpassed that of its alternative varieties Dandara and G-80 with 14.22% and 3.75%, respectively.

The promising cross G-83 x (G-72 x Delcero) gave bolls with a mean value of 1.93g compared with 2.18g for its alternative variety Dandara which surpassed it by 1,1 47% in boll weight.

The coefficient of variability (C.V%) for the boll weight in single plants trial as presented in Table (10) revealed that it ranged from 5.04 to 18.75 and from 3.75 to 20.40% in 1991 and 1992 seasons, respectively. Moreover, heritability estimates in broad sense for boll weight as shown in Table (11) indicated that this trait was constant and had a reliable value of 86.57%. These results suggested that boll weight trait was slightly affected by the changing in the environmental condition. These results are in agreement with those obtained by Khalifa *et al* (1982), El-Gharbawy *et al* (1983) and Awaad (1989). However, they are in disagreement with the findings of Forisa *et al* (1986), Sallam *et al* (1987) and Abou Zahra *et al* (1989b).

The genotypic stability for boll weight trait :

The results of the combined analysis of the genotypes grown in the five different environments presented in Table (1) revealed that the environment, genotype and environment-genotype interaction mean squares were significant. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

The genotype means for boll weight, in grams and the estimates of parameters $\hat{\alpha}$ and $\hat{\lambda}$ for each genotype with its degree of stability are

Table (11) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for boll weight over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability		
		$\hat{\alpha}_i$	$\hat{\lambda}_i$	0.90	0.95	0.99
G.68 x C.B 58	2.36	-0.680	0.314	+	+	+
G.77 x G.45 (A)	2.08	-0.003	0.318	+	+	+
G.77 x G.45 (B)	2.26	0.406	0.762	++	++	++
G.45	1.84	-0.366	0.266	+	+	+
G.70	2.20	0.056	1.806	++	++	++
G.76	2.01	-0.315	0.595	++	++	++
G.77	2.15	-0.193	1.290	++	++	++
G.67 x C.B 58	2.06	0.699	1.543	+	++	++
G.75 x G.81	2.26	0.021	4.197	+	+	+
G.75	2.50	0.337	0.631	++	++	++
G.81	2.30	0.315	1.391	++	++	++
G.72 x G.67	2.49	0.152	2.353	+	+	+
G.83 x (G.72 x Delcero)	1.93	-0.16	1.883	++	++	++
Dandara	2.18	-0.091	2.566	+	+	+
G.80	2.40	0.125	2.326	+	+	+
L.S.D 0.05	0.132					
0.01	0.175					
Heritability value		86.57%				

++ Genotypes with average degree of stability.

\+ Unstable genotypes.

presented in Table (11). The variety G-75 showed the highest mean for boll weight followed in descending order by the genotypes G-72 x G-67, G-80, G-68 x C.B-58, G-81, G-77 x G-45 (B), G-75 x G-81, G-75, Dandara, G-77, G-77 x G-45 (A), G-67 x C.B-58, G-76, G-83 x (G-72 x Delcero) and G-45.

It can be observed from Table (11) and Fig (7) which showed the distribution of $\hat{\alpha}$ and $\hat{\lambda}$ values for boll weight that:

a. The estimated α statistics were not significantly different from $\hat{\alpha} = 0$ for all of the genotypes at all the probability levels, except for G-45 variety and G-67 x C.B-58 cross, which showed $\hat{\alpha}$ statistics that are significantly different from $\hat{\alpha} = 0$ (at P = 0.90), while the cross G-68 x C.B-58 was significantly different (at P = 0.90 and P = 0.95) and

b. The estimated $\hat{\lambda}$ statistics were not significantly different from $\hat{\lambda} = 1$ for all of the genotypes except for the G-45, G-68 x C.B-58 and G-77 x G-45 (A), which showed $\hat{\lambda}$ values significantly less than one and Dandara, G-80, G-75 x G-81 and G-67 x G-72 gave $\hat{\lambda}$ values that were significantly larger than one. The great variation in the $\hat{\lambda}_i$ statistics were deteced and did suggest that the relatively unpredictable component (i.e. $\hat{\lambda}_i$, the deviation from the linear response) of the genotype-environment interaction variance may be much more important than the relatively predictable component (i.e. $\hat{\lambda}_i$, the coefficient of the linear response).

Therefore, the lines; G-75, G-81, G-76, G-77, G-70, G-77 x G-45 (B), G-67 x C.B-58 and G-83 x (G-72 x Delcero) showed average degrees of stability, while the other genotypes were considered unstable, except at P = 0.90. However, the promising cross G-67 x C.B-58 was considered below the average stability. Similar results were obtained by El-Kadi *et al* (1978), El-Shaarawy *et al* (1988b), Awaad (1989) and El-Shistawy *et al* (1994).

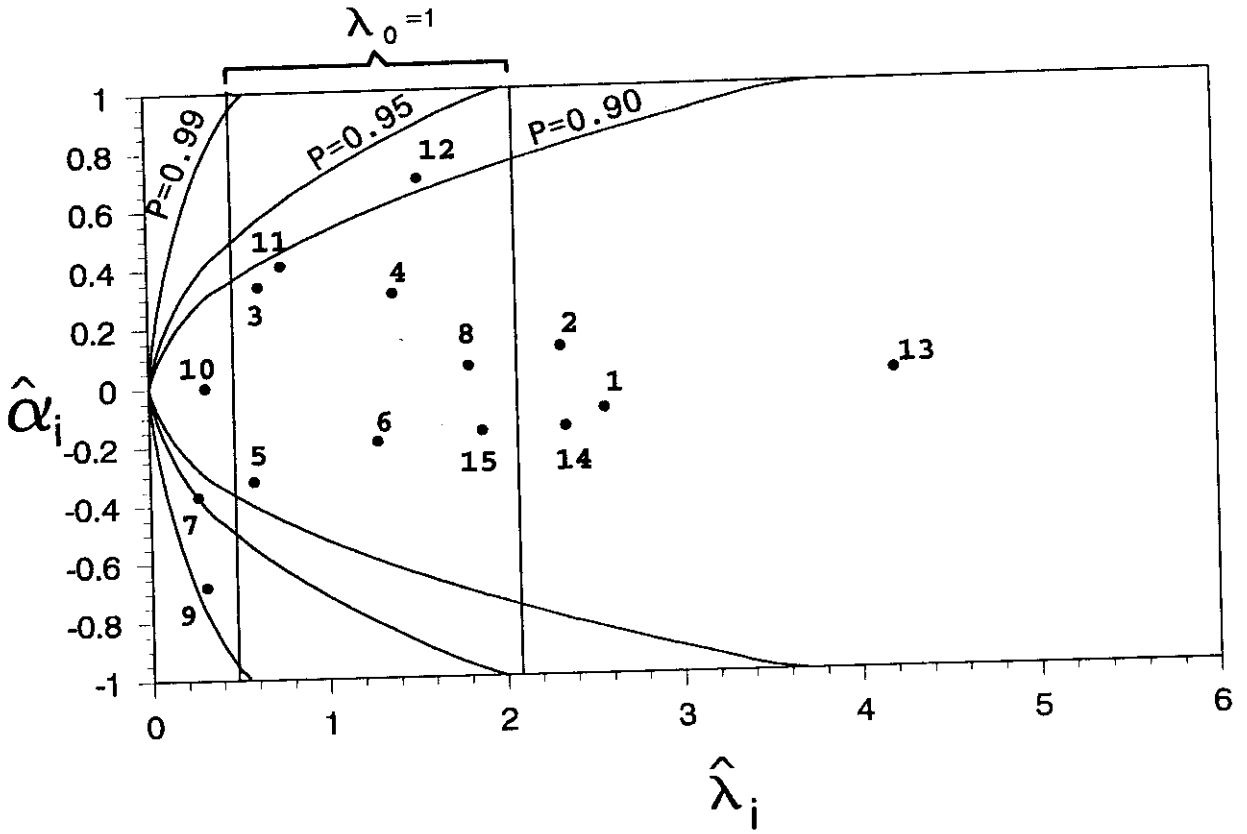


Fig.(7): Stability curves for boll weight.

I- Dandara	6- G. 77	II-G.77XG.45(B)
2- G. 80	7- G. 45	I2-G.67XC.B 58
3- G. 75	8- G. 70	I3-G.75XG.8I
4- G. 8I	9-G.68XC.B 58	I4-G.72XG.67
5- G. 76	I0-G.77XG.45(A)	I5-G.83X(G.72XDelcero)

6. Seed index:

Evaluation of phenotypic variation:

Results of seed index in single plants and plot mean basis trials are presented in Tables (10) and (12), respectively, while the percentage excess of this trait for the promising crosses over their alternative varieties is shown in Table (4).

Results presented in Table (10) showed that the promising cross G-68 x C.B-58 gave seed index values ranging from 7.2 to 10.7g. With an average of 9.83g while the alternative varieties G-70 and G-77 recorded a range from 8.0 to 11.4 and from 7.5 to 11.0g with mean values of 9.66 and 9.49g, respectively in 1991 season. Similar results were recorded in 1992 season as shown in Table (10).

Concerning, the promising cross G-77 x G-45 (A), the seed index ranged from 6.9 to 11.6 and from 7.0 to 11.0g with mean values of 8.79 and 8.83g in 1991 and 1992 seasons, respectively. While, the seed index of the alternative varieties G-45 and G-76 ranged from 7.7 to 11.6g and from 7.0 to 11.0g with mean values of 9.30 and 9.38g, respectively, in the first season and ranged from 7.7 to 11.5g and 7.0 to 11.0g with an average of 9.29 and 9.25g, respectively, in the second season. These results showed that G-77 x G-45 (A) cross had smaller seeds than its two alternative varieties G-45 and G-76.

With respect to the promising cross G-77 x G-45 type (B), the seed index values ranged from 7.3 to 10.4g with a mean value of 8.91g, while the alternative variety G-77 recorded a range from 7.5 to 11.0g with an average of 9.49g in the first season. Nearly, similar results were recorded in the second season, as shown in Table (10). It could be noticed that the G-77 variety, seed index was higher than G-77 x G-45 (B) cross.

Regarding, the promising cross G-67 x C.B-58 the seed index values ranged from 6.9 to 11.6 and from 7.1 to 11.2g with mean values of 9.34 and 9.40g, in 1991 and 1992 seasons, respectively. Moreover, the alternative variety G-81 ranged from 8.0 to 11.1 and from 7.5 to 11.2g with an average of 9.66 and 9.61g in 1991 and 1992 seasons, respectively. The seed index in G-67 x C.B-58 cross was lower than its alternative variety G-81.

Concerning, the promising cross G-75 x G-81, the seed index ranged from 6.2 to 10.7g with a mean value of 8.19g in 1991 season and same range with an average of 8.27g in 1992 season. Whereas, the alternative variety G-75 had the seed index with a range of 8.4 to 12.5g and an average of 10.23g in the first season and same range with an average of 10.18g in the second season. It is clear that G-75 surpassed G-75 x G-81 cross in seed index.

Regarding the promising cross G-72 x G-67, its seed index ranged from 6.5 to 11.5g, with an average of 8.94g in 1991 season and the same range with a mean value of 9.02g in 1992 season. However, its substitute varieties Dandara and G-80 recorded the seed index ranged from 8.0 to 12.0g with an average of 10.22g and from 8.0 to 11.9g with an average of 10.22g, respectively in the first season. Nearly, same results were obtained in the second season for the two varieties Dandara and G-80 (Table 10). The seed index of the promising cross G-72 x G-67 was inferior to Dandara and G-80 varieties.

Moreover, the promising cross G-83 x (G-72 x Delcero) seed index ranged from 7.5 to 11.5 and from 7.2 to 11.2g with mean values of 9.34 and 9.42g, in 1991 and 1992 seasons, respectively, whereas its alternative variety Dandara recorded the seed index ranging from 8.0 to 12.0 with a mean value of 10.22g and the same range with an average of 10.14g, in 1991 and 1992

seasons, respectively. It is clear that Dandara was surperior to G-83 x (G-72 x Delcero) cross regarding seed index.

Results illustrated in Tables (1? and (4) showed that the promising cross G-68 x C.B-58 gave a mean value of 9.77g for seed index, while the alternative varieties G-70 and G-77 gave the lower mean values of 9.52 and 9.23g, respectively. The percentage excess of this cross for seed index, over its alternative varieties G-70 and G-77 were 2.62 and 5.85%, respectively.

The promising cross G-77 x G-45 type (A) recorded a mean value of 9.36g, while its alternative varieties G-45 and G-76 gave mean values of 9.43 and 9.35g, respectively, which mean that the seed index of the promising cross G-77 x G-45 (A) was heavier than G-76 variety by 0.11% and lighter than G-45 variety by 0.67% . Meanwhile, the promising cross G-77 x G-45 type (B) showed a mean value of 9.45g for seed index, while the alternative variety G-77 recorded a mean value of 9.23g. The percentage excess of this cross over the G-77 variety was 2.38% (Table 4).

Concerning, the promising cross G-67 x C.B-58, it showed a mean value of 9.30g, while its alternative variety G-81 gave a mean value of 9.50g with an increase of 2.10% than its alternative cross.

The promising cross G-75 x G-81 gave a mean value of 9.97g, whereas the substitute variety G-75 gave a high mean value of 10.26g for seed index trait, with an increase of 2.83% in seed index compared with its alternative variety G-75 as shown in Table (4).

Regarding, the promising cross G-72 x G-67 the seed index recorded a mean value of 9.36g, compared with Dandara and G-80 which recorded 10.23 and 10.12g, respectively with an increase of 9.30 and 7.51% in seed index than the alternative cross (Table 4).

The promising cross G-83 x (G-72 x Delcero) gave a mean value of 9.44, while the alternative variety Dandara gave a mean value of 10.32g showing a percentage excess in seed index of 8.53% over this cross.

The coefficient of variability (C.V%) for seed index in single plants trial as shown in Table (10) revealed that it ranged from 7.24 to 13.42 and from 7.72 to 12.30% in 1991 and 1992 seasons, respectively. Heritability estimates in broad sense for seed index as shown in Table (12) gave a reliable value of 73.08%, which indicated that it was somewhat affected by the changing in the environmental condition. These results are in agreement with the findings of Forisa ***et al*** (1986), Awaad (1989), Salama ***et al*** (1992) and Hanaa ***et al*** (1993).

The genotypic stability for seed index trait:

The results of the combined analysis presented in Table (1) revealed that the genotype, environment and genotype x environment interaction mean squares were highly significant. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately. These results are in harmony with those obtained by El-Kadi ***et al*** (1978), Abd El-Dayim ***et al*** (1982), El-Hanafi ***et al*** (1982), El-Marakby ***et al*** (1986a), El-Shaarawy ***et al*** (1988a), Awaad (1989), Mohamed (1991) and Shafshak ***et al*** (1993b).

The genotype means for seed index (in grams) are presented in Table (12). The estimates of $\hat{\alpha}$ and $\hat{\lambda}$ parameters for each genotype with its degree of stability are also presented in Table (12); while the distribution of the estimated values for $\hat{\alpha}$ and $\hat{\lambda}$ are shown in Fig 8.

It is clear from Table (12) that Dandara variety showed the highest mean for seed index and it was followed in order by G-75, G-80, G-75 x G-

Table (12) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for seed index over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability	
		$\hat{\alpha}$	$\hat{\lambda}$	0.90	0.95
G.68 x C.B 58	9.77	-0.306	2.608	+	+
G.77 x G.45 (A)	9.36	-0.006	1.730	++	++
G.77 x G.45 (B)	9.45	0.052	0.368	+	+
G.45	9.43	-0.168	2.081	++	++
G.70	9.52	-0.100	2.174	+	+
G.76	9.35	-0.148	0.055	+	+
G.77	9.23	-0.035	0.290	+	+
G.67 x C.B 58	9.30	0.132	0.773	++	++
G.75 x G.81	9.97	0.086	8.648	+	+
G.75	10.26	0.140	1.775	++	++
G.81	9.50	-0.202	0.682	++	++
G.72 x G.67	9.36	-0.086	0.907	++	++
G.83 x (G.72 x Delcero)	9.44	-0.045	1.169	+	+
Dandara	10.32	0.402	0.309	+	+
G.80	10.12	0.284	1.783	++	++
L.S.D 0.05	0.382				
0.01	0.506				
Heritability value		73.08%			

++ Cultivars with average degree of stability.

+ Unstable cultivars.

81, G-68 x C.B-58, G-70, G-81, G-77 x G-45 (B), G-83 x (G-72 x Delcero), G-45, G-77 x G-45 (A), G-67 x G-72, G-76, G-67 x C.B-58 and G-77.

It can be noticed from Table (12) and Fig 8 that the estimated $\hat{\alpha}$ statistics were not significantly different from $\hat{\alpha} = 0$ for all of the genotypes at all probability levels except Dandara and G-77 which showed $\hat{\alpha}$ values close to -1 at the probability level 0.90. The estimated $\hat{\lambda}$ statistics varied for the different genotypes where they were significantly less than one for Dandara, G-76, G-77 and G-77 x G-45 (B) and were significantly larger than one for G-70, G-68 x C.B-58, G-75 x G-81 and G-83 x (G-72 x Delcero). While there were not significantly different from one for the other genotypes.

The distribution of the two parameters as shown above for the seed index, indicated that the relatively unpredictable component (the deviation from the linear response) of the genotype-environment interaction variance may be more imortant than the relatively predictable component (the coefficient of linear response).

The average stability area in the Figure (8) contained seven lines, these lines were G-80, G-75, G-81, G-45, G-77 x G-45 type (A), G-67 x C.B-58 and G-72 x G-67, which showed an average degree of stability at the probability levels 0.90 and 0.95. Similar results were reported by El-Shaarawy (1977), El-Kadi *et al* (1978) and Awaad (1989).

7. Lint percentage:

Evaluation of phenotypic variation:

Results illustrated in Table (13) for single plants trial indicated that lint percentage ranged from 29.6 to 34.8% with an average of 31.87% for the promising cross G-68 x C.B-58 in 1991 season. While, it ranged from 31.9 to 38.1% with a mean value 34.71% for the alternative variety G-70 and from

Table (13) : Statistical constants of lint percentage in single plants in 1991 and 1992 seasons.

Genotype	No. of Plant	Lint percentage					
		1991			1992		
		range	mean	C.V	range	mean	C.V
G.68 x C.B.58	50	29.6-34.8	31.87±0.18	3.96	29.0-34.7	31.85±0.18	3.95
G.77 x G.45 (A)	50	28.3-35.3	34.34±0.04	3.13	30.0-37.0	34.35±0.34	7.07
G.77 x G.45 (B)	50	28.9-36.3	34.60±0.02	4.46	30.0-38.0	36.00±0.34	7.07
G.45	50	30.0-37.4	32.74±0.22	5.25	30.0-36.0	32.66±0.22	4.69
G.70	50	31.9-38.1	34.76±0.27	5.60	318-39.2	34.76±0.27	5.57
G. 76	50	30.8-36.8	33.80±0.23	4.73	30.8-37.2	33.87±0.25	5.24
G.77	50	33.0-38.9	36.33±0.21	4.17	33.0-38.7	36.21±0.22	4.22
G.67 x C.B58	50	32.0-39.9	36.50±0.40	7.57	29.3-40.0	37.03±0.37	7.15
G.75 x G.81	50	30.0-39.2	33.30±0.36	7.59	30.0-39.0	33.44±0.31	6.48
G. 75	50	34.0-39.9	36.64±0.20	3.78	34.0-39.5	36.70±0.20	3.80
G.81	50	35.8-40.0	37.51±0.16	2.98	35.8-40.0	37.37±0.15	2.84
G.72 x G.67	50	36.0-43.6	41.35±0.26	4.48	35.6-45.0	41.36±0.30	5.08
G.83 x (G.72 x Delcero)	50	36.9-43.0	40.03±0.24	4.24	36.5-43.1	40.25±0.22	3.84
Dandra	50	32.0-40.3	37.72±0.27	5.25	32.0-40.0	37.30±0.29	5.61
G.80	50	37.0-42.0	3951±0.17	2.98	36.2-42.0	39.29±0.19	3.32

33.0 to 38.9% with a mean value of 36.33% for the other alternative variety G-77 in 1991 season. In 1992 season the lint percentage of cross G-68 x C.B-58 ranged from 29.0 to 34.7% with an average of 31.85% compared with G-70 variety which recorded a range of 31.8 to 39.2% with a mean value of 34.76% and G-77 variety which ranged from 33.0 to 38.7% with an average of 36.21%. These results indicated that the lint percentage of the promising cross G-68 x C.B-58 was lower than its two alternative varieties G-70 and G-77 in both seasons.

Concerning, the promising cross G-77 x G-45 type (A), lint percentage values ranged from 28.3 to 35.3% with mean value of 34.34% in 1991 season. While its alternative varieties G-45 and G-76 gave ranges from 30.0 to 37.4% and from 30.8% to 36.80% with mean values of 32.74 and 33.80%, respectively, in the first season. In the second seaon, the promising cross, lint percentage ranged from 30.0 to 37.0% with a mean of 34.35% compared with its alternative varieties G-45 and G-76 which ranged from 30.0 to 36.0% and from 30.8 to 37.2% with an average of 32.66 and 33.87%, respectively. These results indicated that the promising cross G-77 x G-45 (A) surpassed the two alternative varieties G-45 and G-76 in lint percentage in both seasons.

With respect to the promising cross G-77 x G-45 (B), the lint percentage ranged from 28.9 to 36.3% with a mean value of 34.6% compared with the alternative variety G-77 which recorded a range from 33.0 to 38.9% with an average of 36.33% in 1991 season. Moreover, in 1992 season, the range was from 30.0 to 38.0% with an average of 36.0% for the above mentioned cross and 33.0 to 38.7% with an average of 36.21% for G-77 variety. These results showed that the lint percentage of the promising cross G-77 x G-45 (B) was less than its alternative variety G-77 in both seasons.

With regard to the promising long staple cross G-67 x C.B-58, the lint percentage ranged from 32.0 to 39.91 and from 29.3 to 40.0% with mean values of 36.50 and 37.03% in 1991 and 1992 seasons, respectively. While, the alternative variety G-81 recorded a lint percentage ranging from 35.8 to 40% and the same range with an average of 37.51 and 37.37% in 1991 and 1992 seasons, respectively. These results indicated that the G-81 variety was superior to the substitute promising cross G-67 x C.B-58 concerning lint percentage in both seasons.

Concerning, the promising cross G-75 x G-81 lint percentage ranged from 30.0 to 39.2% with a mean value of 33.3% in the first season and from 30.0 to 39.0% with a mean value of 33.34% in the second season. Whereas, the substitute variety G-75 had lint percentage ranging from 34.0 to 39.9% with a mean value of 36.6% in the first season and from 34.0 to 39.5% with an average of 36.70% in the second season. These results indicated that the G-75 variety surpassed the promising cross G-75 x G-81 in lint percentage.

The promising cross G-72 x G-67, its lint percentage ranged from 36.0 to 43.6% with a mean value of 41.35%, while its alternative varieties Dandara and G-80 recorded lint percentage values ranging from 32.0 to 40.3% and from 37.0 to 42.0% with mean values of 37.72 and 39.51%, respectively, in 1991 season. Similar results were recorded for lint percentage of this cross and two alternative varieties in 1992 season. These results indicated that the promising cross G-72 x G-67 exceeded its alternative varieties Dandara and G-80 in lint percentage.

Moreover, the promising cross G-83 x (G-72 x Delcero) ranged from 36.9 to 43.0% and from 36.5 to 43.1% with mean values of 40.03 and 40.25% in 1991 and 1992 seasons, respectively. Whereas, its alternative variety Dandara recorded lint percentage values ranging from 32.0 to 40.3%

and from 32.0 to 40.0% with mean values of 37.72 and 37.30% in 1991 and 1992 seasons, respectively. These results indicated that the promising cross G-83 x (G-72 x Delcero) surpassed Dandara variety in lint percentage in both seasons.

Results of lint percentage on plot mean basis trials are presented in Tables (14) and (4) showed the lint percentage of the promising cross G-68 x C.B-58 gave a mean value of 36.43%, while that of the alternative varieties G-70 and G-77 were 34.82 and 33.93%, respectively. The percentage excess of lint percentage of this cross were 4.62 and 7.36% over the alternative varieties G-70 and G-77, respectively.

The promising cross G-77 x G-45 (A) recorded a mean lint percentage value of 32.69%, while its alternative varieties G-45 and G-76 gave mean values of 32.47 and 36.54%, respectively. The cross G-77 x G-45 (A) exceeded alternative variety G-45 by 0.68% and decreased by 10.54% than G-76 variety. Moreover, the promising cross G-77 x G-45 type (B) showed a mean value of 36.28% for lint percentage, while the alternative variety G-77 recorded a mean value of 33.93%. This cross exceeded G-77 variety by 6.93%. Whereas, the promising cross G-67 x C.B-58 gave a mean value of 36.76%, while its alternative variety G-81 gave a mean value of 37.73 showing a percentage excess of 2.57% over its substutited cross. The promising cross G-75 x G-81 gave a mean value of 36.66, also, the alternative variety G-75 gave the same mean for lint percentage trait. Moreover, the promising cross G-72 x G-67 recorded mean value of 41.19%, while the mean values for its alternative varieties Dandara and G-80 were 36.36 and 39.12%, respectively. The percentage excess for this trait as shown in Table (4) revealed that the promising cross G-72 x G-67 surpassed significantly its alternative varieties Dandara and G-80 by 13.28 and 5.29%,

Table (14) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for lint percentage over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability		
		$\hat{\alpha}$	$\hat{\lambda}$	0.90	0.95	0.99
G.68 x C.B 58	36.43					
G.77 x G.45 (A)	32.69					
G.77 x G.45 (B)	36.28					
G.45	32.47					
G.70	34.82					
G.76	36.54	Inadequate sample to estimate				
G.77	33.93					
G. 67 x C.B 58	36.76	The genotypic stability				
G.75 x G.81	36.66					
G.75	36.66					
G.81	37.73					
G.72 x G.67	41.19					
G.83 x (G.72 x Delcero)	38.91					
Dandara	36.36					
G.80	39.12					
L.S.D 0.05	0.78					
0.01	1.03					
Heritability value		93.60%				

respectively. The promising cross G-83 x (G-72 x Delcero) gave a mean value of 38.91% for this trait, showin g the percentage excess of 7.01 % over its alternative variety Dandara which gave a mean value of 36.36%. These results are in general agreement with those reported by Abou Zahra *et al* (1989b) and Sallam *et al* (1992 a).

The coefficient of variability (C.V) for the lint percentage in single plants trials as presented in Table (13) revealed that it was ranged from 2.98 to 7.59 and from 2.84 to 7.15% in 1991 and 1992 seasons, respectively, and the heritability estimate in broad sense Table (14) gave a reliable value of 93.60%, which indicated that it was slightly affected by the changing in the environmental conditions. These results are in agreement with those obtained by Khalifa *et al* (1982), Forisa *et al* (1986) and Hanaa *et al* (1993). However, El-Gharbawy *et al* (1983) disagreed the previous findings.

This trait was studied at three locations only, therefore, the genotypic stability was not estimated. Since this number of locations is an inadequate sample of environment.

C. Lint properties:

1. Fiber length:

Results for fiber length in single plants trial presented in Table (15), revealed that the promising cross G-68 x C.B-58 gave a range from 32.0 to 35.6mm with an average of 33.97mm in 1991 season, while it ranged from 30.0 to 36.0mm with a mean value of 33.76mm for its alternative variety G-70 and from 31.2 to 35.8mm with an average of 33.35mm for other alternative variety G-77 in the first season. Whereas, in the second season, the fiber length of G-68 x C.B-58 cross ranged from 32.0 to 35.7mm with an average of 33.89mm, whereas, it ranged from 30.0 to 36.6mm and from 31.4

Table (15) : Statistical constants of fiber lingth in single plants in 1991 and 1992 seasons.

Genotype	No. of Plant	Fiber length					
		1991			1992		
		range	mean	C.V	range	mean	C.V
G.68 x C.B.58	50	32.0-35.6	33.97±0.15	3.12	32.0-35.7	33.89±0.15	3.10
G.77 x G.45 (A)	50	31.8-36.0	34.01±0.18	3.70	31.7-36.0	33.99±0.18	3.71
G.77 x G.45 (B)	50	31.5-35.9	33.16±0.20	4.14	31.4-36.0	33.24±0.21	3.54
G.45	50	31.1-36.7	34.13±0.19	4.04	31.0-36.7	34.14±0.20	4.90
G.70	50	30.0-36.0	33.76±0.20	4.14	30.0-36.6	33.32±0.23	4.37
G. 76	50	31.0-36.0	33.61±0.27	3.54	30.9-35.5	33.82±0.16	3.37
G.77	50	31.2-35.8	33.35±0.17	3.70	31.4-35.6	33.36±0.17	4.15
G.67 x C.B58	50	26.7-34.6	31.40±0.28	6.20	26.8-34.3	31.38±0.28	6.26
G.75 x G.81	50	28.2-34.8	31.62±0.24	5.29	28.2-34.8	31.26±0.24	5.45
G. 75	50	28.0-35.0	31.96±0.28	6.15	27.9-35.0	31.80±0.27	6.08
G.81	50	28.9-33.7	30.90±0.19	4.24	28.7-33.7	30.86±0.19	4.31
G.72 x G.67	50	26.8-33.6	31.08±0.24	5.48	26.6-33.8	31.15±0.25	5.66
G.83 x (G.72 x Delcero)	50	26.6-34.3	30.58±0.30	6.83	26.5-33.6	30.63±0.30	6.96
Dandra	50	26.0-32.1	29.47±0.21	4.94	26.3-32.1	29.63±0.21	4.96
G.80	50	27.0-33.0	30.52±0.21	4.89	27.0-33.0	30.62±0.22	5.15

to 35.6mm with mean values of 33.32 and 33.36 for its alternative varieties G-70 and G-77, respectively. These results indicated that the fiber of the promising cross G-68 x C.B-58 was longer than its alternative varieties G-70 and G-77.

With regard to the length of the promising cross G-77 x G-45 type (A), it ranged from 31.8 to 36.0mm with a mean value of 34.01mm in 1991 season. On the other hand the fiber length for the two alternative varieties G-45 and G-76 were ranging from 31.1 to 36.7mm with an average of 34.13mm and from 31.0 to 36.0mm with a mean value of 33.61mm in 1991 season, respectively. Similar results were obtained in the second season, where, the fiber length of the promising cross G-77 x G-45 (A) ranged from 31.7 to 36.0mm with a mean value of 33.99mm and ranged from 31.0 to 36.7 with a mean value of 34.14mm and from 30.9 to 35.5 with an average of 33.82mm for G-45 and G-76, respectively. It could be noticed from these results that the fiber of promising cross G-77 x G-45 (A) was either longer or as long as the alternative varieties G-45 and G-76.

Concerning, the promising extra-long stable cross G-77 x G-45 type (B), the fiber length ranged from 31.5 to 35.9mm and from 31.4 to 36.0mm with mean values of 33.16 and 33.24mm in 1991 and 1992 seasons, respectively. While the alternative variety G-77 had a range from 31.2 to 35.8mm and from 31.4 to 35.6mm with averages of 33.35 and 33.36mm in 1991 and 1992 seasons, respectively. These results showed that the fibers of this cross was shorter than that of G-77 variety.

Moreover, the promising cross G-67 x C.B-58 showed fiber length ranging from 26.7 to 34.6mm with a mean value of 31.40mm, while the alternative variety G-81 gave a range from 28.9 to 33.7mm with a mean value of 30.90mm in 1991 season. Similar results were recorded for fiber

length in 1992 season as shown in Table (15). It could be noticed from these results that the promising cross G-67 x C.B-58 may be slightly longer compared with its alternative variety G-81.

With respect to the promising cross G-75 x G-81 fiber length ranged from 28.2 to 34.8mm with a mean value of 31.62mm in 1991 season, and showed the same range with a mean value of 31.26mm in 1992 season. Whereas, the substitute variety G-75 showed fiber length ranging from 28.0 to 35.0mm and from 27.9 to 35.0mm with mean values of 31.96 and 31.80mm in 1991 and 1992 seasons, respectively. These results indicated that the fibers of G-75 variety was longer than that of the promising cross G-75 x G-81 in both seasons.

Regarding the promising cross G-72 x G-67, the fiber length showed a range from 26.8 to 33.6mm with a mean value of 31.08mm in 1991 season, whereas, in 1992 season it ranged from 26.6 to 33.8mm with a mean value of 31.15mm, while the alternative varieties Dandara and G-80 had fiber length ranging from 26.0 to 32.1mm and from 27.0 to 33.0mm with mean values of 29.47 and 30.52mm, respectively in 1991 season. Nearly, similar results were obtained for the two varieties Dandara and G-80 for this trait in 1992 season. It could be concluded that the promising cross G-72 x G-67 was superior to its alternative varieties Dandara and G-80 for fiber length trait.

Concerning, the promising cross G-83 x (G-72 x Delcero), the fiber length ranged from 26.6 to 34.3 and from 26.5 to 33.6mm with average values of 30.58 and 30.63mm in 1991 and 1992 seasons, respectively. Whereas, the substitute variety Dandara recorded ranges from 26.0 to 32.1 and from 26.3 to 32.1mm with mean values of 29.47 and 29.63 m in 1991 and 1992 seasons, respectively. These results indicated that this cross was longer compared with its alternative variety Dandara for fiber length trait.

2. Fiber strength (pressley index):

Results illustrated in Table (16) for single plants trial, indicated clearly that the promising extra-long staple cross G-68 x C.B-58 gave a pressley index ranging from 9.7 to 11.7 with an average of 10.76 in 1991 season. While the alternative varieties G-70 and G-77 recorded a range from 9.7 to 11.2 and from 10.0 to 12.0 with average values of 10.65 and 10.90, respectively in 1991 season. In 1992 season G-68 x C.B-58 cross recorded ranges from 9.8 to 11.5 with a mean value of 10.73, whereas, G-70 and G-77 varieties recorded ranges from 9.8 to 11.5 and from 10.0 to 12.0 with mean values 10.6 and 10.81, respectively. These results suggested that the fibers of promising cross G-68 x C.B-58 may be stronger than that of its alterative varieties G-70 and G-77.

Concerning, the promising cross G-77 x G-45 type (A), the pressley index ranged from 10.0 to 12.1 and from 10.4 to 12.2 with average values of 11.37 and 11.33 in 1991 and 1992 seasons, respectively. However, the alternative varieties G-45 and G-76 recorded ranges from 9.0 to 12.1 and from 9.4 to 12.2 with mean values of 10.86 and 10.76, respectively in 1991 season, while it ranged from 9.0 to 12.1 and from 9.1 to 12.0 with mean values of 10.79 and 10.61, respectively, in 1992 season. These results showed that the fiber of this cross was stronger than the two varieties G-45 and G-70 in both seasons.

With respect to the promising cross G-77 x G-45 (B), its fiber strength ranged from 9.6 to 12.1 with a mean value of 10.93 whereas, the alternative variety G-77 recorded a range from 10.0 to 12.0 with a mean value of 10.90 in 1991 season. Nearly, similar results were obtained in 1992 season for this cross as well as G-77 variety as shown in Table (16). It could be concluded

Table (16) : Statistical constants of pressley index and micronaire reading in single plants in 1991 and 1992 seasons.

Genotypes	No. of plant	Pressley index						Micronaire reading					
		1991			1992			1991			1992		
		Range	Mean	C.V	Range	Mean	C.V	Range	Mean	C.V	Range	Mean	C.V
G.68 x C.B 58	50	9.7-11.7	10.76±0.06	4.18	9.8-11.5	10.73±0.06	3.91	2.4-4.0	2.86±0.05	12.67	2.4-4.0	2.87±0.05	12.09
G.77 x G.45 (A)	50	10.0-12.1	11.37±0.07	4.35	10.4-12.2	11.33±0.06	4.01	2.4-4.3	3.23±0.06	13.73	2.5-4.1	3.13±0.06	12.64
G.77 x G.45 (B)	50	9.6-12.1	10.93±0.08	5.55	9.6-12.1	10.91±0.08	5.06	2.5-4.6	3.29±0.04	10.07	2.4-4.5	3.28±0.09	10.83
G.45	50	9.0-12.1	10.86±0.09	5.68	9.0-12.1	10.79±.0.08	5.36	2.4-3.8	2.98±0.05	12.30	2.3-3.7	2.95±0.05	12.31
G.70	50	9.7-11.2	10.65±0.06	3.83	9.8-11.5	10.60±0.06	3.98	2.4-3.8	3.00±0.06	14.14	2.4-4.0	2.99±0.06	14.74
G.76	50	9.4-12.2	10.76±0.11	7.11	9.1-12.0	10.61±0.12	7.80	2.6-4.0	2.95±0.04	10.83	2.4-3.7	2.92±0.04	10.73
G.77	50	10.0-12.0	10.90±0.08	4.90	10.0-12.0	10.81±0.08	5.40	2.6-4.3	3.10±0.06	13.37	2.6-4.2	3.17±.0.07	14.36
G.67 x C.B 58	50	9.6-12.1	10.00±0.07	3.82	8.7-10.9	9.64±0.07	5.23	2.8-4.4	3.29±0.06	11.69	2.6-4.1	3.43±0.06	11.69
G.75 x G.81	50	9.1-12.0	11.12±0.07	4.16	10.2-12.0	11.12±0.06	3.67	2.8-4.2	3.25±0.04	10.11	2.6-4.2	3.22±0.04	9.39
G.75	50	9.2-12.0	10.71±0.11	7.11	9.3-12.0	10.69±0.11	7.24	2.5-4.3	3.36±.0.06	11.66	2.8-4.3	3.43±0.06	12.52
G.81	50	9.1-12.2	11.02±0.09	5.82	9.0-12.2	10.90±0.10	6.53	2.8-4.5	3.24±0.06	12.80	2.6-4.2	3.27±0.06	12.26
G.72 x G.67	50	7.3-9.5	8.76±0.08	6.26	7.4-9.8	8.66±0.08	6.14	3.0-5.4	4.19±0.07	14.27	2.8-5.0	4.13±0.06	13.98
G.83 x (G72 x Delcero)	50	8.2-10.4	9.30±0.08	5.90	8.0-10.2	9.26±0.08	5.79	3.0-5.2	4.37±0.09	14.36	3.0-5.5	4.39±0.09	14.66
Dandara	50	8.4-10.4	9.36±0.06	4.64	8.3-10.4	9.27±.0.06	4.68	3.0-5.1	3.94±0.06	11.23	3.0-5.0	3.96±0.06	11.73
G.80	50	8.7-10.2	9.32±0.06	4.59	8.8-10.2	9.32±0.06	4.79	2.9-5.2	4.01±0.09	15.26	3.0-5.2	3.99±0.08	14.89

that the promising cross G-77 x G-45 type (B) was slightly stronger compared with G-77 variety.

Regarding, the promising cross G-67 x C.B-58, the pressley index ranged from 9.6 to 12.1 and from 8.7 to 10.9 with an average value of 10.0 and 9.64 in 1991 and 1992 seasons, respectively (Table 16), whereas, that of the alternative variety G-81 recorded ranges from 9.1 to 12.2 and from 9.0 to 12.2 with an average values of 11.02 and 10.90 in 1991 and 1992 seasons, respectively. These results suggested that the fiber of G-81 was stronger than its promising cross G-67 x C.B-58 in both seasons.

Concerning, the promising long staple cross G-75 x G-81, fiber length ranged from 9.1 to 12.0 with a mean value of 11.2 while the alternative variety G-75 had pressley index ranging from 9.2 to 12.0 with a mean value of 10.71 in 1991 season. Somewhat, similar results were obtained in 1992 season for this cross and its alternative variety G-75 for this trait as shown in Table (16). These results suggested that fiber of G-75 variety was stronger than its promising cross G-75 x G-81.

With ragard to the promising cross G-72 x G-67, its pressley index ranged from 7.3 to 9.9 and 7.4 to 9.8 with average values of 8.76 and 8.66 in 1991 and 1992 seasons, respectively. Whereas, its alternative varieties Dandara and G-80 recorded pressley index ranging from 8.4 to 10.4 and 8.7 to 10.2 with mean values of 9.36 and 9.32, respectively, in 1991 season. Moreover, in 1992 season its alternative varieties Dandara and G-80 recorded pressley index ranging from 8.3 to 10.4 and 8.8 to 10.2 with mean values of 9.27 and 9.32, respectively. These results revealed that the promising cross G-72 x G-67 was less in fiber strength compared with its two alternative varieties Dandara and G-80.

The promising cross G-83 x (G-72 x Delcero) showed that fiber strength ranged from 8.2 to 10.4 and from 8.0 to 10.2 with mean values of 9.30 and 9.26 in 1991 and 1992 seasons, respectively. Whereas, the alternative variety Dandara recorded pressley index ranging from 8.4 to 10.2 with average values of 9.36 and 9.27 in both seasons, respectively. These results stated that Dandara variety may be stronger than its substituted cross G-83 x (G-72 x Delcero).

3. Fiber fineness (micronaire reading):

Evaluation of phenotypic variation :

Results of micronaire reading for single plants and an plot mean basis are presented in Tables (16 and 17), respectively, while the percentage excee of this trait for the promising crosses over their alternative varieties is shown in Table (4).

From the results presented in Table (16) showed that the promising cross G-68 x C.B-58 gave micronaire reading value ranging from 2.4 to 4.0 with a mean value of 2.86 in the first season, while the alternative varieties G-70 and G-77 recorded ranges from 2.4 to 3.8 and from 2.6 to 4.3 with mean values of 3.0 and 3.10 , respectively. In the second season the promising cross G-68 x C.B-58 gave micronaire reading ranging from 2.4 to 4.0 with a mean value of 2.87. However, the alternative varieties G-70 and G-77 recorded a range from 2.4 to 4.0 and from 2.6 to 4.2 with mean values of 2.99 and 3.17, respectively. These results indicated that the promising cross G-68 x C.B-58 was finer compared with its alternative varieties G-70 and G-77.

Concerning, the promising cross G-77 x G-45 (A), micronaire reading values ranged from 2.4 to 4.3 with a mean value of 3.23, while it ranged

from 2.4 to 3.8 with a mean value of 2.98 for the alternative variety G-45, from 2.6 to 4.0 with a mean value of 2.95 for the other alternative variety G-76 in 1991 season. In 1992 season, the micronaire reading of cross G-77 x G-45 (A) ranged from 2.5 to 4.1 with a mean value of 3.13 compared with G-45 variety which recorded a range of 2.3 to 3.7 with a mean value of 2.95 and G-76 variety which ranged from 2.4 to 3.7 with an average of 2.92. These results suggested that the promising cross G-77 x G-45 (A) is coarser compared with its alternative varieties G-45 and G-76.

With respect to the promising cross G-77 x G-45 type (B) micronaire reading ranged from 2.5 to 4.6 and from 2.4 to 4.5 with average values of 3.29 and 3.28 in 1991 and 1992 seasons, respectively. While the alternative variety G-77 recorded ranges from 2.6 to 4.3 and from 2.6 to 4.2 with mean values of 3.10 and 3.17 in 1991 and 1992 seasons, respectively. The results indicated that this cross is coarser than its alternative variety G-77.

Moreover, the micronaire reading results of the promising cross G-67 x C.B-58 presented in Table (16) ranged from 2.8 to 4.4 with a mean value of 3.29 and ranged from 2.6 to 4.1 with a mean value of 3.43 in 1991 and 1992 seasons, respectively, while the alternative variety G-81 recorded micronaire reading values ranging from 2.8 to 4.5 and from 2.6 to 4.2 with mean values of 3.24 and 3.27 in 1991 and 1992 seasons, respectively. These results stated that this cross is finner compared by the variety G-81.

Concerning, the micronaire reading of the promising cross G-75 x G-81, it ranged from 2.8 to 4,2 with a mean value of 3.25 in the first season and ranged from 2.6 to 4.2 with a mean value of 3.22 in the second season. Meanwhile, the substitute variety G-75 had micronaire reading values ranging from 2.5 to 4.3 with a mean value of 3.36 in 1991 season and from

2.8 to 4.3 with a mean value of 3.43 in 1992 season. These results suggested that this cross was somewhat finner compared with the variety G-75.

Moreover, the micronaire reading values of the promising cross G-72 x G-67 ranged from 3.0 to 5,4 with a mean value of 4.19, whereas, its alternative varieties Dandara and G-80 recorded micronaire reading values ranging from 3.0 to 5.1 and from 2.9 to 5.2 with mean values of 3.94 and 4.01, respectively, in 1991 season. Nearly, similar results were recorded in 1992 season for this cross and its alternative varieties Dandara and G-80 as shown in Table (16). These results indicated that the cross G-72 x G-67 is slightly coarser than its alternative varieties Dandara and G-80 for this trait.

Moreover, the rpomising cross G-83 x (G-72 x Delcero) showed micronaire reading values ranging from 3.0 to 5.2 and from 3.0 to 5.5 with mean values of 4.37 and 4.39, while the alternative variety Dandara recorded micronaire reading values ranging from 3.0 to 5.1 and from 3.0 to 5.0 with average values of 3.94 and 3.96 in 1991 and 1992 seasons, respectively. This mean that this cross was somewhat coarser compared with its alternative variety Dandara.

Results illustrated in Table (17) and (4) showed remarkably that the promising cross G-68 x C.B-58 gave a mean value of 3.06 for micronaire reading, while the mean values for its alternative varieties G-70 and G-77 were 3.20 and 3.0, respectively. This cross showed a percentage excess 2.0% over G-77 variety and a percentage decrease of 4.38% below G-70 variety (Table 4).

The promising cross G-77 x G-45 type (A) recorded a mean value of 3.16, while its alternative varieties G-45 and G-70 gave mean values of 3.14 and 3.18 of micronaire reading, respectively. These results indicated that this

cross is coarser than its alternative variety G-45 and finner than G-76 variety (Table 4).

Moreover, the promising cross G-77 x G-45 type (B) showed a mean micronaire value of 3.24, while the alternative variety G-77 recorded a mean value of 3.00 showing a percentage decrease of 8.0% compared with the promising cross.

The promising cross G-67 x C.B-58 gave a mean micronaire value of 3.35, while its alternative variety G-81 recorded mean value of 3.42 for this character, with a percentage excess of 2.05% over this cross and it was coarser than it.

The promising cross G-75 x G-81 showed a mean micronaire value of 3.42, while the alternative variety G-75 gave a mean value of 3.41 without significant difference between them.

Concerning, the promising cross G-72 x G-67, the micronaire reading recorded mean value of 3.56, whereas, the alternative varieties Dandara and G-80 gave mean values of 3.52 and 3.56, respectively. This cross is slightly coarser than Dandara by 1.14% and similar to its substitute variety G-80.

Regarding, the promising cross G-83 x (G-72 x Delcero), the micronaire reading gave a mean value of 3.73, while the alternative variety Dandara gave a mean value of 3.52, showing a percentage decrease of 5.96% compared with Dandara variety. It is clear that the cross is coarser than Dandara. These results are in harmony with those obtained by El-Mogazy ***et al*** (1983), El-Gharbawy ***et al*** (1985) and Abo El-Zahab ***et al*** (1992).

The coefficient of variability (C.V) for the micronaire reading in single plants trait as presented in Table (16) revealed that it ranged from 10.11 to 15.26% and from 9.39 to 14.89% in 1991 and 1992 seasons, respectively. Heritability estimates in broad sense for micronaire reading presented in

Table (17) showed a reliable value of 83.98%, indicating the effect of environmental fluctuation on this character. These results are in general accordance with those obtained by Awaad (1989). On the other hand, Al-Rawi and Kohel (1970) reported low heritability value for micronaire reading.

The genotypic for micronaire reading trait:

The results of the combined analysis of the genotypes grown in the five environments presented in Table (1) revealed that the genotypes, environments and genotypes x environments interaction mean squares were significant. The significance of genotype-environments interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately.

Table (17) shows the genotype means in addition to the estimated $\hat{\alpha}$ and $\hat{\lambda}$ parameters for each genotype with its degree of stability. Moreover, Fig (9) shows the distribution of the estimated $\hat{\alpha}$ and $\hat{\lambda}$ parameters. It is clear that the G-77 cultivar had the lowest value and was the finest genotype. It was followed in order descending by the promising cross G-68 x C.B-58, G-77 x G-45 (A), G-45, G-76, G-70 and promising cross G-77 x G-45 (B) which belongs to extra-long category. Moreover, it was followed in the descending order by the remaining eight genotypes which belongs to the long staple category (Table 17).

It was clear from Table (17) and Fig (9) that:

- The estimated $\hat{\alpha}$ statistics were not significantly different from $\hat{\alpha} = 0$ for all the genotypes at all of the probability levels except for the cross G-77 x G-45 (A) (at the probability level 0.90) and cross G-67 x C.B-58 (at P = 0.90 and P = 0.95).

Table (17): Average of genotypes, estimates of stability parameters, and heritability in broad sense for micronaire reading over five environments.

Genotypes	Mean	Stability parameters		Degrees of stability	
		$\hat{\alpha}_i$	$\hat{\lambda}_i$	0.90	0.95
G.68 x C.B 58	3.06	-0.470	1.866	++	++
G.77 x G.45 (A)	3.16	0.891	0.719	++	+
G.77 x G.45 (B)	3.24	0.403	0.367	+	+
G.45	3.14	0.362	2.193	+	+
G.70	3.20	-0.190	1.514	++	++
G.76	3.18	0.374	1.155	++	++
G.77	3.00	-0.271	0.938	++	++
G.67 x C.B 58	3.35	0.580	0.205	+	+
G.75 x G.81	3.42	-0.750	0.694	++	++
G.75	3.41	0.327	0.906	++	++
G.81	3.42	0.403	1.866	++	++
G.72 x G.67	3.56	-0.227	0.872	++	++
G.83 x (G.72 x Delcero)	3.73	-0.286	1.242	++	++
Dandara	3.52	-0.985	2.827	+	+
G.80	3.56	-0.160	1.393	++	++
L.S.D 0.05	0.174				
0.01	0.230				
Heritability value		83.98%			

++ Cultivars with average degree of stability.
+ Unstable cultivars.

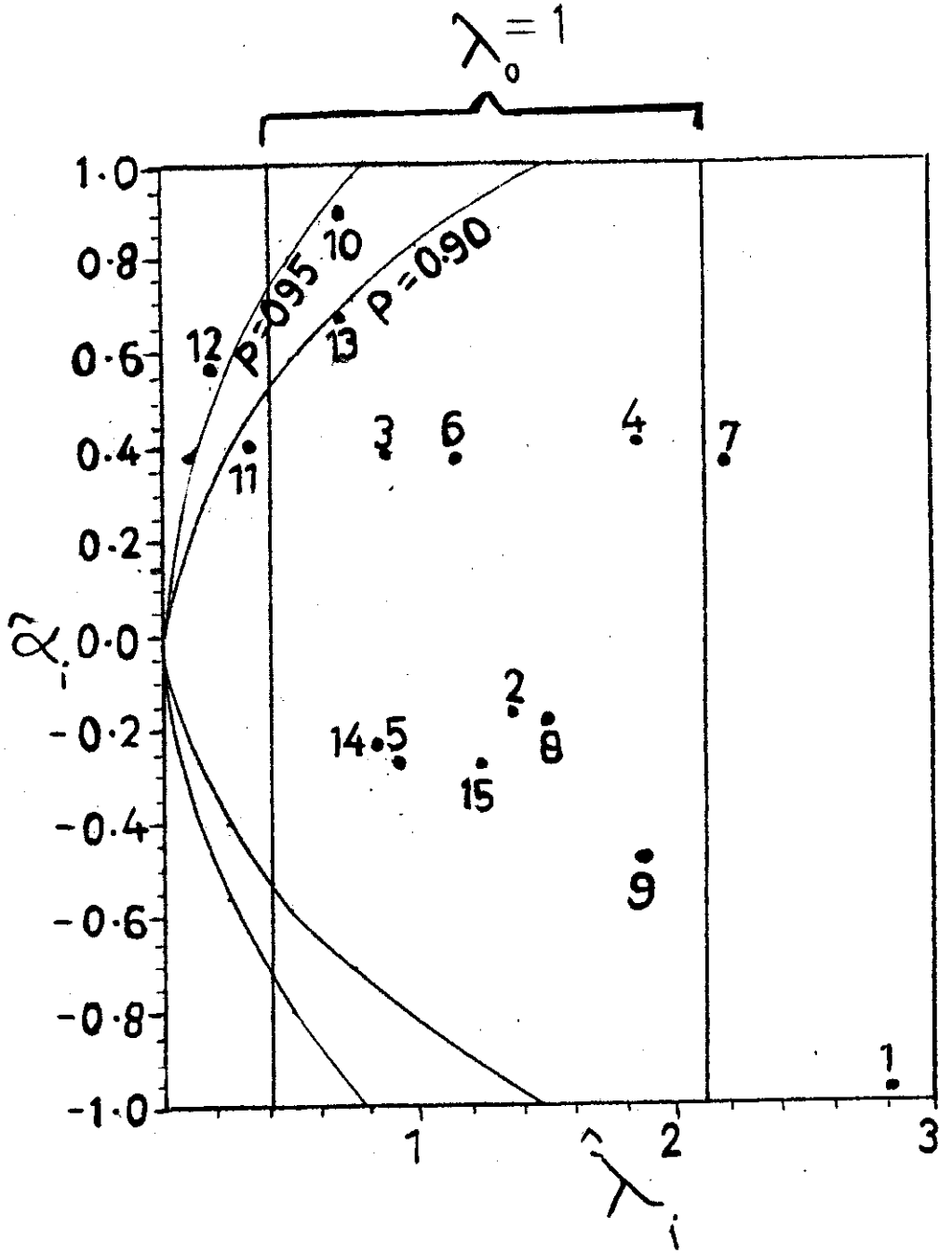


Fig.(9) :Stability curves for maicronaie reading.

I- Dandara	6- G. 77	II- G.77XG.45(B)
2- G. 80	7- G. 45	I2- G.67XC.B 58
3- G. 75	8- G. 70	I3- G.75XG.8I
4- G. 8I	9- G.60XC.B 58	I4- G.72XG.67
5- G. 76	IO- G.77XG.45(A)	I5- G.83X(G.72XDeicere)

b. The genotypes varied in the amount of deviation from linear response ($\hat{\lambda}$). All genotypes revealed $\hat{\lambda}$ statistics did not differ significantly from $\hat{\lambda} = 1$, however, lines G-77 x G-45 type (B), G-67 x C.B-58, G-45 and Dandara showed $\hat{\lambda}$ statistics that were significantly less than one.

Finally, it could be stated that ten lines showed average degree of stability. These line were G-80, G-75, G-81, G-76, G-77, G-70, cross G-68 x C.B-58, cross G-75 x G-81, cross G-72 x G-67 and cross G-83 x (G-72 x Delcero) at P = 0.90 and at P = 0.95. However, promising cross G-77 x G-45 type (A) showed the average degree of stability (P = 0.95). On the other hand, lines; Dandara, G-45, G-77 x G-45 (B) and G-67 x C.B-58 were unstable for this character. Similar results were obtained by El-Shaarawy (1977), El-Kadi *et al* (1978), El-Marakby *et al* (1986a), Awaad (1989) and Shafshak *et al* (1993c).

4. Hair weight

Evaluation of phenotypic variation:

Results of hair weight are presented in Tables (18) and (4). These results showed that the promising extra-long staple cross G-68 x C.B-58 gave a mean value of 121.15m/tex. Moreover, its alternative varieties G-70 and G-77 recorded mean values of 124.3 and 126.3 m/tex, respectively (Table 18). The percentage decrease of hair weight of the cross under the two varieties G-70 and G-77 were -2.53 and -4.08%, respectively, as shown in Table (4). These results showed that this cross is finner than the two alternative varieties G-70 and G-77.

Moreover, the promising cross G-77 x G-45 (A) gave a mean value of hair weight of 117.05 m/tex, while its alternative varieties G-45 and G-76

gave means of 121.30 and 116.90 m/tex (Table 18), respectively. The promising cross recorded a percentage decrease of -3.50% under G-45 variety and a percentage increase of 0.11% over G-76 variety. These results show that the promising cross G-77 x G-45 (A) may by slightly finner than G-45 variety and nearly, the same as G-76 variety.

Concerning, the promising cross G-77 x G-45 type (B), it exhibited mean value of 125.45 m/tex for hair weight trait, while its alternative variety G-77 gave a little higher mean value of 126.3 m/tex showing a percentage excess of 0.67% over this cross. This result indicated that this cross could be as finner as its alternative variety G-77.

With regard to the promising cross G-67 x C.B-58, it showed an average hair weight value of 131.0 m/tex, whereas, its alternative variety G-81 recorded mean value of 133.80 m/tex. This result indicated that G-81 variety gave a percentage excess of 2.09% over the promising cross G-67 x C.B-58 and it was slightly coarser than its substitute cross.

Moreover, the promising cross G-75 x G-81 showed a mean value of 136.6 m/tex, while the alternative variety G-75 gave a lower mean of 133.4 m/tex, for hair weight trait, showing a percentage decrease of 2.40% compared its alternative cross G-75 x G-81 for hair weight trait and may be finner than it. It is clear that the promising cross G-75 x G-81 is coarser than its alterative variety G-75.

With regard to the promising cross G-72 x G-67, it recorded a mean hair weight value of 139.25 m/tex, while the mean values of its alternative varieties Dandara and G-80 were 131.65 and 140.5 m/tex, respectively. The percentage excess of hair weight of this cross over Dandara variety was 5.77% and it was nearly the same as G-80 variety by 0.89%. These results

indicated that the promising cross G-72 x G-67 was slightly coarser than Dandara and the same fineness as G-80 variety.

Moreover, the promising cross G-83 x (G-72 x Delcero) gave a mean hair weight value of 141.10 m/tex, while the alternative variety Dandara gave a lower mean of 131.65 m/tex (Table 18). This result showed that this cross gave a percentage excess of 7.18% over Dandara variety for hair weight trait and it may be coarser than it.

Heritability estimates in broad sense for hair weight as shown in Table (18) showed that this trait was consistent and had a reliable value of 84.54%, indicating the low effect of environmental fluctuation on this character.

The genotypic stability for hair weight trait:

The results of the combined analysis of the genotypes grown in the five environments presented in Table (1) revealed significant environments, genotypes and environment-genotype interaction mean squares. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotype separately. These results were agreement with those obtained by Abdel-Salam *et al* (1985), El-Gohary *et al* (1987), Ismail *et al* (1989b) and Hanna *et al* (1994).

The genotype means of hair weight with the estimates of $\hat{\alpha}$ and $\hat{\lambda}$ parameters for each genotype and its degree of stability are presented in Table (18). While, the distribution of the estimated values for $\hat{\alpha}$ and $\hat{\lambda}$ are shown in Fig (10).

It is clear from Table (18) that the variety G-76 and the promising cross G-77 x G-45 (A) has lower mean performance for hair weight, 116.92 and 117.05 m/tex, respectively, than other genotypes, followed in descending

Table (18) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for hair weight over five environments.

Genotypes		Mean	Stability parameter		Degrees of stability	
			$\hat{\alpha}_i$	$\hat{\lambda}_i$	0.90	0.95
G.68 x C.B 58		121.15	-0.151	1.416	++	++
G.77 x G.45 (A)		117.05	0.164	1.156	++	++
G.77 x G.45 (B)		125.45	0.047	0.120	+	+
G.45		121.30	0.081	2.169	+	+
G.70		124.30	-0.037	2.176	+	+
G.76		116.92	0.158	0.017	+	+
G.77		126.30	-0.146	3.886	+	+
G.67 x C.B 58		131.00	0.362	1.201	++	++
G.75 x G.81		136.60	-0.748	0.454	+++	++
G.75		133.40	-0.168	0.504	++	++
G.81		133.80	0.265	3.425	+	+
G.72 x G.67		139.25	0.427	0.384	+	+
G.83 x (G.72 x Delcero)		141.10	0.380	5.361	+	+
Dandara		131.65	-0.057	0.822	++	++
G.80		140.50	-0.578	0.379	+	+
L.S.D	0.05	6.642				
	0.01	8.789				
Heritability value			84.54%			

+++ Genotypes with above average degree of stability.

++ Genotypes with average degree of stability.

+ Unstable genotypes.

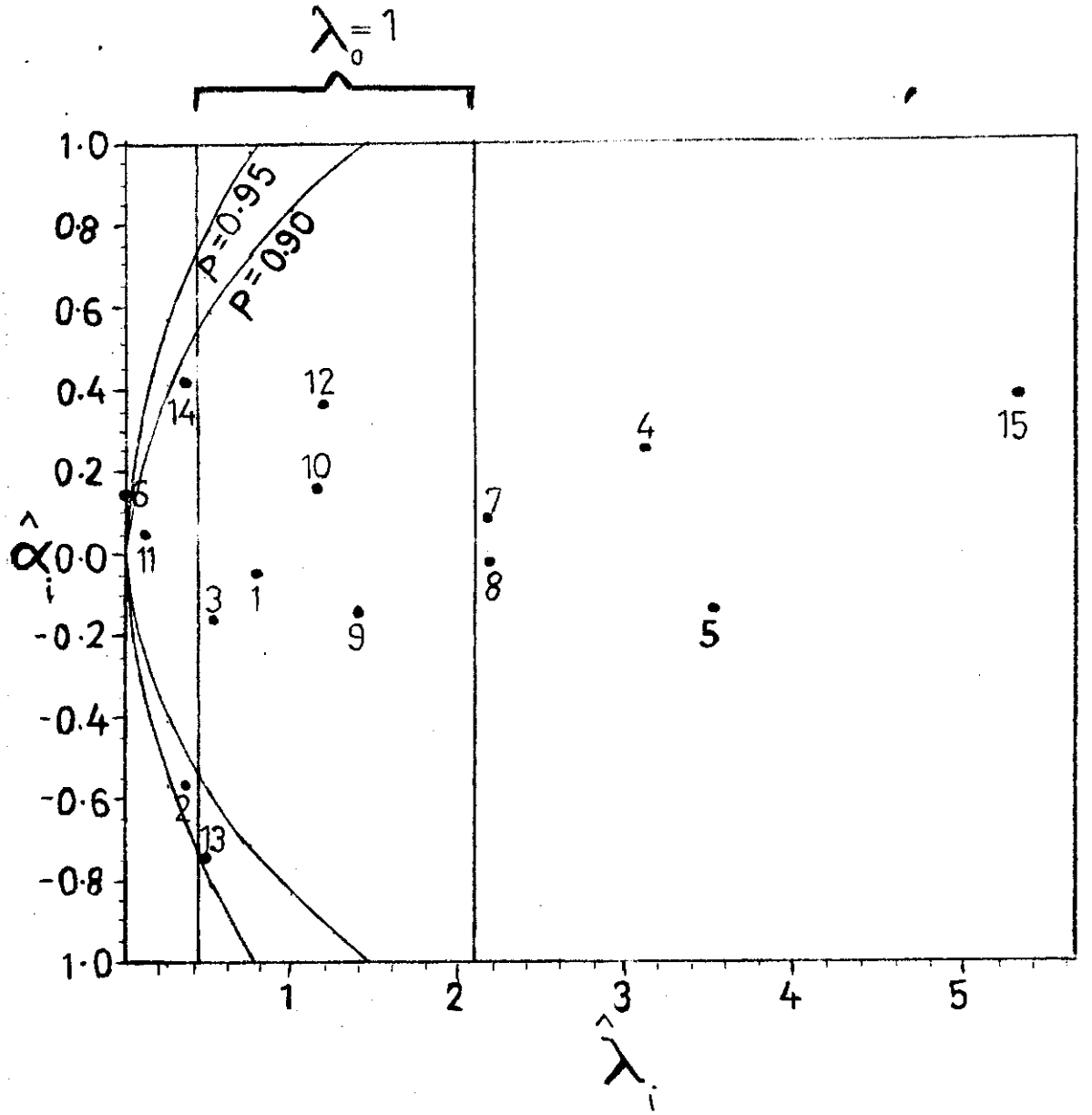


Fig.(10) : Stability curves for hair weight.

I- Dandera	6- G. 77	II-G.77xG.45(B)
2- G. 80	7- G. 45	I2-G.67xC.B 58
3- G. 75	8- G. 70	I3-G.75xG.8I
4- G. 8I	9-G.68xC.B 58	I4-G.72xG.67
5- G. 76	IO-G.77XG.45(A)	I5-G.83x(G.72xDelcero)

order by G-68 x C.B-58, G-45, G-70, G-77 x G-45 (B), G-77, G-67 x C.B-58, Dandara, G-75, G-81, G-75 x G-81, G-72 x G-67, G-80 and G-83 x (G-72 x Delcero).

It is clear from Table (18) and Figure (10) that :

a. The estimated $\hat{\alpha}$ statistics were not significantly different from $\hat{\alpha} = 0$ for all the genotypes at the probability levels P = 0.90 and P = 0.95, except for G-80 and G-75 x G-81 (at the probability level 0.90) and the vriety G-77 (at P = 0.90 and P = 0.95).

b. The genotypes varied greatly in the amount of the deviation from the linear response. The genotypes; Dandara, G-75, G-68 x C.B-58, G-77 x G-45 (A), G-67 x C.B-58 and G-75 x G-81 showed values significantly equal to one. The estimated $\hat{\lambda}$ values was significantly less than one for G-80, G-77, G-77 x G-45 (B) and G-72 x G-67, while the estimates were significantly large than one for G-81, G-76, G-45, G-70 and G-83 x (G-72 x Delcero). The great variation in the $\hat{\lambda}$ estimates did suggest that the relatively unpredictable component for this trait.

Therefore, the average stability area at different probability levels in the figure contained the genotypes; Dandara, G-75, G-68 x C.B-58, G-77 x G-45 type (A) and G-67 x C.B-58, while the promising cross G-75 x G-81 showed above average degree of stability (P = 0.90), while it showed average degree of stability (P = 0.95). On the other hand, the rest of genotypes were located in the unstable zone of the graph.

5. <u>Yarn strength</u>:

Evaluation of phenotypic variation:

Results of yarn strength genotypes over five environments and the percentage excess of this trait for the promising crosses over their alternative

varieties are presented in Tables (19 and 4), respectively. These results showed that the promising cross G-68 x C.B-58 gave a mean value of 2446.50, while its alternative varieties G-70 and G-77 recorded mean values of 2435.0 and 2544.25, respectively. These results indicated that the promising cross G-68 x C.B-58 was nearly as strong as G-70 variety, while G-77 was slightly stronger than this cross by 3.84% as shown in Table (4).

Moreover, the promising cross G-77 x G-45 type (A) gave a mean value of 2592.75, while its alternative varieties G-45 and G-76 gave lower means of 2435.75 and 2461.00, respectively. The percentage excess of this cross was 6.44% over G-45 variety and 5.38% over G-76 variety. These results indicated that the promising cross G-77 x G-45 type (A) could be stronger than the alternative varieties G-45 and G-76 for yarn strength trait. Similar results were reported by Sallam *et al* (1992 b).

Concerning, the promising cross G-77 x G-45 type (B), it showed a mean value of 2406.25 for yarn strength trait (Table 19), while the alternative variety G-77 recorded a high mean value of 2544.25, showing a percentage excess of 5.42% for this trait over the promising cross G-77 x G-45 type (B), may be stronger than it. It was clear that G-77 variety may be stronger than its alternative cross G-77 x G-45 (B).

With regard to the promising cross G-67 x C.B-58, it showed an average yarn strength of 2258.50, while the alternative vareity G-81 gave a slightly lower mean value of 2227.75. The results indicated that this cross gave a very low percentage excess of 1.38% over its alternative variety G-81 for yarn strength trait as shown in Table (4).

Moreover, the promising cross G-75 x G-81 gave a mean value of 2244.50, whereas, its alternative variety G-75 gave slight higher mean value

of 2274.75, showing a very slight percentage excess of 1.33% over the promising cross G-75 x G-81 for yarn strength trait.

Concerning to the promising cross G-72 x G-67, it gave an average yarn strength of 2233.65, while its alternative varieties Dandara and G-80 gave relatively low mean values of 2189.25 and 2172.50, respectively. The percentage excess of yarn strength of this cross were 2.03% and 2.81% over the alternative varieties Dandara and G-80, respectively. These results indicated that the promising cross G-72 x G-67 may be stronger than the two alternative varieties Dandara and G-80, El-Gharbawy ***et al*** (1985) obtained similar results.

Moreover, the promising cross G-83 x (G-72 x Delcero) gave a mean yarn strength value of 2130.00, while the alternative varieties Dandara gave a high mean value of 2189.25 for this trait. These results indicated that the promising cross G-83 x (G-72 x Delcero) recorded a percentage decrease of (-2.71) than Dandara for yarn strength.

Heritability estimates for yarn strength in broad sense (Table 19) showed a reliable value of 85.17% indicating that the effect of environmental fluctuation on this character. These results confirm the findings of Awaad (1989) and Abo El-Zahab ***et al*** (1992b).

The genotypic stability for yarn strength trait:

The combined analysis of the yarn strength trait presented in Table (1) revealed significant environments, genotypes and environment-genotype mean squares. The significance of genotype-environment interaction mean squares indicated that, it is essential to determine the degree of genotypic stability for each genotypic separately.

The means for yarn strength in addition to the estimates of $\hat{\lambda}$ and $\hat{\alpha}$ parameters for the promising crosses and commercial varieties with their degrees of stability are presented in Table (19); while Fig (11) shows the distribution of the $\hat{\alpha}$ and $\hat{\lambda}$ values.

It is clear observed that the promising cross G-77 x G-45 type (A) has the strongest yarn strength and it was followed in a descending order by G-77, G-76, promising cross G-68 x C.B-58, G-45, G-70 and promising cross G-77 x G-45 type (B), then the remaining eight promising crosses and varieties of long staple category.

The estimated $\hat{\alpha}$ statistics ranged between -3.5 and +3.5 for yarn strength. However, these estimates varied from -1 and +1 for the other characters. This may be attributed to the small difference between the mean squares for environments and that for replicates.

It is clear from Table (19) and Fig (11) that :

a. The estimated $\hat{\alpha}$ statistics were not significantly different from $\hat{\alpha} = 0$ for all of the genotypes except for G-70 (at P = 0.90).
b. The estimated $\hat{\lambda}$ statistics varied for the different genotypes. While they were significantly equal to one for the genotypes; G-75, G-81, G-76, G-45, cross G-77 x G-45 type (A) and (B) and G-75 x G-81, they were significantly different from $\hat{\lambda} = 1$ for the other genotypes.

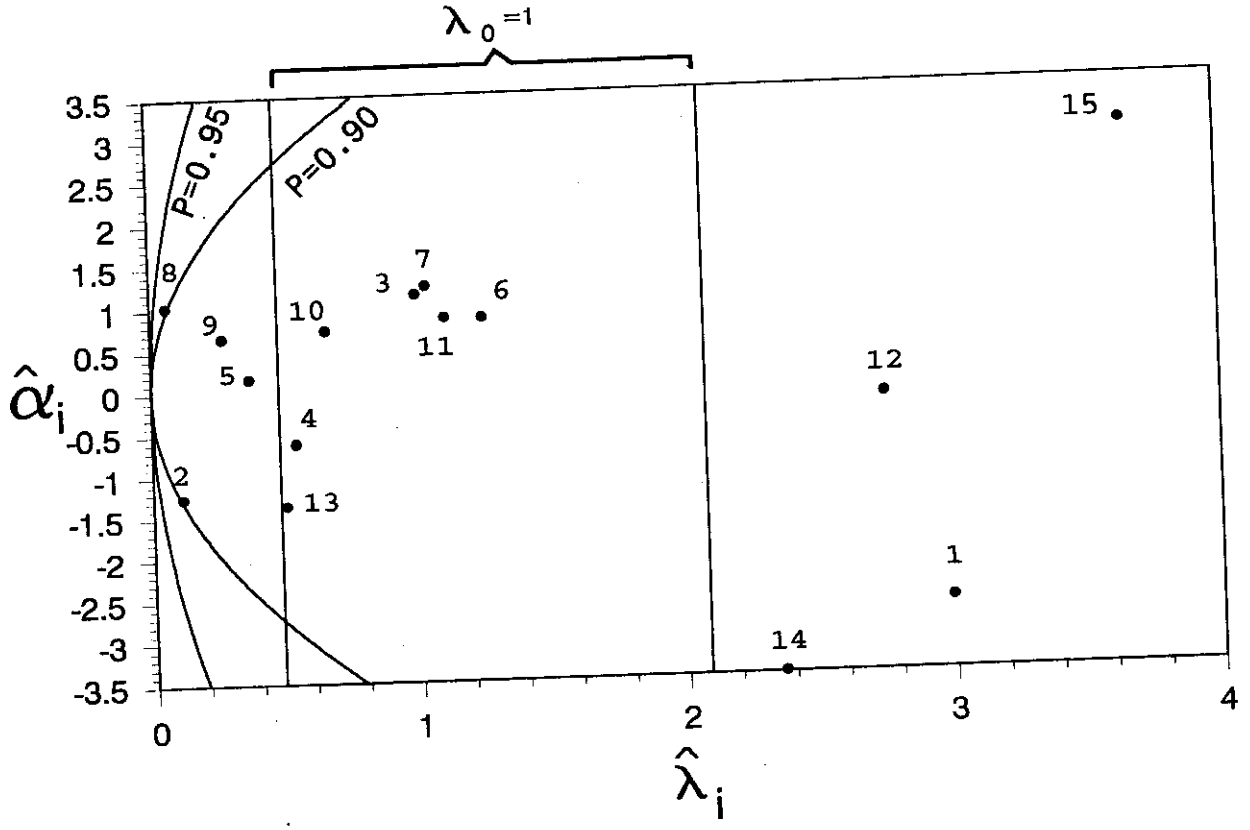
Apparently, the genotypes varied greatly in the amount of the linear response than in the amount of the deviation from the linear response, significantly the genotypes differed greatly in the amount of the deviation from the linear response than they differed in the amount of the linear response. This may suggest that the relatively unpredictable component of the

Table (19) : Average of genotypes, estimates of stability parameters, and heritability in broad sense for yarn strength over five environments.

Genotypes	Mean	Stability parameter		Degrees of stability	
		$\hat{\alpha}_i$	$\hat{\lambda}_i$	0.90	0.95
G.68 x C.B 58	2446.50	0.647	0.272	+	+
G.77 x G.45 (A)	2592.75	0.721	0.660	++	++
G.77 x G.45 (B)	2406.25	0.846	1.112	++	++
G.45	2435.75	0.227	1.044	++	++
G.70	2435.00	0.031	0.060	+	+
G.76	2461.00	0.163	0.373	+	+
G.77	2544.25	0.839	1.248	++	++
G.67 x C.B 58	2258.50	-0.178	2.749	+	+
G.75 x G.81	2244.50	-0.367	0.496	++	++
G.75	2274.75	0.125	1.001	++	++
G.81	2227.75	-0.622	0.539	++	++
G.72 x G.67	2233.65	-0.495	2.365	+	+
G.83 x (G.72 x Delcero)	2130.00	0.980	3.650	+	+
Dandara	2189.25	-0.648	2.995	+	+
G.80	2172.50	-0.269	1.107	+	+
L.S.D 0.05	210.86				
0.01	279.02				
Heritability value		85.17%			

++ Cultivars with average degree of stability.

+ Unstable Cultivars.



Fig(II) : Stability curves for yarn strenght.

I- Dandara
2- G. 80
3- G. 75
4- G. 8I
5- G. 76
6- G. 77
7- G. 45
8- G. 70
9- G.68XC.B 58
IO- G.77XG.45(A)
II- G.77XG.45(B)
I2- G.67XC.B 58
I3 G.75XG.8I
I4- G.72XG.67
I5- G.83X(G.72XDelcero)

genotype-environment interaction variance may be more important than the predictable component.

Finally, the genotypes differed in their degrees for the genotypic stability. The genotypes G-70, G-81, G-77, G-45, G-77 x G-45 type (A), G-77 x G-45 type (B) and G-75 x G-81 showed average degree of stability. While, the remaining eight genotypes were considred unstable. However, four lines out of them, Dandara, G-67 x C.B-58, G-67 x G-72 and G-83 x (G-72 x Delcero), were obviously more unstable than the others. These results are in agreement with those obtained by Simpson and Duncan (1953), El-Shaarawy (1977) and El-Marakby *et al* (1986a).

Breeding implications:

The present results demonstrated in general that there were strains of some promising crosses surpassed the old cultivars in seed and lint cotton yield and may be desirable substitutes in future. These promising crosses were ; G-68 x C.B-58, which exceeded its alternative varieties G-70 and G-77, promising cross G-77 x G-45 type (A) which exceeded its alternative varieties G-45 and G-76, promising cross G-72 x G-67 which exceeded its alternative varieties Dandara and G-80 and promising cross G-83 x (G-72 x Delcero) which exceeded its alternative variety Dandara. Moreover, the differences between the cultivated cultivars and their substitutes should be stable over locations.

The genotypic stability results detected that both strains of the promising crosses and cultivated cultivars showed different features of stable characteristics. The potentially useful lines varied in demonstrating stable agronomic and quality characteristics. For example; G-81 was the high staple line which showed ten stable traits out of eleven. However, Dandara was the

low stable line that showed only three stable traits. The results also indicated that the strains of the promising crosses showed four stable variables for three crosses, five traits for two crosses , six traits for one cross and seven traits for one cross, as shown in Table (20), these results may lead to the fact that there is no any stable commercial variety for general cultivation in the cotton areas all over Egypt. moreover, every Egyptian cotton category has a distinct district to be cultivated within to obtain its maximum potentiality, earliness and especially fiber characteristics, however, the low stable lines suggest that an effective breeding methods would be one leading towards introducing lines more genetically stable than cultivated varieties.

Table (20): Stability of traits for cultivated varieties along with their alternative promising lines.

Genotypes / Characters	G.68 X C.B.58	G.77 X G.45 (A)	G.77 X G.45 (B)	G.45	G.70	G.76	G.77	G.67 X C.B.58	G.75 X G.81	G.75	G.81	G.72 X G.67	G.83 X (G.72X Delcero)	Dandara	G.80
Position of first symbodium	+	+	+	–	+	+	–	–	–	+	+	–	+	–	+
Earliness percentage	+	–	+	+	–	+	+	+	–	–	+	–	+	+	+
Number of fruiting branches/plant	–	+	+	–	+	+	+	+	–	+	+	–	–	+	–
Seed cotton yield/ plant	–	+	–	+	–	–	+	+	–	–	+	–	+	–	–
Seed cotton yield/F	–	–	–	+	–	+	–	–	–	–	+	+	–	–	+
Lint cotton yield/F	–	–	–	+	–	+	–	–	–	–	+	+	–	–	+
Bool weight	–	–	+	–	+	+	+	+	–	+	+	–	+	–	–
Seed index	–	+	–	–	–	–	–	+	–	+	+	+	–	–	+
Miconaire reading	+	+	–	–	+	+	+	–	+	+	+	+	+	–	+
Hair weight	+	+	–	–	–	–	–	+	+	+	–	–	–	+	–
Yarn strength	–	+	+	+	–	–	+	–	+	+	+	–	–	–	–

(+) = Genotypes with average degree of stability.
(-) = Unstable genotypes.