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BREEDING FOR IMPROVING SOME EXOTIC CHICKPEA GENOTYPS UNDER STRESS CONDITIONS. 1-STABILITY ANDSELECTION FOR YIELD AND DROUGHT SUSCEPTAPILITY INDEX.

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ABSTRACT

Sixty-four chickpea genotypes introduced from ICARDA were evaluated with the commercial cultivars Giza-1 for yield and some components (water regime and rainfall) during two growing seasons (2002/03and 2003/04) at Maryout and and 2003/2004 seasons El-Maghara Research Stations, Desert Research Center.

Seed yield and some components were subjected to phenotypic stability analysis according to the procedure proposed by Eberhart and Russell (1966). The results indicated that a wide range of variability between two locations and high genotypic differences were detected. The genotype x environment interaction was significant and a major portion of this was accounted by the deviation from linear response. Seed yield and some components influenced by the two supplemental irrigations. The highest values of these traits were obtained when chickpea plants were irrigated for two times. This outyielded for seed yield per plant by 436.19 and 134.18% at Env.2 and Env.1 (only one irrigation at sowing with seasonal rainfed) and 55.02 and 151.59% at Env.4 and Env.5 (under intervals drip irrigation).

Genotypes no. 1,2,5,10,15,29,30,39,Giza-1 and 44 gave the highest values for all traits, whereas genotypes no.20, 12,11 and 14 as well as genotypes no.11, 5,3,4,36,43,42,33 and 34 recorded the highest values for DSI_1 and DSI_2 respectively. Also, genotypes no.1, 5,8,23,36 and 46 were more stable for seed yield and some components compared with the other genotypes and the commercial.

Finally, genotypes no.5 and 1 are consider the best genotypes because they more stable and highly drought tolerant.

Keywords: Chickpea genotypes, stress susceptibility index, drought, rainfall and stability.

INTODUCTION

Chickpea is one of the major food legumes in Egypt. The suitable irrigation management has remained one of the major constrains for this crop to realization of full yield potential. Nimje (1991), mentioned that grain yield, pods and grain/plant of chickpea were improved with increasing number of irrigation up to three, scheduling at pre-sowing, branching and pod-filling stages. However, Prabhakar and Saraf (1991), found that two irrigations for chickpea during vegetative and reproductive stages gave7 q/ha more grain than with no irrigation. Also, El-Waraky and El-Koliey (2000) found that chickpea production can be improved by applying three irrigations at branching, flowering and pod development stages. However, if two irrigations were only available, their scheduling at branching and pod development stages is the best. Whereas, when one irrigation is available its scheduling at pod development stage is better for getting the highest yield and water use efficiency of chickpea at Malawi (*Middle Egypt*) conditions.

Saxena *et al* (1990) found that, irrigation increased seed yield in winter and spring sowing dates by 56% and 72%, respectively, over those receiving 316mm annual precipitation. Irrigation is therefore, a way to increasing the productivity and yield stability of chickpea in Northern, Syria but the improvement in yield depends on the total rainfall and its distribution over the growing season.

The objectives of this study were to starting chickpea breeding program, to determine the performance, stability and stress susceptibility index for 46 exotic chickpea genotypes compared with the commercial cultivar Giza-1 growing under five different environments.

MATERIALS AND METHODS

Five field trials were conducted during 2002/03 and 2003/04 growing seasons at Maryout and EL-Maghara Research Stations, Desert Research Center, to evaluate 46 chickpea genotypes introduced from ICARDA compared with the commercial cultivar Giza –1. The pedigree and origin of the 47 chickpea genotypes are presented in Table -1. The filed experiments were designed at a randomized complete block design with three replications. The experimental plot consists of two ridges 3m long and 60 cm apart. Seeds were hands planted in hills spaced by 20 cm at one side of the ridge with one seed per hill. The first and second experiments (Env.1 and Env.2) at Maryout 2002/03 and 2003/04, dry method was used with one irrigation at sowing and after that plants were left to grown under seasonal rainfall. Whereas, the third experiment (Env.3 at Maryout 2003/2004) received two irrigations, the first after 45 days from sowing and the second after 45 days from the first in additional to seasonal rainfall (Table 2). The fourth and fifth experiments (Env.4 and Env.5) at El-Maghara 2003/04 growing season, dry method was used with intervals drip irrigation at 6 and 9 days with one hour at the one time (drip = 8L/hour). All genotypes were sown at 25 th November and the first week of December at Maryout and El-Maghara Research Stations, respectively.

Table (1): The pedigree and origin of 47 chickpea genotypes.

Entry NO.	Cross No./ Entry Name	Pedigree	Origin	FAO Status*
1	× 2001TH 25	(FLIP 98-29C x S99442) x SEL99 TH 15042	ICARDA/ICRISAT	U
2	× 2001 TH 27	(FLIP 98-132Cx S99442) x Sel 99TER85448	ICARDA/ICRISAT	U
3	× 2001TH 29	(FLIP 98-29C x S99001) x S 98008	ICARDA/ICRISAT	U
4	× 2001TH 30	(FILP 98-129C x S99003) x S 98006	ICARDA/ICRISAT	U
5	× 2001TH 31	(FILP 98-132C x S99075) x UC 27	ICARDA/ICRISAT	U
6	× 2001TH 32	(S 98588 xS99148) x S98008	ICARDA/ICRISAT	U
7	× 2001TH 33	(FILP 98-138CxSEL99 TER 85035) xSEL99TH 15042	ICARDA/ICRISAT	U
8	× 2001TH 36	(FILP 98-138CxSEL99TER 85461) xSEL99TH 15063	ICARDA/ICRISAT	U
9	× 2001TH39	(FILP 98-52CxFILP98-10C) x SEL 99TH 15039	ICARDA/ICRISAT	U
10	× 2001TH 40	(FILP9852CxFILP 98-12C) x SEL 99TH 15045	ICARDA/ICRISAT	U
11	× 2001TH 42	(ILC 310 x FILP 98-129 C x S 98008	ICARDA/ICRISAT	U
12	× 2001TH 43	(ILC 3216 x FILP 98-132 C) x S 98006	ICARDA/ICRISAT	U
13	× 2001TH 44	(ILC 3843 x S 98033	ICARDA/ICRISAT	U
14	× 2001TH 46	(ILC 4945 x FILP 98-132 C) x S 98006	ICARDA/ICRISAT	U
15	× 2001TH 47	(ILC 5766 x S 98588) x S 98033	ICARDA/ICRISAT	U
16	× 2001TH 53	CA 9783005 x SEL 99 TER 85530	ICARDA/ICRISAT	U
17	× 2001TH 57	CA 9783069 x SEL 99 TER 85530	ICARDA/ICRISAT	U
18	× 2001TH 76	ILC 3805 x S EL 99 TER 85530	ICARDA/ICRISAT	U
19	× 2001TH 77	ILC 3805 x SEL 99 TER 85581	ICARDA/ICRISAT	U
20	× 2001TH 104	S 99050 x S 98008	ICARDA/ICRISAT	U
21	× 2001TH 105	S 99040 x S 98033	ICARDA/ICRISAT	U
22	× 2001TH 106	S 99032 x UC 27	ICARDA/ICRISAT	U
23	× 2001TH 107	S 99188 x S 98006	ICARDA/ICRISAT	U
24	× 2001TH 108	S 99286 x S 98008	ICARDA/ICRISAT	U
25	× 2001TH 110	FILP 97-111 C xS98006	ICARDA/ICRISAT	U
26	× 2001TH 111	FILP 97-121C x S 98008	ICARDA/ICRISAT	U
27	× 2001TH 147	FILP 98-52 C x S EL 99 TH 15042	ICARDA/ICRISAT	U
28	× 2001TH 148	FILP 98-138 C x SEL 99 TH 15039	ICARDA/ICRISAT	U
29	× 2001TH 149	FILP 98-81 x SEL 99 TH 15063C	ICARDA/ICRISAT	U
30	× 2001TH 150	ICCV 2 x SEL 99 TH 15243	ICARDA/ICRISAT	U
31	× 2001TH 151	S 99326 x SEL 99 TH 15042	ICARDA/ICRISAT	U
32	× 2001TH 153	SEL 99 TH 15042 x ILC 5901	ICARDA/ICRISAT	U
33	× 2001TH 155	SEL 99 TH 15063 x ILC 5901	ICARDA/ICRISAT	U
34	× 2001TH 156	SEL 99 TH 15243 x ILC 3805	ICARDA/ICRISAT	U
35	× 2001TH 158	SEL 99 TER 85314 x ILC 3805	ICARDA/ICRISAT	U
36	× 2001TH 160	SLE 99 TH 15039 x S 98008	ICARDA/ICRISAT	U
37	× 2001TH 164	SEL 99 TER 85314 x S 98008	ICARDA/ICRISAT	U
38	× 2001TH 169	UZ-6510 x SEL 99 TER 85534	ICARDA/ICRISAT	U
39	× 2001TH 171	UZ-7332 x SEL 99 TER 85534	ICARDA/ICRISAT	U
40	× 2001TH 172	BAHODIR x SEL 99 TER 85530	ICARDA/ICRISAT	U
41	× 2001TH 173	IREDA-96 x SEL 99 TER 85581	ICARDA/ICRISAT	U
42	× 2001TH 174	GLK 95069 x SEL 99 TER 85530	ICARDA/ICRISAT	U
43	× 2001TH 175	ICCV 2 x SEL 99 TER 85534	ICARDA/ICRISAT	U
44	× 2001TH 176	ICCV 95510 x SEL 99 TER 85485	ICARDA/ICRISAT	U
45	ILC 482	Long term check	Turkey	D
46	FLIP82-150c	ILC 523 x ILC 183 (Improved check)	ICARDA/ICRISAT	D
47	Giza-1	A.R.C.	Egypt	D

***D=Designated, U = Undesignated**

Table (2): Monthly mean rainfall (mm^2) at Maryout Research Station.

Month	2002/2003	2003/2004
October	4.31	0.25
November	2.03	4.52
December	69.60	41.91
January	38.10	70.86
February	83.80	56.64
March	40.64	2.03
April	0.25	0.25
Total	238.73	176.46

Source: Meteorological Desert Research Lab.

Some chemicals and physical analysis of soil and irrigation water of the two locations were carried out (Table 3). The fields were fertilized using calcium superphosphate at the rate of 25 kg of P_2O_5 per feddan before sowing. Hoeing was applied when necessary.

In each experiment data of number of seeds per plant, 100- seed weight and seed yield per plant were recorded on ten individual plants chosen randomly from each plot. The data were analyzed on individual plant mean basis, the ordinary analysis of variance for R.C.B.D. was performed according to Snedecor and Cochran (1967).

Table (3): Some chemical and physical analyses of soil and irrigation water of the two Experimental stations.

Locations	Types	EC dsm^{-1}	pH	Cations me/L				Anions me/L			$CaCO_3$ %	Textural Class
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	$SO_4^{=}$		
Maryout	Soil (0-30)	4.80	7.7	17.3	9.22	30.65	1.09	3.6	32.00	22.66	24.0	Loamy clay
	Water	3.52	7.5	7.02	8.03	17.33	0.42	9.33	16.44	6.87	-----	
El-Maghara	Soil (0-30)	0.9	7.4	4.00	1.50	3.30	0.15	1.80	5.20	1.95	11.7	Sand
	Water	4.06	8.4	11.4	3.48	24.6	0.69	4.40	32.20	3.57	------	

The stability parameters suggested by Eberhart and Russell (1966) was calculated for all the studied traits.

Data of seed yield was used to estimate the drought susceptibility index (DSI) as suggested by Saulescu *et al* (1995) as follows: *DSI=S/NS*
Where S and NS yield with stress conditions and normal irrigation.

RESULTS AND DISDUSSIONS

This kind of investigations provides opportunity to supply breeding stocks in a relatively large number of environments.The average yield of genotypes in replicated trials appears to be the best method available for estimating the differences across yield environments.

Bartlett test (Gomez and Gomez, 1984) of homogeneity of variance showed that the variance estimates were homogeneous.
Data presented in Table (4), show the mean performance for number of seeds per plant of seventy four chickpea genotypes grown under five different environments

From the previous data it's clearly that, all genotypes were differed significantly for all traits under all environments. On the other hand, all genotypes recorded the highest mean values for all studied traits at environment no.3 compared with the other environments. These results due to the two supplementary irrigation which are given after sowing date and low irrigation water salinity (Table-3). Saxena *et al* (1990) and Sivakumar and Piara Singh (1987) obtained similar results. Also, all genotypes gave the highest mean values for all traits under environment no.1 compared with environment no.2. These results due to increasing the seasonal and distribution rainfall especially at poding stage (Table 2). Omar (2004), found that faba bean genotypes affected differently to various of soil moisture, which offered opportunities of selecting appropriate genotypes for certain soil moisture.

1- Number of seeds per plant:

The average number of seeds per plant for all genotypes under the five environments ranged from 18.98(genotype no.38) to 46.51(genotype no.30) with overall average 32.36. The highest numbers of seeds per plant were obtained by genotypes no.2, 15,3,5,10,19and 30 at environment no.3.This results may be due to the available soil moisture to grown chickpea. The results obtained by Omar (2003) indicated that, all genotypes varied significantly with respect to all studied characters for the two generations under the three treatments and rainfall conditions.

2-100-seed weight (g):

Genotype no.44, 1 and 39 gave the highest mean values under all environments compared with the other genotypes. These outyielded the over all-mean by 49.6,42.6 and 22.6% respectively. The average of 100-seed weight ranged from 14.51for-genotype no.6 to 27.00 for genotype no.44 with an overall average of 18.17. Ammar *et al* (2003) suggested that 100-seed weight, plant height, number of branches/plant could be considered as selection criteria for improving lentil seed yield indirectly.

3- Seed yield per plant:

The highest mean values of seed yield per plant were recorded by genotypes no.2, 5,1,29,15,13,44,and 39 compared with the commercial cultivar Giza 1 and the other genotypes under study at the combined data. These outyielded the over all mean by 69.10,52.90,46.60,45.00,41.80,41.00,38.70 and 33.80, respectively.

The seed yield per plant ranged from 3.89 for genotype no.33 to 10.67 for genotype no.2 with an overall average 6.31g/plant over all five environments. The yield was greatly affected by the yield components. This finding agreed with the results obtained by Omar (2003 and 2004) and Darwish *et al* (1999), they found that the environmental effects under newly reclaimed conditions affected the performance, yield and its components of faba bean genotypes. Also, Bayoumi (2003), mentioned that selection for mean productivity will be accompanied by an increase in mean yield in both stress and non stress condition.

4- Drought susceptibility index:

This part from these studies involved information on the genetic parameters for susceptibility index (DSI) concerning seed yield in chickpea genotypes evaluated under different environmental conditions.

Stress tolerant genotypes, as defined by DSI values, need to have high yield potential since DSI provides a measure of tolerance based on minimization of yield loss under stress rather than on stress yield per se.

Table (4): The genotypes mean performance in each environment and drought susceptibility index of 47 chickpea genotypes for eed yield and some components.

Genotypes	No. of seeds/plant					100-seed weight (g)				
	Env. 1	Env. 2	Env. 3	Env. 4	Env. 5	Env. 1	Env. 2	Env. 3	Env. 4	Env. 5
Genotype -1	25.45klm	15.98 kl	56.17g	42.81 fg	25.40lmn	27.65 b	22.95 a	34.75 b	23.63 d	20.59 c
Genotype -2	43.46 d	20.41 g	78.66a	54.06 a	35.30 b	21.01 de	21.13 b	27.75 e	20.56 lm	19.54 de
Genotype -3	38.97 e	24.76 e	71.91 b	51.99 b	35.80 b	14.43 r	12.68 g	19.26 t	15.97 *	15.08 w
Genotype -4	17.51 st	15.20 lm	44.3 nop	37.71 kl	29.89 fg	18.36 ij	15.47 e	23.08 k	19.89 no	18.15 l-l
Genotype –5	43.45 d	25.51 de	71.16 bc	52.25 ab	39.51 a	19.93 fg	15.51 e	25.97 g	19.15 rst	18.68 gh
Genotype –6	19.77 qrs	16.67 jkl	43.24opq	43.71 ef	30.22 efg	10.77 u	9.09 r	18.51 u	17.56 z *	16.60 qrs
Genotype –7	17.17 t	11.93 op	41.52 qrs	33.65nop	24.17nop	16.15 mn	12.66 g	22.47 lm	19.64opq	17.73 l-o
Genotype –8	28.52 h	17.52 ijk	52.09 ij	43.64 ef	29.81 fg	11.79 t	9.16 r	19.26 t	17.93 yz	15.94 tu
Genotype –9	20.69 pqr	12.27 op	42.47 n-o	35.41 mn	28.36 hij	15.78 mn	11.27 jk	21.30 n	19.36 pqr	16.26 rst
Genotype–10	47.61 c	27.88 bc	71.71 b	45.44 de	31.87 cd	16.06 mn	10.01opq	22.52 l	21.37 ghi	17.29 op
Genotype–11	33.04 g	24.15 ef	49.81 gkl	34.76 mn	30.28 efg	11.77 t	12.56 gh	16.74 v	17.46 *	14.97 wx
Genotype–12	28.48 h	20.66 g	52.54 hi	35.38 mn	18.95 v	16.62 lm	16.20 d	20.44 qrs	18.6vwx	14.26 y
Genotype–13	40.74 e	25.30 e	58.56 f	42.93 fg	30.71 def	22.47 c	11.82 ij	29.84 c	21.69 g	17.93 j-n
Genotype–14	28.35 h	17.46 ijk	47.65 lm	37.90 kl	29.51 fgh	16.08 mn	15.63 de	21.24 no	18.7uvw	15.94 tu
Genotype–15	25.69j-m	15.33 lm	76.57 a	47.28 c	36.87 b	21.78 cd	8.05 s	27.17 f	22.18 f	17.99l-m
Genotype–16	51.43 b	31.97 a	53.65 ghi	38.86 jk	24.23nop	9.43 v	10.5mno	16.18 w	17.35 *	14.60 xy
Genotype–17	23.42 mn	15.94 kl	51.40 ijk	34.08nop	24.18nop	13.37 s	9.14 r	19.08 t	16.52 *	13.83 z
Genotype–18	28.00 hij	19.74 gh	39.67 s-v	30.34 q	19.51 tuv	15.56 no	11.24j-m	20.62 pqr	18.5vwx	15.56 uv
Genotype–19	23.05 no	14.19 mn	69.50 bc	47.13 cd	31.38 de	15.63 n	10.3 nop	20.48 qrs	19.31 p-s	16.65 qr
Genotype–20	49.28 bc	27.65 bc	44.54 no	35.31 mn	21.05 s	19.19 gh	15.79 de	22.48 lm	19.97 no	17.47nop
Genotype–21	28.24 hi	20.57 g	37.5 uvw	28.89 qr	20.25 stu	21.79 cd	10.98 k-n	29.13 d	22.90 e	19.12 ef
Genotype–22	21.78 n-q	12.72 no	41.96 o-s	32.63 op	22.69 qr	14.75 o-r	10.1 opq	20.03 s	18.18 xy	15.52 uv
Genotype–23	25.40 lm	17.33 ijk	55.04 gh	39.56 h-k	29.06 ghi	16.21 mn	10.93 k-n	20.55 qrs	18.73 t-w	15.54 uv
Genotype–24	26.88 h-l	19.87 gh	40.52 rst	34.9 mno	24.7mno	15.38 n-q	10.57 k-o	20.74opq	19.31 p-s	17.26 p
Genotype–25	17.90 st	9.51 rs	36.4wxy	26.57 st	20.47 stu	15.mn	10.54 l-o	20.13 rs	19.71 op	15.30 vw
Genotype–26	27.76 h-k	13.30 no	49.24 kl	38.42 jkl	27.58 jk	15.37 n-q	9.98 opq	19.46 t	18.88 s-v	16.23 rst
Genotype–27	18.71 rst	8.61 s	38.15 t-w	29.87 qr	23.02 pqr	14.20 r	9.06 r	23.53 jk	20.70 kl	17.88 k-n
Genotype–28	39.01 e	23.04 f	51.97 ij	39.81 h-k	25.51 lm	17.25 kl	10.4 nop	25.64 g	21.53 gh	16.69 qr
Genotype–29	58.26 a	26.54 cd	66.28 d	47.47 c	30.21 efg	19.35 gh	10.90 k-n	24.11 hi	20.89 jkl	18.91 fg
Genotype–30	49.70 bc	28.85 b	68.93 c	48.28 c	36.76 b	17.81 jk	11.24 jkl	20.45qrs	18.7uvw	16.19 st
Genotype–31	25.95 l-l	13.12 no	46.17 mn	36.52 lm	19.33 uv	14.56 qr	9.76 pqr	23.82 ij	21.07 ijk	18.28 h-k
Genotype–32	12.45 rst	10.24 qr	34.21 yz	28.06 rs	20.76 st	18.23 ij	12.20 ghi	21.12nop	19.50 r-u	17.6 m-p
Genotype–33	18.38 rst	12.88 no	37.1vwx	30.27 q	22.24 r	15.4 nop	9.47 qr	18.28 u	16.11 *	15.93 tu
Genotype–34	13.34 u	9.81 qrs	34.81 xy	30.43 q	24.23nop	12.78 s	9.13 r	20.77opq	18.5vwx	18.37 hij
Genotype–35	22.87nop	12.94 no	43.67 n-q	39.11 ijk	28.34 hij	14.75 o-r	10.99 k-n	26.68 f	24.07 c	21.37 b
Genotype–36	21.80 n-q	14.14 mn	43.96 n-q	38.33 jkl	30.67 def	18.09 ij	13.76 f	24.74 h	20.25 mn	18.66 gh
Genotype–37	17.38 t	10.11 qrs	39.78 stu	34.75 mn	17.38 w	18.78 hi	11.95 hi	20.57qrs	18.3wxy	16.64 qr
Genotype–38	14.15 u	6.84 t	31.99 z	26.07 t	15.87 x	15.82 mn	12.64 g	26.91 f	23.85 cd	19.65 d
Genotype–39	35.47 f	18.53 hi	55.98 g	41.11 ghi	26.49 kl	22.49 c	16.99 c	25.80 g	24.78 b	21.30 b
Genotype–40	21.10opq	11.14 pq	41.77 p-s	32.41 p	23.09 pqr	21.06 de	17.48 c	22.40 lm	19.82 o	18.45 hi
Genotype–41	31.85 g	16.81 jkl	51.59 ijk	41.29 gh	23.59opq	18.61 hij	15.17 e	21.36 n	19.27qrs	16.78 q
Genotype–42	32.11 g	17.74 ij	54.97 gh	42.78 fg	30.84 def	17.07 kl	12.25 ghi	20.43qrs	17.57 z*	17.80lmn
Genotype–43	21.48 n-q	13.36 no	47.80 lm	40.41 hij	31.80 cd	15.70 n	11.87 ij	34.60 b	21.22 hij	19.77 d
Genotype–44	25.44 h	17.31 ijk	47.14 lm	34.95 mn	23.29 pqr	28.60 a	20.79 b	36.85 a	26.43 a	22.35 a
Genotype–45	26.61 h-l	16.10 kl	47.78 lm	36.41 lm	26.24 l	19.93 fg	13.91 f	29.85 c	22.90 e	20.94 c
Genotype–46	25.70j-m	16.10 kl	47.47 lm	39.31 h-k	22.76 qr	14.59 pqr	10.5 nop	21.97 m	20.72 kl	19.56 de
Giza-1	40.21 e	20.17 g	61.59 e	46.37 cd	28.03 ij	20.33 ef	16.21 d	29.33 d	23.71 cd	21.46 b
Mean	28.81	17.41	50.45	38.50	26.64	17.21	12.57	23.37	20.05	17.63

L- values followed by same letter (s) are not different at P ? 0.05

*** = Outside alphabetical letters**

Table (4): Con.

Genotypes	Seed yield/plant (g)					Drought index	
	Env. 1	Env. 2	Env. 3	Env. 4	Env. 5	DSI_1	DSI_2
Genotype –1	7.41 g	3.86 b	19.69 c	10.08bcd	5.22 ij	0.21ghi	0.51 t-w
Genotype –2	9.15 bcd	4.36 a	21.81a	11.16 a	6.90 b	0.21 ghi	0.62 g-m
Genotype –3	5.62 ijk	2.77 g	13.89gh	8.28 gh	5.40 hi	0.20 ig	0.74 a
Genotype –4	3.24 stu	3.35 ij	10.16lmn	7.50 klm	5.42 hi	0.23 fg	0.73 ab
Genotype –5	8.35 ef	3.95 b	18.52 d	10.01 cd	7.42 a	0.21 f-l	0.74 a
Genotype –6	2.12 wx	1.50 m-p	8.03 r	7.67 jkl	5.02 j	0.19 l-l	0.66 c-l
Genotype –7	3.12 tuv	1.52 m-p	9.34 op	6.62 p-t	4.55 kl	0.16 no	0.69 bcd
Genotype –8	3.19 tuv	1.61 mno	10.05lmn	7.84 ijk	4.74 k	0.16 no	0.61 j-o
Genotype –9	3.32 r-u	1.39 n-q	8.92 pq	6.84 o-r	4.62 kl	0.16 no	0.68 c-f
Genotype –10	7.57 g	2.76 g	16.13 f	9.72 de	5.50 gh	0.17 mno	0.57 o-s
Genotype –11	3.79 p-s	3.03 ef	8.36 qr	6.06 uv	4.52 klm	0.27 d	0.75 a
Genotype –12	4.82 lmn	3.35 d	10.70 jkl	6.61 p-t	2.70 u	0.31 c	0.42 y
Genotype –13	9.25 bc	2.94 fg	17.48 e	9.35 ef	5.51 gh	0.17 mno	0.59 l-r
Genotype –14	4.12 mno	2.72 gh	10.10lmn	7.07 m-p	4.71 kl	0.27 d	0.67 c-g
Genotype –15	5.63 ijk	1.22 q	20.81 b	10.47 b	6.64 c	0.06 v	0.64 f-l
Genotype –16	4.89 lm	3.38 d	8.64 qr	6.75 p-s	3.53 qr	0.39 b	0.53 s-v
Genotype –17	3.10 tuv	1.45 n-q	9.77 mno	5.64 wx	3.37 rs	0.15 opq	0.60 l-q
Genotype –18	4.27 nop	2.21 jk	8.14 r	5.59 wx	3.03 t	0.27 d	0.57 o-s
Genotype –19	4.55 mno	1.43 n-q	14.24 g	9.11 f	5.22 ij	0.10 tu	0.58 n-r
Genotype –20	9.48 b	4.34 a	10.04lmn	7.03 n-q	3.68 pq	0.44 a	0.53 s-v
Genotype –21	6.07 c	2.28 jk	10.91 jk	6.57 q-t	3.86 op	0.21 ghi	0.58 m-r
Genotype –22	3.30 r-u	1.30 pq	8.37 qr	5.94 vw	3.52 qr	0.15 opq	0.60 k-p
Genotype –23	4.15 op	1.91 l	11.28 ij	7.40 k-n	4.52 klm	0.17 mno	0.62 h-n
Genotype –24	4.06 opq	2.09 kl	8.41 qr	6.75 p-s	4.27 mn	0.25 e	0.65 d-j
Genotype –25	2.85 uv	0.99 r	7.32 s	5.24 xy	3.14 st	0.13 qrs	0.60 k-p
Genotype –26	4.36 m-p	1.35 pq	9.56 nop	7.24 l-o	4.47 lm	0.14 pqr	0.62 c-n
Genotype –27	2.65 vw	0.77 r	8.94 pq	6.18 tuv	4.10 no	0.09 u	0.66 c-h
Genotype –28	6.74 h	2.83 ij	13.34 h	8.57 g	4.26 mn	0.18 j-m	0.50 vwx
Genotype –29	11.26 a	2.86 fg	16.02 f	9.90 cd	5.70 fg	0.18 j-m	0.58 n-r
Genotype –30	8.87cde	3.27 d	14.05 g	9.03 f	5.92 ef	0.23 ef	0.66 c-l
Genotype –31	3.78 p-s	1.29 pq	11.03 ijk	7.70 jkl	3.51 qr	0.12 st	0.47 x
Genotype –32	2.26 wx	1.25 q	7.20 s	5.34 x	3.66 pq	0.17 l-o	0.69 b-e
Genotype –33	2.96 tuv	1.24 q	6.82 s	4.89 y	3.55 qr	0.18 j-m	0.72 ab
Genotype –34	1.73 x	0.93 r	7.22 s	6.31 s-v	4.44 lm	0.13 rs	0.70 abc
Genotype –35	3.35 r-u	1.38 opq	11.69 l	9.43 ef	6.07 de	0.12 st	0.64 e-k
Genotype –36	3.84 pqr	1.90 l	10.73 jkl	7.76 ijk	5.71 fg	0.18 k-n	0.75 a
Genotype –37	3.25 r-s	1.22 q	8.17 r	6.41 r-u	2.9 tu	0.15 opq	0.48 wx
Genotype –38	2.27 wx	0.91 r	8.56 qr	6.19 tuv	3.12 t	0.10 tu	0.52 t-w
Genotype –39	8.66 def	3.16 de	14.47 g	10.16 bc	5.74 fg	0.22 fgh	0.56 p-s
Genotype –40	4.45 mno	1.93 l	9.33 op	6.41 r-u	4.27 mn	0.20 hij	0.67 c-f
Genotype –41	5.92 ij	2.54 hi	11.03 ijk	7.96 hij	3.97 o	0.23 fg	0.51 u-x
Genotype –42	4.45 jk	2.25 jk	11.21 ij	7.52 klm	5.48 gh	0.19 ijk	0.73 ab
Genotype –43	3.20 q-t	1.62 mn	16.52 f	8.61 g	6.27 d	0.10 tu	0.74 a
Genotype –44	8.31 f	3.59 c	17.41 e	9.22 f	5.24 hij	0.21 ghi	0.58 n-r
Genotype –45	5.29 kl	2.26 jk	14.25 g	8.35 gh	5.50 gh	0.16 nop	0.66 c-l
Genotype –46	3.83 pqr	1.69 m	10.44klm	8.17 ghi	4.44 lm	0.16 mno	0.55 q-t
Giza-1	8.19 f	3.18 cde	18.05 de	10.96 a	6.02 e	0.17 l-o	0.55 r-u
Mean	5.06	2.21	11.85	7.74	4.71		

L-values followed by same letter(s) are not different at P ? 0.05.

Genotype identified as stress tolerance using DSI should possess tolerance mechanisms, which may need to be incorporated into germplasm with higher yield potential for develcpment of high yielding and stress tolerant genotypes.

Saulescu *et al* (1995), reported that the cultivars that are superior to the average for the shoot dry weight ratio, stressed/non-stressed include cultivar successfully grown in dry area. Abdalla *et al* (2003) found that the studied chickpea genotypes possessed reaction to various environmental conditions. Moreover, some traits could compensate low performance of other associated traits.

Drought susceptibility index (DSI) for all genotypes under study was determined on the basis of seed yield between the two environments at Maryout (Env.3/Env2=DSI_1) and El-Maghara (Env.5/Env.4=DSI_2) Table (4).

Genotypes no.20 followed no. 16,12,11 and 14 gave the best desirable DSI_1 for seed yield per plant. While, genotypes No.11, 5,3,4,36,43,42,33 and 34 gave the best desirable $DSI_2$for seed yield per plant. Omar (2003) and El-Hosary *et al* (2002) found the same trend of these results.

Data presented in Table (5) indicated that significant differences among genotypes, environment interaction were detected indicating that chickpea genotypes responded differently to the different environmental conditions. The importance of assessments of identifies the best genetic makeup for a particular environment.

Table (5): Analysis of variance for seed yield and some components of 47 chickpea genotypes grown under 5 environments.

Source of variance	d.f.	No. of seed/plant	100-seed weight (g)	Seed yiel/plant (g)
Replicates	10	10.03	1.37	0.42
Environments (Env.)	14	22336.05 **	2223.79 **	1893.73 **
Genotypes (G.)	46	775.09 **	117.69 **	48.10 **
Env. x G.	184	87.23 **	13.63 **	7. 59 **
Error	460	20.72	1.79	1.06

*** and ** significant at 0.05 and 0.01 levels of probability, respectively.**
d.f. = Degrees of freedom.

Many authors previously detected significant environmental effects on chickpea seed yield, Brown *et al* (1989), EL-Waraky and EL–Koliy 2000, Sivakumar and Piara Singh (1987) and Saxena *et al* (1990).

The analysis of variance for single environment as well as, the combined analysis for seed yield and some component are given in Table (6). The results showed significance differences between genotypes at all environments revealing that the genotypes varied in their performance from one to another. These results suggested that the comparison between genotypes should be made in order to determine the best performance genotypes at the five systems of water regime treatments.

Data in Table (6): showed that the linear response of environments was highly significant. Consequently the regression coefficient (bi) of seed yield and some components on the environmental index and deviation from regression mean squares (S^2di) pooled over the five environments were calculated for each genotype and were presented in Table (7).

Darwish *et al* (1999): found that the significant genotypes x environment interaction for almost traits indicates that the tested genotypes ranked differently across newly reclaimed environments and all environments for seed yield and its components also the same results are founded by Omar (2004).

Table (6): Analysis of variance for yield and some components of 47 Chickpea genotypes grown under 5 different environments.

Source of variance	d.f.	No. of seeds/plant	100- seed weight (g)	Seed yield /plant (g)
1- Total	234	200.92	23.96	15.93
2- Genotypes (G.)	46	258.36 **	39.23 **	16.03 **
3- Env. + G. x Env.	188	186.87 **	20.22 **	15.91 **
a- Env. Linear	1	29781.35 **	2965.10 **	2524.99 **
b- G. x Env. linear	46	49.84 **	8.30 **	6.62 **
c- Pooled deviation	141	21.6 8 **	3.22 **	1.14 **
Genotype -1	3	5.72	22.53**	2.61 **
Genotype -2	3	7.15	8.08**	2.71 **
Genotype -3	3	2.36	0.46.	0.17
Genotype -4	3	38.79 **	0.24	1.18 *
Genotype -5	3	3.51	3.22**	1.31 *
Genotype -6	3	50.53**	5.73**	3.03 **
Genotype -7	3	15.85	0.26	0.58
Genotype -8	3	5.75	3.03**	1.08 *
Genotype -9	3	19.68 *	0.28	0.71
Genotype -10	3	52.25**	1.64*	0.56
Genotype -11	3	7.94	3.45**	0.19
Genotype -12	3	25.62*	3.55**	1.38 *
Genotype -13	3	13.65	6.44**	2.90 **
Genotype -14	3	2.91	1.55	0.18
Genotype -15	3	49.56**	7.02**	1s.36**
Genotype -16	3	122.25**	7.23**	0.45
Genotype -17	3	7.27	0.06	0.17
Genotype -18	3	10.38	0.15	0.18
Genotype -19	3	29.80**	1.03	0.26
Genotype -20	3	128.98**	0.73	5.54 **
Genotype -21	3	9.51	2.87 **	0.78
Genotype -22	3	1.68	0.34	0.12
Genotype -23	3	7.66	0.49	0.11
Genotype -24	3	1.25	1.14	0.27
Genotype -25	3	3.66	1.51	0.13
Genotype -26	3	4.01	1.47	0.39
Genotype -27	3	9.57	2.15 *	0.63
Genotype -28	3	23.29*	0.38	0.72
Genotype -29	3	129.37**	1.92 *	5.99 **
Genotype -30	3	31.28**	1.54	1.70 **
Genotype -31	3	5.08	2.18 *	0.28
Genotype -32	3	19.12*	1.13	0.55
Genotype -33	3	5.97	1.77	0.19
Genotype -34	3	31.02**	5.00 **	2.16 **
Genotype -35	3	19.18*	7.13 **	2.64 **
Genotype -36	3	25.85*	0.19	0.96
Genotype -37	3	12.50	2.25 **	0.39
Genotype -38	3	4.26	3.25 **	0.53
Genotype -39	3	8.05	1.07	1.29 *
Genotype -40	3	3.56	1.61	0.05
Genotype -41	3	7.10	0.74	0.52
Genotype -42	3	1.63	1.08	0.19
Genotype -43	3	32.30**	12.62 **	2.82 **
Genotype -44	3	1.65	14.44**	2.26 **
Genotype -45	3	0.54	0.93	0.21
Genotype -46	3	4.68	4.07 **	0.69
Giza - 1	3	15.42	0.80	0.57
4- Pooled error	460	6.89	0.60	0.35

- and ** significant at 0.05 and 0.01 levels of probability, respectively.
- d.f = degrees of freedom

The partitioning of G. x Env. sum squares to each genotype and testing its significance according to Eberhart and Russell (1966) allows the calculation of GxEnv. interaction for each genotype across environments. Genotype no. 6,12,15, 29,34,36, and 43 were highly significance for all studies traits. Genotypes no 10 and 16 were highly significance for number of seeds plant and 100-seed weight, also genotypes no. 1,2,5,13,and 44 were highly significance for 100- seed weight and seed yield, whereas genotypes no.9, 19,20,30,32,and 36,11.21,27,31,37,38,and 46 and genotypes no. 4,20,30,and 39, were highly significant were detected and the absence of significant compared with the other genotypes ast all studied traits. Omar (2004) obtained the same trend for this result.

According to Eberhart and Russell model (1966), which provides a mean of partitioning the genotype, environment variation due to the response of the genotypes to varying environmental index (sum of squares due to regression on the environmental index. They added that a stable preferred genotypes would have approximately.

1)- bi=1.0 2)-S^2di=0.0 3) =a high mean yield.

Genotypes no. 30,2,5,29, 10 and 3 (Table 7) obtained the highest number of seeds per plant of genotypes. Also, the minimum deviations from regression mean squares (S^2di) pooled over five environments were obtained by genotypes No. 11,8,39, and No.1 (Table7). Whereas, the deviation from regression means squares (S^2di) were significant for genotypes No. 2,17,23, and 41.

The slop of regression lines did not deviated significantly from unity for genotypes no. 4,6,9,11,13,14,16,18,20,21,22,24,25,27, 28,32,33,34,35,36,37,38,40,44,and45. These results revealed that the previous genotypes were more stable than the other genotypes.

The unstable genotype no.1, 2,3,5,8,10,15,19,23,29,30,39, 41,42, and Giza 1 seemed to have number of seeds per plant above grand mean. These genotypes, however, could be over looked because they're high number of seeds per plant potential was limited to particular environments.

The highest mean values for 100-seed weight (g) of genotypes were obtained by genotypes no.44, 1,39, Giza 1, 2,45,21 and 13. (Table 7). Also, the minimum deviation from regression mean squares (S^2di) pooled over five environments were obtained by genotypes no.3.10, 27,33 and 40 (Table7). Also, the deviations from regression mean squares (S^2di) were significant for genotype no.1, 2,5,6,8,11,12,13,15,16,21,29,31,34,35,37,38,43,44 and 46.

The slop of regression lines did not deviate significantly from unity in genotype no.8, 36,24,1,5,6,7,9,17,18,19,22,23,26 and 25. These results revealed that the previous genotypes were more stable than the other genotypes.

The unstable genotype no.2, 4,14,20,39 and 40 seemed to have 100-seed weight (g) above grand mean. These genotypes, however, could be over looked, because their heavier 100-seed weight (g) was limited to particular environments.

Table (7): Mean values of seed yield and some components over environments, regression coefficient (bi) and deviation mean squares (S^2di) for 47 chick pea genotypes.

Genotypes	No. of seeds/plant			100- seed weight (g)			Seed yield /plant (g)		
	Mean	Bi	S^2di	Mean	Bi	S^2di	Mean	Bi	S^2di
Genotype -1	33.16	1.27	-1.17	25.92	0.94	21.93	9.25	1.67	2.26
Genotype -2	46.38	1.72	0.27	21.99	0.54	7.49	10.67	1.79	2.36
Genotype -3	44.68	1.43	-4.53	15.99	0.59	-1.13	7.19	1.15	-0.18
Genotype -4	28.92	0.90	31.90	18.98	0.70	-0.36	5.73	0.83	0.83
Genotype -5	46.38	1.34	-3.37	19.85	0.88	2.63	9.65	1.46	0.96
Genotype -6	30.72	0.88	43.64	14.51	0.94	5.13	4.87	0.72	2.68
Genotype -7	25.69	0.91	8.97	17.73	0.92	-034	5.03	0.81	0.23
Genotype -8	34.31	1.07	-1.14	14.82	0.99	2.43	5.49	0.90	0.72
Genotype -9	27.84	0.89	12.80	16.80	0.96	-0.32	5.02	0.78	0.35
Genotype -10	44.90	1.27	45.36	17.45	1.22	1.04	8.34	1.37	0.20
Genotype -11	34.41	0.73	1.05	14.70	0.48	2.85	5.15	0.57	-0.17
Genotype -12	31.20	1.02	18.74	17.22	0.43	2.96	5.63	0.83	1.03
Genotype -13	39.65	0.98	6.77	20.75	1.57	5.85	8.90	1.45	2.55
Genotype -14	32.18	0.89	-3.98	17.51	0.54	0.95	5.74	0.78	-0.17
Genotype -15	40.35	1.80	42.67	19.44	1.71	6.42	8.95	1.99	1.01
Genotype -16	40.03	0.65	115.37	13.61	0.65	6.64	5.44	0.59	9.26
Genotype -17	29.80	1.07	0.38	14.39	0.94	-0.54	4.67	0.87	-0.18
Genotype -18	27.45	0.63	3.50	16.29	0.89	-0.45	4.65	0.63	-0.17
Genotype -19	37.05	1.69	22.91	16.48	0.97	0.44	6.91	1.34	-9.49
Genotype -20	35.57	0.49	122.09	18.98	0.61	0.14	6.91	0.56	5.19
Genotype -21	27.09	0.52	2.62	20.79	1.62	2.28	5.94	0.87	0.43
Genotype -22	26.36	0.89	-5.21	15.72	0.94	-0.26	4.49	0.74	-0.24
Genotype -23	33.28	1.14	0.78	16.39	0.91	-0.11	5.85	0.98	-0.25
Genotype -24	29.37	0.65	-5.64	16.65	0.97	0.54	5.12	0.66	-8.32
Genotype -25	22.17	0.79	-3.22	16.31	0.94	0.91	3.91	0.65	-0.22
Genotype -26	31.26	1.06	-2.87	15.98	0.91	0.87	5.40	0.84	4.27
Genotype -27	23.67	0.86	2.68	17.07	1.39	1.55	4.53	0.84	0.28
Genotype -28	35.87	0.87	16.41	18.31	1.43	-0.22	7.06	1.14	0.37
Genotype -29	45.75	1.13	122.48	18.83	1.19	1.33	9.15	1.26	5.64
Genotype -30	46.51	1.14	24.39	16.88	0.84	0.95	8.23	1.06	1.35
Genotype -31	28.22	1.04	-1.80	17.50	1.35	1.59	5.46	1.05	-7.32
Genotype -32	21.14	0.75	12.23	17.64	0.80	0.54	3.94	0.63	0.19
Genotype -33	24.18	0.74	-0.92	15.05	0.78	1.18	3.89	0.56	-0.17
Genotype -34	22.52	0.76	24.13	15.92	1.11	4.40	4.13	0.67	1.08
Genotype -35	29.39	0.94	12.29	19.57	1.54	6.54	6.38	1.09	2.28
Genotype -36	29.78	0.89	18.96	19.05	0.97	-0.40	5.99	0.91	0.60
Genotype -37	23.88	0.98	5.61	17.26	0.76	1.66	4.39	0.78	3.99
Genotype -38	18.98	0.78	-2.63	19.77	1.40	2.65	4.21	0.83	0.17
Genotype -39	35.52	1.12	1.16	22.27	0.84	0.47	8.44	1.15	0.94
Genotype -40	25.90	0.92	-3.33	19.84	0.41	1.01	5.28	0.75	-0.31
Genotype -41	33.03	1.08	0.22	18.24	0.57	0.14	6.29	0.89	0.16
Genotype -42	35.69	1.11	-5.25	17.03	0.71	0.48	6.38	0.89	-0.16
Genotype -43	30.97	1.03	25.41	20.63	2.03	12.02	7.24	1.55	2.46
Genotype -44	29.63	0.92	-5.24	27.00	1.36	13.83	8.75	1.42	1.91
Genotype -45	30.63	0.95	-6.35	21.51	1.43	0.33	7.13	1.23	-0.14
Genotype -46	30.27	1.01	-2.21	17.46	1.12	4.11	5.71	0.94	0.34
Giza-1	39.27	1.25	8.53	22.21	1.19	0.21	9.28	1.53	0.21
General mean	32.36	0.99	14.80	18.17	0.99	2.62	6.31	0.99	0.79
L.S.D.	5.59	2.15		2.16	0.18		1.33	0.41	
S.E.	0.34	0.18	**	0.13	0.18	**	7.88	0.15	**

Genotype no.2, Giza 1, 5,1,29,15,13,and 44 gave the highest mean values for seed yield per plant (Table7). Also, the minimum deviations from regression mean squares (S^2di) pooled over five environments were showed at genotype no. 12,15,and 34 (Table7). Whereas, the deviation from regression mean squares (S^2di) were significant for genotypes no.1, 2, 6, 13, 16, 20, 24, 26, 29, 30, 31, 35, 37, 43, and 44.

The slop of regression lines did not deviate significantly from unity in genotypes no.8, 17,21,23,36,41,42 and 46. These results revealed that these genotypes were more stable than the other genotypes under the environment study. Eberhart and Russell (1966) reported that the stable genotype has a high mean yield, bi equal one and the deviation from regression near zero. Moreover, Eberhart and Russell (1969) and Brecse (1969) reported that the most important stability parameter appeared to be the minimum deviation mean squares.

According to these report genotypes no.8, 23,36 and 46 were more stable than the other genotypes. The unstable genotypes, i.e. no.1, 2,3,5,10,13,19,28,29,30,31,35,39,43,44,45, and Giza-1 seemed to have seed yield per plant above grand mean. These genotypes, however, could be over looked because their high seed yield per plant potential was limited to particular environments.

CONCLUSION

Drought is one of the most important factors limiting the productivity of rainfed chickpea. Action on breeding for drought resistance depends on the ability to screen germplasm and segregating material. This becomes practicable with the availability of simple criteria for selection and the development of simple and reproducible field screening.

From the previous results in this study we can classificate genotypes under study into three groups. The first included that genotypes were higher drought tolerant i.e., genotype no. 3, 4, 5, 11, 12, 14, 20, 33, 34, 42 and 43. The second group which include the moderate genotypes for drought tolerant i.e., genotypes no. 8, 6, 7, 14, 24, 26, 27, 30, 32, 40 and 45 and the third group which included the other genotypes that is the low drought tolerante.

The final recommended, some genotypes was more stable for a wide environmental range i.e., genotypes no. 1, 5, 8, 23, 36 and 46. We can use these genotypes as a new introduced genotypes to cultivate under new reclaimed lands. Also, some genotypes i.e., no. 1, 2, 10, 15, 29, 30, 39, Giza-1 and 44 may be used when the irrigation water is available. On the other hand, some genotypes i.e. 5 and 1 offers good opportunity for improving this crop and may be used as a parents at chickpea breeding program for drought resistance.

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التربية لتحسين بعض التراكيب الوراثية المستوردة من الحمص تحت ظروف الإجهاد البيئي

١-الانتخاب للمحصول والثبات الوراثى ومعامل الإجهاد البيئى

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تم زراعة ٤٦ تركيب وراثى من الحمص مستوردة من الايكاردا مع الصنف التجارى جيزة ١ وذلك تحت ظروف الإجهاد البيئى فى كل من محطة بحوث مريوط (موسم ٢٠٠٣/٢٠٠٢، ٢٠٠٤/٢٠٠٣) ومحطة بحوث المغارة (موسم ٢٠٠٤/٢٠٠٣) وذلك لانتخاب أحسن هذه التراكيب تحت ظروف خمس بيئات مختلفة وهى :

ا لزراعةالجافة مع إعطاء رية الزراعة بالإضافة الى كمية الأمطار (٢٣٩مم)فى الموسم الاول (بيئة ١)، ا لزراعة الجافة مع إعطاء رية الزراعة بالإضافة إلى كمية الأمطار (١٧٦مم)فى الموسم الثانى (بيئة ٢)، الزراعة الجافة مع إعطاء رية الزراعة بالإضافة الى كمية الأمطار (١٧٦مم)فى الموسم الثانى ثم اعطاء ريتين كل ٤٥ يوم (بيئة ٣)،استخدام الرى بالتنقيط كل ٩،٦ أيام فىالموسم الثانى بمحطة بحوث المغارة (بيئة ٤،٥ على الترتيب) وذلك لتحديد التراكيب الأكثر ثباتا لصفات المحصول وبعض مكوناته وكذلك تقدير معامل الإجهاد البيئى لانتخاب السلالات المتفوقة تحت ظروف الإجهادات البيئة المختلفة.

هذا وقد أظهرت النتائج ما يلى :

١-أظهرت جميع التراكيب الوراثية تحت الدراسة اختلافات معنوية للصفات المدروسة فى جميع البيئات التي تم الزراعة فيها.كما أدت إضافة ريتين بعد رية الزراعة فى منطقة مريوط الى زيادة محصول البذور للنبات فى السنة الثانية الى زيادة بمقدارا ٤٣٦,١٩ ؛١٣٤,١٨% مقارنة بمحصول البذور تحت تأثير الري عند الزراعة فقط والأمطار الموسمية خلال موسمي الزراعة على الترتيب.

٢-أعطت التراكيب الوراثية رقم ١، ٢،٥، ١٠، ١٥، ٢٩، ٣٠، ٣٩، جيزة ١، ٤٤ أعلى قيم لمحصول البذور بالنبات تحت تأثير البيئات الخمسة.بينما أعطت التراكيب رقم٢٠، ١٢، ١١، ١٤ أعلى قيم لمعامل الإجهاد البيئى بمنطقة مريوط والتراكيب رقم ١١، ٥، ٣، ٤، ٣٦، ٤٣، ٤٢، ٣٣، ٣٤ بمحطة بحوث المغارة حيث تزيد بها نسبة ملوحة مياه الرى مقارنة بمحطة بحوث مريوط.

٣-أظهرت التراكيب رقم ١، ٥، ٨، ٢٣، ٣٦، ٤٦ درجة عالية من الثبات الوراثى مقارنة بالصنف جيزة ١ وباقى الأصناف الأخرى.

هذا وتعتبر السلالات أرقام ١١،٥ أكثر التراكيب تحملا لظروف الإجهادات البيئية المختلفة بالصحراء المصرية وخاصة منطقة الساحل الشمالى ومنطقة وسط سيناء والتى يمكن استخدامها كسلالات جديدة تلائم الزراعة فى الأراضى الجديدة أو استخدامها كأباء فى برامج التربية لتحمل ظروف الإجهاد فى البيئات المختلفة.