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BREEDING FABA BEAN FOR ENVIRONMENTAL STRESS CONDITIONS 2-PERFORMANCE AND PHENOTYPIC STABILITY FOR YIELD AND ITS COMPONENTS

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ABSTRACT

Multi-evaluating (over environments and generations) and stability analysis of the mean performance of twenty one faba bean genotypes in F4 and F5 generations compared with the commercial cultivar Giza - 461 were conducted to gain information for developing superior genotypes in seed yield and its attributes. The results indicated that the differences between environments and genotypes significantly influenced the performance of faba bean traits. The response of yield and yield components varies from genotype to another across different environmental conditions this may offer row material for improving faba bean performance under investigated condition. The ranking of performance stability of faba bean genotypes differed between all environments. Therefore, breading and recommendation of faba bean genotypes specialized for newly reclaimed land is an important goal for improving yielding ability and stability under such conditions.

Moreover, faba bean genotypes affected differently to various levels of soil moisture, which offered opportunities of selecting appropriate genotypes for certain, soil moisture. Genotype no. 2 was more stable and adapted than all the studied genotypes for seed index at all environments.

Key word: performance, genotypes, stability, faba bean, genotypes-environment interaction, drought, rainfed, yields.

INTRODUCTION

Faba bean (*Vicia faba* L.) the most important pulse crop grown in Egypt is affected by different environments. The information of adaptability and performance stability of genotypes over environments is important for crop production. Most genotypes, when tested under different environmental conditions differ in their performance and consequently it becomes difficult to recognize a variety, which is relatively stable in its performance under different environmental conditions.

Various statistical techniques were developed to rank genotypes within environments by several investigators, i.e. Eberhart and Russell (1966), Perkins and Jinks (1968), Freeman and Perkins (1971), Tai (1971) and others.

Consequently, breeding faba bean genotypes for less favorable environments represent an important goal to faba bean breeders. Thus, studying performance and stability of different faba bean genotypes across various soil moisture levels and rain-fed conditions may provide reliable information for recommending genotypes and planning breeding programs for stress condition. The present studies throw some light on this aspect.

MATERIALS AND METHODS

Twenty one faba bean genotypes compared with the commercial cultivar Giza-461 were used in the present study. These genotypes have been selected throughout breeding faba bean program at the F4 and F5 generation during 2000/01 and 2001/02 seasons at Maryout Research Station, Desert Research Center (D.R.C.) Alex. Governorate. The last three genotypes (Table 2) were developed by the plant breeding program at Dept. of Agron., Fac. Agric. Moshtohor, Zagazig University Egypt (El-Hosary, 1989). The soil of the experiment was sand clay loam, non saline (Ec. 4.83 ds/m), calcareous (27.73%) and 0.81% organic mater. The amount of mean rainfall is presented in Table (1).

Table (1): Monthly means rainfall (mm2) at Maryout Research Station:

Month	2000/2001	2001/2002
October	59.94	21.37
November	6.35	3.81
December	5.32	72.39
January	28.7	82.55
February	8.38	22.35
March	0.76	3.81
April	00.00	4.61
Total	109.45	210.88

Selected plants from F3 generation were sown on 20th November 2000 in three experiments using a randomized complete block design with three replications. The first experiment (normal) was irrigated monthly in addition to the natural rainfall (Env.1) .In the second experiment, (dry + one irrigation) dry sowing method was used with one irrigation at sowing and after which left to grow under natural rainfall conditions (Env. 2). In the third experiment (dry), dry method of sowing was used without any irrigation and the plant grew under natural rainfall (Env. 3).

Selected plants from F4 generation of the three experiments were sown in the second season 2001/02 (Env. 4, 5 and 6). The fields were fertilized using calcium superphosphate at the rate of 20 Kg of P2O5 per feddan before sowing. Hoeing was applied when necessary.

In each experiment, plot consisted of ten ridges and each ridge was 2 meter long and 50 cm. wide. Hills were spaced at 20 cm. with one seed per hill on one side of the ridge. Each ridge was planted by seeds of individual plant from ten selected plants of each generation.

In each experiment data of number of pods per plant, 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).

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

RESULT AND DISCUSSION

This kind of study provides faba bean breeders with information on evaluation of different breeding stocks in a large number of environments. Many factors such as soil, temperature, humidity, air movement, presence or absence of other organisms (insect, pathogens, weeds, etc..) and other factors affect on environment. The average yield of genotypes in replicated trials appears to be the best method for measuring differences in yield .

The analysis of variance for single environment (water regime in two years) and the combined analysis over environments were made for yield/plant and its components. Bartlet's test (Gomez and Gomez, 1984) of homogeneity of variance showed that the variance estimates were homogeneous.

The analysis of variance for single environment (water regime) as well as the combined analysis for yield and its components are given in Table (2). The results of analysis of variance showed presence of 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 performing genotypes at the three water regime treatments.

Eberhart and Russell,s. model (1966) provides a mean of partitioning the genotype-environment interaction for each variety into two parts:

(1) The variation due to the response of the genotype to varying environmental index (sum of squares due to regression).
(2) The unexplainable deviations from the regression on the environmental index.

A stable preferred variety would have approximately
1- bi = 1.0 2- S2di = 0.0 and 3- A = high mean yield

Data in Table (2) showed that the linear response of environment was highly significant. Consequently, the regression coefficient bi of seed yield and its components on the environmental index and deviation from regression mean

squares (S2di) pooled over the six environments were calculated for each genotype are presented in Table (3).

Significant genotype × environments was detected in Table (2). This indicated the differences among genotypes for their regression on the environmental index. Proceeded further to estimate the (bi) values: when this interaction is significant, pooled deviation mean square was insignificant suggesting linear regressions also assume importance considering deviation mean square for individual genotype. Darwish *et al.* (1999), found that the significant genotypes x environment interaction for almost all traits indicates that the tested genotypes ranked differently across newly reclaimed environments and all environments for seed yield and its components.

Significant bi values were obtained for all genotype and the slope of regression lines deviate significantly from unity in the most genotypes for all traits. The deviation from regression mean squares (S2di) were significant for most genotype.

Data presented in Table (3), showed that the mean performance for seed yield and its attributes of twenty two faba bean genotypes under six different environments

1-Number of pods / plant:

Sowing faba bean genotypes by using the first system of water regime (Env.1 and 4) produced significantly higher number of pods per plant than the other environments. The number of pods averaged over all environments ranged from 23.91 (Genotype.2) to 35.25 (Genotype.19) with an overall average of 28.36. The best genotype no.19 showed a number of pods per plant of 54.9 pod followed by genotype no.3 (51.2) at the first system of water regime, these had higher yield by 32.3 and 27.9% than the average of all genotypes. Omar (2003) reported the superiority of the same genotype in this trait compared to other faba bean genotypes using the same system of water regime. Genotypes no. 12,7,10,15 and M.127 had the nearest (bi) from the unit slope. Generally, genotype M-127 may be considered a stable genotype for number of pods per plant.

2-Number of seed's per plant:

The average number of seeds per plant for all genotypes under the six different environments ranged from 82.59 (Genotype13) to 118.86 (Genotype-19) with overall average 96.46. The highest number of seeds per plant (219.5) was obtained for genotype no.19, at the Env. 1. This may be due to the available soil moisture to grown faba bean. 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 water irrigation treatments and rain conditions.

The stability parameter, i.e. S2di was significant for the majority of the studied genotypes indicating that all these genotypes were not stable. Consequently, it could be concluded that most of the studied genotypes varied in their number of seeds per plant from environment to another.

Table (2): Analysis of variance for yield and its components of 22 faba bean genotypes grown under 6 different environments.

S.O.V	d.f	No. of pods/plant	No. of seeds/plant	100-seed weight (g)	Seeds weight (g)/plant
1- Total	131	158.93**	2807.32**	123.59**	1863.44**
2- Genotypes (G)	21	53.38**	531.94**	75.95**	375.53**
3- Env. + G × Env.	110	179.08**	3241.71**	132.68**	2147.50**
a- Env. Linear	1	17534.13**	340678.47**	11208.11**	223195.55**
b- G × Env.-Linear	21	22.95	162.91	34.43	234.05**
c- Pooled deviation	88	19.12	141.92	30.27	92.21
Giza- 461	4	9.4*	106.16*	54.88**	6.46
Genotype- 2	4	15.21**	31.66	24.00**	43.12
Genotype -3	4	7.38	89.16*	38.91**	118.08**
Genotype -4	4	77.90**	224.92**	155.53**	17.37
Genotype -5	4	18.12**	77.53*	18.59**	144.22**
Genotype -6	4	36.75**	560.45**	31.79**	57.53*
Genotype -7	4	8.69*	115.07**	11.04*	147.99**
Genotype -9	4	2.35	8.86	38.39**	33.76
Genotype -10	4	17.52**	162.37**	27.21**	50.98
Genotype -12	4	37.26**	271.11**	23.11**	156.11**
Genotype -13	4	25.11**	268.77**	14.56*	142.76**
Genotype -15	4	14.65**	80.59*	43.67**	39.16
Genotype -16	4	60.54**	259.39**	27.43**	48.96
Genotype -18	4	9.59*	76.02*	13.04*	58.27*
Genotype -20	4	8.62*	50.63	25.92**	155.55**
Genotype -22	4	6.03	9.21	5.40	41.89
Genotype-24	4	9.63*	233.54**	63.71**	369.06**
Genotype-25	4	8.68*	71.79	4.38	33.90
Genotype-27	4	17.49**	73.39	19.74**	55.73*
Moshtohor-102	4	8.12*	39.94	5.85	11.46
Moshtohor-103	4	16.28**	137.44**	11.72*	80.12*
Moshtohor-127	4	5.29	174.24**	7.17	148.73**
4- Pooled error	252	3.23	30.84	4.37	20.93

* and ** Significantly at 0.05 and 0.01 levels of probability, respectively.

3- 100- seed weight:

Genotype no.21 gave the highest values under all the environments no. 1,2 and 4 and overall environments (mean) these out yielded than over all mean by 16.7,13.3,13.1 and 9.6% respectively. The average of 100-seed weight ranged from 65.41 for genotype no. 11 to 78.99 for genotype no.21 with an overall average of 72.07g.. Genotype no.2 was more stable and adapted than all the studied genotypes in the six environments.

4- Seeds weight per plant:

Adequate conditions at the environment 1 and 4 gave 122.3 and 124.7 g./plant compared with 76.1 and 71.9 at the environments 2 and 5 and 29.4, and 17 at the environments 3 and 6. These results may be due to the variation between quantity of rainfed and soil moisture (Table 1). The seed yield per /plant ranged from 60.46g. for genotype no. 16 to 85.55g. for genotype no.21 with an overall average 73.61 g/plant over all six environments. The yield was greatly affected by the yield attributes. The finding agreed with the results obtained by Omar (2003).

Table (3): The genotypes mean performance in each environment as well as the combined data of twenty two faba bean genotypes for yield and its components.

Genotype	100 – seed weight (g)								
	Env. 1	Env. 2	Env. 3	Env. 4	Env. 5	Env. 6	Mean	b_i	S^2d_i
Giza- 461	67.0 fgh	64.9 def	60.9 abc	89.1 abc	88.0 b-e	65.0 a-g	72.49	1.06	50.51
Genotype-1	67.4 e-h	62.6 ef	59.2 a-f	83.6 b-e	71.6 hij	67.1 a-e	68.60	0.72	19.63
Genotype-2	78.4 bcd	71.5 bcd	64.2 a	81.9 cde	97.3 a	68.8 abc	77.03	1.03	34.54
Genotype-3	84.0 ab	72.9 abc	61.9 ab	95.6 a	63.8 k	60.9 efg	73.20	0.85	151.16
Genotype-4	66.0 ghi	62.9 ef	54.8 d-h	76.2 ef	83.7 efg	64.8 b-g	68.07	0.94	14.22
Genotype-5	75.9 cd	71.4 bcd	60.1 a-d	68.4 f	80.4 g	65.5 a-f	70.27	0.52	27.42
Genotype-6	74.0 def	68.9 cde	60.1 a-d	84.6 b-e	74.4 h	66.4 a-f	71.42	0.77	6.67
Genotype-7	64.3 hi	61.2 fg	61.8 ab	77.6 def	83.9 efg	68.8 abc	69.62	0.74	34.02
Genotype-8	77.1 bcd	72.6 abc	60.6 abc	83.8 b-e	96.4 a	69.7 ab	76.69	1.13	22.84
Genotype-10	78.1 bcd	73.8 abc	52.7 gh	80.2 cde	83.6 efg	61.3 d-g	71.62	1.12	18.74
Genotype-11	68.1 e-h	63.0 ef	53.4 fgh	69.2 f	73.4 hi	65.3 a-f	65.41	0.61	10.19
Genotype-12	81.4 abc	76.9 ab	58.4 a-g	87.9 a-d	74.0 h	71.4 a	75.02	0.79	39.30
Genotype-13	74.6 cde	71.1 bcd	58.9 a-f	82.1 cde	68.9 ij	68.2 abc	70.66	0.60	23.06
Genotype-15	74.0 def	71.5 bcd	59.6 a-e	83.9 b-e	91.5 b	65.7 a-f	74.37	1.11	8.67
Genotype-16	71.5 d-h	67.9 cde	54.5 d-h	83.1 b-e	68.8 j	62.3 c-g	68.02	0.83	21.55
Genotype-18	74.8 cde	69.7 cd	58.0 b-g	93.4 ab	88.9 bcd	67.4 a-d	75.36	1.31	1.03
Genotype-19	57.8 I	55.6 g	50.9 h	86.9 a-d	88.5 bcd	58.4 g	66.34	1.50	59.34
Genotype-20	72.7 d-g	68.2 cde	53.8 e-h	82.6 cde	85.2 def	60.0 fg	70.43	1.21	0.01
Genotype-21	86.1 a	78.3 a	59.4 a-f	94.9 a	91.7 b	63.1 c-g	78.99	1.42	15.37
M -102	73.9 def	68.5 cde	55.1 c-h	88.3 abc	91.4 bc	64.8 b-g	73.66	1.37	1.48
M-103	77.6 bcd	73.8 abc	57.8 b-g	90.5 abc	82.3 fg	62.7 d-g	74.14	1.17	7.35
M-127	78.1 bcd	72.7 abc	57.9 b-g	83.4 b-e	87.1 cde	64.9 a-g	74.03	1.07	2.80
General mean	73.8	69.1	57.9	83.9	82.48	65.4	72.07	0.99	25.90
S.E.							± 1.29	± 0.24	± 3.17
L.S.D., 0.05									6.34
Genotype	Seeds weight / plant (g)								
	Env. 1	Env. 2	Env. 3	Env. 4	Env. 5	Env. 6	Mean	B_i	S^2d_i
Giza- 461	102.0 f	65.5 e-h	18.3 a-f	104.5 f-i	62.6 hij	27.8 b-e	63.46	0.79	-14.74
Genotype-1	110.7 def	61.3 fgh	19.4 a-e	112.9 f-i	56.2 j	28.1 b-e	64.74	0.87	22.19
Genotype-2	105.6 ef	74.1 b-f	16.1 d-i	99.2 hi	91.4 c	22.1 e	68.09	0.83	97.15
Genotype-3	136.9 a-d	81.0 bc	14.0 ghi	144.4 abc	77.4 ef	26.5 cde	80.04	1.19	-3.56
Genotype-4	116.1 c-f	78.2 b-e	21.4 ab	115.4 e-h	101.7 b	38.0 a	78.47	0.87	123.29
Genotype-5	149.6 a	78.2 b-e	17.5 b-g	134.2 bcd	78.4 e	26.1 cde	80.67	1.19	36.60
Genotype-6	127.9 a-f	61.7 fgh	14.9 f-i	137.4 bcd	54.1 j	22.1 e	69.67	1.13	127.06
Genotype-7	108.9 def	64.6 e-h	18.2 b-g	120.8 d-g	80.5 de	26.3 cde	69.86	0.93	12.83
Genotype-8	132.8 a-e	83.7 ab	22.1 a	138.3 bcd	71.1 e-i	32.8 abc	80.13	1.07	30.05
Genotype-10	118.9 c-f	56.9 h	12.7 hi	113.7 e-i	94.1 bc	24.8 cde	70.22	0.98	135.18
Genotype-11	105.9 ef	57.9 gh	15.9 di	101.6 hi	90.1 cd	27.8 b-e	66.51	0.83	121.83
Genotype-12	126.7 a-f	63.0 fgh	15.9 di	134.9 bcd	71.3 e-i	27.5 b-e	73.22	1.09	18.23
Genotype-13	102.7 f	58.7 gh	12.3 i	97.4 i	75.4 efg	20.9 e	61.25	0.83	28.03
Genotype-15	131.4 a-e	72.1 b-g	17.1 c-g	127.9 c-f	66.6 ghi	37.3 a	75.37	1.02	37.34
Genotype-16	99.9 f	69.4 c-h	16.8 d-g	99.9 hi	41.6 k	35.1 ab	60.46	0.73	134.62
Genotype-18	138.5 abc	80.7 bcd	14.7 f-i	155.6 a	93.8 bc	23.3 de	84.42	1.28	20.96
Genotype-19	127.2 a-f	62.1 fgh	16.9 c-g	147.9 ab	117.2 a	35.5 ab	84.49	1.13	348.76
Genotype-20	117.3 c-f	66.9 d-h	16.8 d-h	113.2 f-i	61.7 ij	32.9 abc	68.11	0.90	12.97
Genotype-21	142.5 abc	95.3 a	19.8 a-d	142.7 abc	80.9 de	32.1 abc	85.55	1.16	34.80
M-102	119.8 c-f	69.4 c-h	17.2 d-g	129.3 cde	78.2 e	32.9 abc	74.47	0.99	-9.44
M-103	121.9 b-f	80.2 bcd	15.3 e-i	140.1 bc	67.3 fi	31.8 a-d	76.08	1.07	59.19
M-127	148.4 ab	95.5 a	21.0 abc	131.2 b-e	72.8 e-h	35.7 ab	84.09	1.10	127.80
General mean	122.3	71.9	17.0	124.7	76.1	29.4	73.61	0.99	70.74
S.E.							± 2.26	± 0.95	± 4.53
L.S.D ., 0.05									9.06

L- values followed by same letter (s) are not different at $p \leq 0.05$ of Duncan's multiple range test
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Table (3): The genotypes mean performance in each environment as well as the combined data of twenty two faba bean genotypes for yield and its components.

Genotype	No. of pods / plant								
	Env. 1	Env. 2	Env. 3	Env. 4	Env. 5	Env. 6	Mean	b_i	S^2d_i
Giza- 461	38.1 d-g	28.7 def	12.0 b-f	35.6 cde	23.8 e	13.6 e-h	25.30	0.84	6.17
Genotype-1	41.3 b-g	28.1 d-g	13.0 a-e	41.0 bc	24.7 e	14.8 b-h	27.16	0.93	11.98
Genotype-2	33.7 g	29.7 c-f	9.8 fgh	31.4 de	25.7 e	13.1 e-h	23.91	0.77	4.15
Genotype-3	40.8 c-g	31.4 b-e	8.6 gh	39.3 bcd	51.2 a	10.0 i	30.22	1.23	74.67
Genotype-4	43.9 bcd	35.4 ab	15.6 a	40.3 bcd	44.0 b	17.2 a-d	32.74	0.99	14.89
Genotype-5	49.2 ab	31.1 b-e	11.4 c-g	50.0 a	25.7 e	14.4 c-h	30.29	1.24	33.52
Genotype-6	43.2 bcd	24.5 fgh	8.5 gh	41.3 bc	27.9 e	11.9 hi	26.22	1.12	5.46
Genotype-7	42.2 b-f	30.1 cde	11.7 b-f	40.2 bcd	36.4 d	15.6 a-f	29.38	1.02	-0.88
Genotype-8	42.9 b-e	32.7 bcd	14.5 ab	41.4 bc	25.7 e	17.4 abc	29.10	0.90	14.29
Genotype-10	38.1 d-g	22.0 h	9.5 fgh	37.7 cde	41.6 bcd	12.2 ghi	26.84	1.03	34.03
Genotype-11	38.9 d-g	26.2 e-h	11.8 b-f	37.6 cde	41.6 bcd	15.1 b-g	28.52	0.95	21.88
Genotype-12	38.7 d-g	24.4 fgh	10.9 d-h	41.1 bc	37.4 cd	13.8 e-h	27.72	1.01	11.42
Genotype-13	34.2 fg	23.1 gh	8.2 h	29.9 e	42.7 bc	10.5 i	24.78	0.92	57.31
Genotype-15	44.2 bcd	30.9 b-e	11.4 c-g	43.8 abc	28.4 e	14.9 b-h	28.93	1.08	6.36
Genotype-16	34.9 efg	29.1 def	12.4 b-f	30.2 e	23.9 e	15.6 a-f	24.36	0.66	5.39
Genotype-18	46.2 bcd	33.1 bcd	10.1 e-h	44.9 ab	41.1 bcd	12.8 f-i	31.36	1.26	2.80
Genotype-19	54.9 a	31.7 bcd	13.3 a-d	50.9 a	42.9 bc	17.7 ab	35.25	1.35	6.40
Genotype-20	40.2 c-g	28.1 d-g	12.5 b-f	35.8 cde	25.2 e	15.9 a-e	26.29	0.83	5.45
Genotype-21	41.5 b-g	34.9 abc	13.1 a-e	40.3 bcd	26.3 e	15.7 a-f	28.63	0.93	14.25
M-102	40.4 c-g	28.9 def	12.5 b-f	37.3 b-e	25.7 e	15.9 a-e	26.80	0.86	4.89
M-103	39.3 c-g	30.9 b-e	10.3 d-h	40.9 bc	24.3 e	14.2 d-h	26.67	0.96	13.05
M-127	47.3 bc	38.6 a	14.3 abc	45.9 ab	36.1 d	18.4 a	33.42	1.09	2.06
General mean	41.5	29.7	11.6	39.8	32.8	14.6	28.36	0.99	15.97
S.E.							± 1.03	± 0.15	± 2.51
L.S.D., 0.05									5.02
Genotype	No. of seeds / plant								
	Env. 1	Env. 2	Env. 3	Env. 4	Env. 5	Env. 6	Mean	b_i	S^2d_i
Giza- 461	152.4 def	100.5 c-g	30.0 b-g	117.6 f	69.8 i	35.3 e-i	84.27	0.85	73.32
Genotype-1	163.1 c-f	98.2 c-g	32.5 b-e	142.3 cde	78.2 ghi	38.5 b-h	92.12	0.95	1.18
Genotype-2	134.8 f	103.9 cde	25.1 fgh	125.1 ef	93.4 def	34.2 f-i	85.08	0.82	58.32
Genotype-3	163.2 c-f	110.8 bc	23.0 gh	151.1 bcd	121.1 ab	26.0 j	99.21	1.07	194.08
Genotype-4	175.9 bcd	123.9 ab	39.4 a	159.5 bc	121.5 ab	44.8 a-d	110.84	1.01	46.69
Genotype-5	196.9 ab	109.7 bcd	29.2 c-g	179.0 a	96.9 de	37.4 c-h	108.18	1.25	529.61
Genotype-6	172.7 b-e	89.2 e-h	24.7 fgh	154.0 bcd	72.8 hi	31.0 hij	90.74	1.09	84.23
Genotype-7	168.8 b-f	105.4 cde	29.3 c-g	151.5 bcd	95.9 def	40.6 a-f	98.59	1.02	-21.98
Genotype-8	171.5 b-e	115.4 abc	36.5 ab	157.1 bcd	73.8 hi	45.2 abc	99.91	1.01	131.53
Genotype-10	152.3 def	77.0 h	24.1 fgh	141.6 cde	112.4 bc	31.7 g-j	89.86	0.95	240.27
Genotype-11	155.6 def	91.6 d-h	29.8 b-g	149.2 cd	123.1 ab	39.3 b-g	98.09	0.94	237.93
Genotype-12	154.9 def	85.5 fgh	27.4 d-h	149.5 cd	96.3 de	35.9 e-h	91.58	0.96	49.75
Genotype-13	136.8 f	82.6 gh	20.9 h	118.5 f	109.4 c	27.4 ij	82.59	0.83	228.39
Genotype-15	176.7 bcd	107.9 bcd	28.7 d-g	159.5 bc	79.3 ghi	38.8 b-h	98.48	1.09	45.18
Genotype-16	139.9 ef	101.9 c-f	30.9 b-f	116.6 f	78.8 ghi	40.7 a-f	84.79	0.76	19.79
Genotype-18	184.7 bcd	115.8 abc	25.3 e-h	162.0 abc	105.6 cd	33.2 fj	104.43	0.83	-21.63
Genotype-19	219.5 a	111.1 bc	33.4 a-d	170.6 ab	132.3 a	46.3 ab	118.86	1.26	202.70
Genotype-20	160.9 c-f	98.3 c-g	31.3 b-f	144.6 cde	72.4 hi	41.5 a-d	91.49	0.95	40.95
Genotype-21	166.1 b-f	122.2 ab	33.2 a-d	150.2 bcd	88.2 efg	40.8 a-f	100.13	0.99	42.55
M-102	161.7 c-f	101.4 c-f	31.2 b-f	136.2 de	78.9 ghi	41.5 a-d	91.81	0.92	9.10
M-103	157.3 c-f	108.4 bcd	26.4 d-h	155.1 bcd	71.3 hi	37.0 d-h	92.59	1.01	106.60
M-127	189.3 abc	131.2 a	36.2 abc	162.6 bc	83.6 fgh	47.8 a	108.44	1.10	143.40
General mean	166.1	104.2	29.5	147.9	93.4	37.9	96.46	0.98	115.05
S.E.							± 2.81	± 0.09	± 6.87
L.S.D., 0.05									13.74

L- values followed by same letter (s) are not different at $p \leq 0.05$ of Duncan's multiple range test

M- Moshtohor.

Finally, it is obvious that drought has harmful effects on Faba bean and the alleviation of such effects is important. The investigated faba bean materials exhibited wide variation for reaction to drought-stress. Such variation is obvious from the yield performance, in addition to tolerance criteria and stability parameters across different drought conditions. This variability could be of benefit for improving Faba bean reaction to drought stress conditions. Darwish *et al.* (1999), showed that the environmental effects under newly reclaimed conditions affected the performance, yield and its components of Faba bean genotypes.

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تربية الفول البلدي لظروف الإجهادات البيئية المعاكسة
٢- الأداء والثبات الظاهري للمحصول ومكوناته

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يعتبر محصول الفول البلدي من أهم المحاصيل البقولية التي تستخدم كغذاء للإنسان، ويتأثر تأثرا شديدا باختلاف العوامل البيئية من عام إلى آخر لذا كان من الأهمية دراسة تأثير الاختلافات البيئية على الأداء والثبات المظهري للمحصول ومكوناته لعدد (٢١) من التراكيب الوراثية المتباينة مقارنة مع الصنف جيزة ٤٦١ لتحديد وانتخاب افضل هذه التراكيب الوراثية ملائمة لظروف الإجهادات البيئة المعاكسة وقد استهدفت هذه الدراسة دراسة الأداء والثبات المظهري للمحصول ومكوناته في الجيل الرابع والخامس خلال موسمي ٢٠٠٠/٢٠٠١، ٢٠٠١/٢٠٠٢ بمحطة بحوث مريوط التابعة لمركز بحوث الصحراء تحت الظروف الآتية:

- الزراعة تحت ظروف الري الدائم كل ٣٠ يوم بالإضافة إلى كمية الأمطار خلال موسم النمو.
- الزراعة تحت ظروف الأمطار بعد إعطاء رية الزراعة فقط.
- الزراعة تحت تأثير ظروف الأمطار فقط.

وكانت كمية الأمطار خلال موسمي النمو ١١٠ ، ٢١١ ملم على الترتيب. هذا وقد أقيمت التجارب باستخدام تصميم القطاعات كاملة العشوائية في ثلاث مكررات وقد سجلت النتائج على عينة من عشرة نباتات فردية اختيرت عشوائيا من كل تركيب وراثي وتم تقييمها لصفات عدد القرون بالنبات - عدد البذور بالنبات - وزن الـ ١٠٠ بذرة - وزن محصول البذور للنبات. وقد أظهرت النتائج ما يلي:

- وجود اختلافات معنوية بين التراكيب الوراثية المختلفة تحت ظروف النموفي البيئات المختلفة.
- كان هناك تباين في الثبات المظهري للتراكيب الوراثية في صفات محصول البذرة ومكوناته.
- اظهر التركيب الوراثي رقم ٢ ثباتا عاليا لصفة دليل البذرة تحت جميع الظروف البيئية مقارنة بالتراكيب الأخرى وبالتالي فانه يمكن استخدام هذا التركيب كأب في برامج التربية لمقاومة ظروف الإجهاد البيئي المعاكسة أواستخدامه كسلالة جديدة تلائم الزراعة تحت الظروف البيئية المعاكسة بمنطقة الساحل الشمالي الغربي.