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STABILITY OF SIXTEEN FABA BEAN GENOTYPES ACROSS DIFFERENT ENVIRONMENTAL CONDITIONS

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ABSTRACT

This investigation was conducted to explore the stability of performance of 16 faba bean genotypes. These genotypes included seven cultivars, (Sakha 2, Giza 40, Giza 429, Giza 3, Nubaria 1, Giza 843 and Giza716) and nine promising mutant lines coded (248, 258, 244, 252, 278, 332, 336, 285 and 163) across sixteen diverse environments. The environmental conditions were the combinations of two levels soil salinity (normal and saline) affected and four Rhizobium inoculations (control, F.b. ARC 200, F.b. ARC 201 and F.b. ICARDA 448) during 2003/2004 and 2004/2005 seasons. The field trials were carried out at Demo Research Station, Faculty of Agriculture, Fayoum University. Two parameters of stability, i.e. regression coefficient bi and deviation from regression S^2d were used for measuring stability for plant dry weight (g), number of branches/plant, number of pods/plant, number of seeds/plant, seed yield/plant (g) and 100-seed weight (g).

The stability analysis of variance revealed highly significant differences for environments, genotypes and GxE interaction for all studied traits. This proved evidence that the studied faba bean genotypes differed in response to the investigated environments. Highly significant linear effect of environments and genotypes x environments interaction and pooled deviation were recorded for number of branches/plant, number of pods/plant, number of seeds/plant. The partition deviation from regression due to each genotype were highly significant or significant for most traits across studied environments. The stability parameters revealed that the mutant lines 285, 278, 332 and 248, respectively, are the most stable genotypes for seed yield/plant and for studied components under tested environmental conditions. Therefore, these lines may be recommended to for grown under wide range of environments.

Key words: *Stability, Faba bean, Vicia faba, Genotypes, Environmental conditions.*

INTRODUCTION

Faba bean (*Vicia faba* L.) is the most important pulse crop grown in Egypt. The acreage of this crop is 175,353 feddan according to the Agricultural Statistics of 2006. The crop is used for human consumption, animal feeding, and green manuring, industry. .....etc. The importance of faba bean in Egypt lies not only in its multiple uses in preparing diverse local dishes but also to its important role in the crop rotation. The obscure impact of genotype-environment interaction (GxE) on the relative performance and stable genotypes across environments is so important that it forms challenging difficulty to the breeder in developing superior cultivars (Eberhart and Russell 1966). Furthermore, Freeman and Perkins (1971) stated that the basic cause of the differences between genotypes in

their yield stability is the wide occurrence of genotype x environment interaction.

On the other hand, stability may in fact, depends on holding certain morphological and physiological attributes steady as long as possible and allowing others to vary. Several investigations had attempted to estimate GXE numerically for several genotypes of different crops such as maize (AbdEl-Aziz 2000), sorghum (Mostafa 2001), wheat (El-Marakby *et al* 2002 and Tawfelis 2006), ryegrass (Ahmed *et al* 2004), Rice (Abdel-Hafez *et al* 2007), cotton (El-Kadi *et al* 2007). Eberhart and Russell (1966), developed two estimates for stability, the first is the regression coefficient bi of a line on environmental indices that estimate its response to favorable conditions while the remainder sums of squares after the regression S^2d illustrates the latter un-described interaction effects. They defined a stable cultivar as one which had a regression coefficient bi equal to 1.0 and with S^2d equal to, or does not deviate significantly from 0.0. Apparently, a cultivar that did not meet both qualifications would be closed as unstable. However, an ideal cultivar would have both a high average performance over a wide range of environments plus stability.

The major objectives of this work are to estimate degrees of stability of 16 faba bean genotypes grown under 16 diverse environments for seed yield/plant and some agronomic traits utilizing the two stability parameters.

MATERIALS AND METHODS

Four field experiments were carried out in 2003/2004 and 2004/2005 seasons at Demo Research Station, Faculty of Agriculture, Fayoum University. In each season two field trials were conducted in both normal and saline soil conditions. The soil was sandy loamy in texture with E.C. of 2.47 ds/m (1581ppm) and 2.90 ds/m (1856 ppm) at normal conditions in first and second seasons, respectively, and 4.84 ds/m (3098 ppm) and 4.20 ds/m (2688 ppm) at salinity conditions in first and second seasons, respectively. Preceding crop was peanut in the 1st season and maize in the 2 nd season. Each trial was devoted as RCBD with 3 replications in split - plot arrangement. Four *Rhizobium* inoculation treatments were assigned in the main-plots and 16 faba bean genotypes were arranged in the sub-plots. The Four treatments *Rhizobium leguminosarum* were the control (R1) and three strains, i.e., F.b.ARC 200 (R2), F.b.ARC 201 (R3) and F.b. ICARDA 448-ARC (R4). Seeds were treated with *Rhizobium* strains in the field directly before sowing as recommended. The sixteen faba bean genotypes used in the study included, seven local cultivars, Sakha 2, Giza 40, Giza 429 , Giza 3, Nubaria 1, Giza 843 and Giza 716 and nine promising mutant selected lines. These lines coded: L. 248, L.258, L. 244, L. 252, L. 278, L. 332, L. 336, L. 285 and L.163. The mutant lines, their parents and gamma ray doses used are displayed in Table (1).

Table 1. Mutant lines used in the study, their parents and gamma-ray doses.

Line code number	Parents	γ-ray doses
248	**Giza 461**	**3 Kr**
258	Nubaria 1	**3 Kr**
244	**Giza 643**	**12 Kr**
252	**Giza 461**	**6 Kr**
278	Nubaria 1	**3 Kr**
332	**Giza 717**	**6 Kr**
336	**Giza 714**	**3 Kr**
285	**Giza 643**	**9 Kr**
163	**Giza 2**	**3 Kr**

The experimental plot consisted of four ridges, 3 m long and 60 cm apart. Plants were spaced 20 cm within ridge and one plant was left per hill in both of the ridge. Sowing date was on 19 and 8 November in the two respective seasons. The recommended cultural practices for faba bean production were followed. At harvest, 10 guarded plants per plot were randomly taken to determine plant dry weight included roots (g), number of branches/plant, number of pods/plant, number of seeds/plant, seed yield/plant(g) and 100-seed weight (g) .

Statistical procedures; Phenotypic stability parameters were computed according to Eberhart and Russell (1966) and used to describe the performance of each genotype over the sixteen environments. These environments were the combination of two seasons, normal and saline soil conditions and four *Rhizobium* treatments.

RESULTS AND DISCUSSION

Significance of mean squares

Mean squares due to different sources of variation of combined analysis over sixteen environments are presented in Table (2). The mean squares of environments were highly significant for all traits, suggesting that the environments affected differently the faba bean studied traits. The genotypes were found to be highly significant source of variation for all studied traits, reflecting the presence of genetic diversity regarding recorded characters. Highly significant GXE interaction was detected for all characters which, provide evidence that the studied faba bean genotypes differed in their response to the various environmental conditions. In this

Table 2. Stability analysis of variance for seed yield/plant and other agronomic characters of sixteen faba bean genotypes under different environmental conditions.

S.O.V	df	Plant dry weight (g)		Branches /plant		Pods/ /plant		Seeds /plant		Seed yield/ /plant(g)		100-seed weight (g)	
Environments(E)	15	4671.82	**	18.62	**	240.51	**	1770.14	**	1956.63	**	11117.40	**
Genotypes (G)	15	948.81	**	21.83	**	208.95	**	1002.66	**	306.97	**	3281.37	**
GXE	225	231.50	**	1.76	**	17.60	**	112.37	**	65.52	**	142.20	**
Env. + (G.x Env.)	240	509.02	**	2.81	**	31.53	**	215.99	**	138.58	**	288.05	**
Env. (linear)	1	70077.30	**	279.25	**	3607.58	**	26552.14	**	17389.48	**	167661.56	**
GxEnv. (linear)	15	281.84	ns	3.83	**	56.01	**	288.96	**	94.78	ns	189.64	ns
Poold deviation	224	213.66	**	1.51	**	13.93	**	93.53	**	59.46	**	130.58	**
Sakha 2	14	128.96	*	1.79	**	3.98	ns	29.21	ns	27.80	ns	280.84	**
Giza 40	14	110.47	ns	1.25	**	14.39	**	70.10	**	26.32	ns	85.09	*
Giza 429	14	60.30	ns	1.08	**	4.24	ns	22.49	ns	11.39	ns	94.43	**
Giza 3	14	351.62	**	1.22	**	8.51	*	80.82	**	65.78	**	116.12	**
Nubaria1	14	174.90	**	1.49	**	7.27	ns	58.52	*	66.88	**	267.89	**
Giza 843	14	128.87	*	0.96	**	11.91	**	93.12	**	53.82	**	113.53	**
Giza 716	14	77.71	ns	2.28	**	3.37	ns	21.82	ns	18.14	ns	139.21	**
line248	14	552.58	**	2.06	**	33.62	**	206.42	**	138.51	**	175.20	**
line258	14	194.32	**	1.49	**	9.47	**	84.82	**	58.04	**	140.37	**
line244	14	247.81	**	1.06	**	16.91	**	116.01	**	83.50	**	129.68	**
line252	14	125.11	*	3.67	**	9.80	**	51.44	*	34.22	*	98.23	**
line278	14	191.28	**	1.44	**	23.32	**	93.90	**	52.80	**	78.95	*
line332	14	214.08	**	1.10	**	23.04	**	162.81	**	65.79	**	48.72	ns
line336	14	351.23	**	1.90	**	16.91	**	168.42	**	114.23	**	70.99	ns
line285	14	221.53	**	0.63	ns	15.15	**	106.57	**	73.67	**	148.38	**
line163	14	287.77	**	0.68	*	20.98	**	130.75	**	79.04	**	148.07	**
Poold error	480	69.01		0.39		4.55		29.49		18.79		48.22	

* and ** denote significant at 5% and 1% level of probability, respectively

respect significant differences among environments, genotypes and GXE interaction items were recorded for seed yield and its attributes by other authors (Ibrahim and Rukenbauer 1987, Abdalla *et al* 1998, Darwish *et al* 1999, Omar *et al* 1999 and Awaad 2002). The linear effect of environments and genotypes x environment interaction exhibited highly significant variation the linear interaction for plant dry weight, seed yield/plant and 100-seed weight. The pooled deviation from regression was highly significance for seed yield/plant and other agronomic studied traits. This indicated that the faba bean genotypes differed considerably with respect to their stability across the investigated environments. The mean square due to variation from regression of all genotypes for studied traits showed wide variability. In other words, these variation varied widely in significance and magnitudes. Eight, four, one and three genotypes recorded significant MS

deviation for line 248 and varieties, Giza 716 and Nubaria1 and three characters out of six ones, respectively. These results proved that the investigated faba bean genotypes responded differently to the tested environments. This suggesting the inconsistency performance of these genotypes over the sixteen environments. The absence of significance for one to five traits over the sixteen environments, indicated the consistency of their performance regarding these traits. In this respect, significant differences among environments, genotypes and GxE interaction items were recorded for seed yield and its attributes by many researchers (Abdalla *et al* 1998, Due 1998, Darwish *et al* 1999, Omar *et al* 1999 and Awaad 2002).

Stability parameters

The mean performance as well as regression coefficients bi and deviation from regression S^2d as two parameters of stability of faba bean genotypes across the 16 environments are presented in Table 3. According to Eberhart and Russell (1966) method the mean performance with the regression coefficient values bi and deviation from regression S^2d provide useful parameters to identify the adapted genotypes. Guilan *et al* (1990) reported that the deviation from regression seemed to be very important for estimating the stability. When average stability associated with average yield over all environments, genotypes may be described as having general adaptability and vice versa. Moreover, bi values significantly more than unit 1.0 identify genotypes benefit response to more inputs, while genotypes having bi values significantly less than 1.0 don't response to more inputs of favorable environmental factors. Also, the test of significance of each S^2d for values differed from zero indicates that the genotypes in question have specific adaptability. Therefore, in this research a genotype will be selected if it has; higher mean performance than the grand mean, bi > 1.0 and smaller S^2d value. Mean performance and stability of different genotypes for the characters studied will be reported as follows:

Plant dry weight

The results of mean values for plant dry weight (biomass weight) ranged from 18.82g for the variety Giza 716 to 36.63g for the mutant line 285 with an average of 26.98g. Concerning stability parameters, bi values did not differ significantly from unity for all genotypes exhibiting general adaptability across different environments, except bi values for the check variety Giza 40 and mutant lines 332 and 285, were significantly and greater than unity for the line 285, indicating the higher responsive of this line under good environments. However, the variety Giza 40 and mutant line 332 had bi values less than unity, indicating the higher responsive for poor environments. Concerning S^2d, their values differed significantly from zero for genotypes with various magnitudes except Giza 40, Giza 429 and Giza

Tbale3. Means and stability parameters for seed yield/plant and other agronomic characters of sixteen faba bean genotypes under different environmental conditions.

Genotypes	Plant dry weight/plant			Pods/plant			Pods/plant		
	Mean	bi	σ^2 di	Mean	bi	σ^2 di	Mean	bi	σ^2 di
Sakha 2	28.58	0.888	492.695 **	65.06	1.1286	0.0266 ***	442.85	0.9588	0.9999
Giza 40	24.58	0.928 ***	386.689	46.06	0.8688	0.0088 ***	384.41	1.1283	44.466 ***
Giza 429	25.88	1.220	189.7777	56.06	1.1585	0.0033 ***	779.86	1.1588	1.1.098
Giza 3	26.13	0.889	1816.897 ***	46.722	0.9480	0.0097 ***	557.66	0.0721 ***	22.580 **
Nubaria1	24.33	1.094	597.997 ***	66.98	1.1799	0.0166 ***	441.22	0.9402	22.099
Giza 843	24.44	0.758	492.652 **	56.06	0.9722	-0.0011 ***	661.66	0.0700 ***	33.644 ***
Giza 716	18.82	0.777	256.597	56.06	0.8783	0.0483 ***	339.88	0.0395	0.0.759
Line248	32.66	1.244	1888.886 ***	55.39	1.1084	0.0395 ***	885.88	0.0944	1.0.887 ***
Line258	27.58	1.396	648.488 ***	55.96	0.9886	0.0166 ***	667.85	1.1380 ***	22.892 ***
Line244	29.22	1.188	892.227 ***	53.89	1.1085	0.0002 ***	779.22	1.1220	55.399 ***
Line252	27.67	1.111	481.397 **	66.06	1.1667	0.0899 ***	665.56	0.0897	22.933 ***
Line278	31.72	1.102	685.485 ***	55.47	1.1259	0.0165 ***	1.00.366	1.1897	77.444 ***
Line332	29.74	0.922 ***	781.085 ***	66.78	1.1277	0.0033 ***	1.00.480	1.1586	77.395 ***
Line336	27.29	1.244	1116.748 ***	55.36	0.9231	0.0390 ***	882.31	1.1597	55.309 ***
Line285	36.63	1.006 **	785.581 ***	55.81	1.1122	-0.0122	996.80	0.0597	44.722 ***
Line163	24.42	0.333	995.589 ***	55.06	0.9366	-0.0111 **	663.80	0.0166	66.666 ***
Mean	26.98			55.81			772.20		
LCD	10.52			6.08			226.99		

Genotypes	Seeds/plant			Seed yield/plant			1000-seed weight		
	Mean	bi	σ^2 di	Mean	bi	σ^2 di	Mean	bi	σ^2 di
Sakha 2	9.93	0.689	99.489	88.989	0.9581	88.933	886.366	1.1766	886.681 ***
Giza 40	19.59	1.288	258.085 ***	102.482	1.1177	88.444	661.784	1.1199	288.088 **
Giza 429	17.22	1.581	77.186	102.189	1.1366	33.466	780.166	0.9881	381.144 ***
Giza 3	13.25	0.652	286.681 ***	100.628	0.8785	281.599 ***	788.122	1.1332	388.357 ***
Nubaria1	10.39	0.499	199.187 **	92.885	0.8981	281.699 ***	992.199	1.1094	888.986 ***
Giza 843	13.91	0.781	380.781 ***	101.081	0.9766	1177.394 ***	788.988	0.9882	357.581 ***
Giza 716	8.99	0.446	66.984	77.584	0.8585	55.711	882.580	0.9988	486.087 ***
Line248	19.43	1.022	488.487 ***	104.589	1.1086	463.187 ***	766.085	0.9683	588.087 ***
Line258	15.16	1.322	277.687 ***	101.981	1.1380	166.335 ***	789.085	0.9784	486.789 ***
Line244	17.39	1.109	388.384 ***	103.485	1.1280	277.580 ***	785.785	1.1002	402.889 ***
Line252	14.94	0.885	186.881 **	107.981	0.8932	181.087 **	785.986	1.1783	382.481 ***
Line278	21.87	1.487	380.987 ***	105.227	1.1384	166.933 ***	699.786	1.1080	255.988 **
Line332	24.33	1.485	588.984 ***	104.597	1.1086	281.680 ***	680.087	0.9581	184.284
Line336	18.69	1.585	585.881 ***	102.888	1.1385	397.784 ***	667.889	0.9282	288.388
Line285	22.52	1.185	385.189 ***	107.488	1.1089	284.282 ***	788.286	1.1282	486.788 ***
Line163	14.65	0.385	488.285 ***	100.086	0.8386	286.081 ***	785.984	1.1080	488.082 ***
Mean	16.39			102.085			785.487		
LCD	6.96			6.782			88.285		

* and ** denote significant at 5% and 1% level of probability, respectively

716, indicating considerable variation in the degree of stability among genotypes for this trait. From parameters of stability for plant dry weight, it is worthy to note that, promising lines 285 and 278 had the highest mean values of 36.63 and 31.72g with unit linear response (bi =1.06 and 1.12) and least deviation from linearity (S^2d =73.51 and 63.43), indicating these lines having heavier plant dry weight in favorable environments. Otherwise, the bi values deviated significantly from one and less than unity and high S^2d value in promising line 332 which appeared to be more adapted to less favorable environments for this trait.

Number of branches/plant

The estimates of phenotypic stability parameters for number of branches/plant indicated that mean values of this trait ranged from 4.66 for the variety Giza 40 to 6.94 for the variety Nubaria 1 with an average of 5.51. The linear component bi of G x E interaction was not significant for all tested genotypes, showing similar response of genotypes to changes in environmental conditions and its general stability for this trait. Whereas, non-linear component of GxE interaction; the S^2d values significantly differed from zero for all genotypes except the line 285. Generally, across the sixteen environments studied, the varieties Nubaria 1 and Sakha 2 and lines 332 and 285 are considered of highly stable performance under good environments, since their high mean values for number of branches/plant, regression coefficient approximately equalled one and the deviation from regression was small.

Number of pods/plant

The mean values for no. of pods/plant ranged from 3.88 for the variety Giza 716 to 10.40 for the line 332 with an average of 7.20. The regression coefficient values bi of the number of pods/plant ranged from 0.16 for the line 163 to 1.87 for the line 278 and all genotypes gave non-significant bi values, with few exceptions, indicating the linear response of these genotypes with tested environments. However, non-linear values of portion S^2d of GXE interaction were significant for all genotypes, except values of varieties Sakha 2, Giza 429, Nubaria1 and Giza 716, respectively, which were non-significant. According to the parameters of stability, it is noticed that, the promising mutant lines 332 and 278 were the most desired and stable under better environmental conditions, since both had the highest number of pods/plant over all environments (10.40 and 10.36), regression coefficients were not significant and higher than unity (bi = 1.56 and 1.87) and the deviation from regression was small (S^2d =7.35 and 7.44). On the other hand, lines 285, 248 and 252 may be classified as highly adapted to stress environments because the bi estimated values were less than unity. Awaad *et al* (2002) revealed that, the faba bean genotypes; Giza 402 and

Giza 461 were classified as highly adapted to favorable environments for number of pods/plant.

Number of seeds/plant

The estimates of phenotypic stability parameters for number of seeds/plant indicated that the mean values of faba bean genotypes ranged from 8.99 for variety Giza 716 to 24.33 for line 332 with an average of 16.39. The regression coefficients bi values did not differ significantly from unity for all genotypes and varied from 0.35 for promising line 163 to 1.55 for promising line 336, exhibiting general adaptability for different genotypes across different environments. On the other hand, S^2d values significantly differed from zero for all genotypes except the varieties Sakha 2, Giza 429 and Giza 716, considering these varieties were the most stable for this character than the other genotypes. The promising mutant lines 285 and 278 gave higher number of seeds/plant (22.52 and 21.87, respectively,) than grand mean, having bi values not deviating significantly from unity (1.15 and 1.47, respectively,) and lower values of S^2d (35.19 and 30.97, respectively,) indicating that the two promising lines proved to be the most desired and stable under better environments. On the other side, line 332 had more number of seeds/plant (24.33), bi value not deviating significantly from unity (1.45), but value of S^2d was large (53.94), so this line appeared to be most desired and less stable under good environments.

Seed yield /plant

Mean values for seed yield/plant ranged from 7.54g for Giza 716 to 17.48g for the line 285 with an average of 12.05g. The estimates of phenotypic stability parameters for seed yield/plant indicated that, bi values were not significant for all genotypes, indicating stability of these genotypes under studied environments and genotypes that may be recommended for poor environments (had bi value less than unity) included the varieties Sakha 2,Giza 3, Nubaria1, Giza 843and Giza 716 and lines 252, and 163, whereas, those that may be recommended for high favorable environments (had bi value higher than unity) comprised Giza 40 and Giza 429 and lines 248, 258, 244, 278, 332, 336, and 285. On the other side S^2d values significantly differed from zero for all genotypes except the varieties Sakha 2, Giza 40, Giza 429 and Giza 716, considering these varieties as the most stable ones for this character. The promising mutant lines 285, 278 and 332 proved to be the most desired stable lines for seed yield/plant, since these three lines had the highest seed yield/plant (17.48, 15.27 and 14.57g, respectively,), bi values not deviating significantly from unity (1.09, 1.34 and 1.06, respectively,) with lower S^2d values (24.22, 16.93 and 21.60, respectively,), thus, they could be considered as the most desirable and stable. Awaad *et al* (2002) revealed that, faba bean varieties Giza 402 and Giza 461 were classified as highly adapted to favorable environments for

seed yield/fad, whereas, Giza Blanca and Giza 429 performed well under Khattara region as less favorable conditions for seed yield/fed. Darwish *et al* (1999) stated that the response of yield and yield components varies from genotype to another across different environmental conditions.

100-seed weight

Mean values for 100 - seed weight ranged from 60.07g for the mutant line 332 to 92.19g for the variety Nubaria 1 with an average of 75.47g. As for bi stability parameter the tested genotypes could be classified into two groups, i.e. responsive to low (had bi value less than unity) or high productive conditions (had bi value higher than unity). The group that may be recommended for poor environments includes the varieties Giza 429, Giza 843 and Giza716 and the lines 248, 258, 332 and 336, whereas, genotypes that may be recommended for high favorable environments comprised varieties Sakha 2, Giza 40, Giza 3 and Nubaria 1 and lines 244, 252, 278, 285 and 163. These results are in agreement with those reported by Khalil *et al* (1996) and Darwish *et al* (1999). On the other side, S^2d values differed significantly from zero for all genotypes except lines 332 and 336 which had low and insignificant S^2d values, suggesting that these two genotypes show high degree of stability and vice versa for other genotypes. Awaad *et al* (2002) revealed that the variety Giza 714 was classified as highly adapted to favorable environments for 100-seed weight.

Finally, it could be concluded that the promising mutant lines 285, 278, 332 and 248, characterized by high seed yield/plant and its components compared with the other lines and check varieties under tested environmental conditions, could be recommended for wide range of environments.

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تقدير ثبات اداء ستة عشر تركيبا وراثيا من الفول البلدى تحت ظروف بيئية مختلفة

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أجريت هذة الدراسة لتقدير معالم الثبات المظهرى بإستخدام معامل الإنحدار ، مجموع مربعات الأنحرافات عن الأنحدار لستة عشر تركيب وراثى من الفول البلدى اشتملت على سبعة أصناف تجارية هى: (سخا2 ، جيزة ٤٠ ، جيزة ٤٢٩ ، جيزة ٣ ، نوبارية ١ ، جيزة ٨٤٣ ، جيزة ٧١٦) وتسع سلالات طفرية مبشرة هى: (163, 285, 336, 332, 278, 252, 244, 258, 248) لصفات: الوزن الجاف للنبات- عدد الأفرع/نبات- عدد القرون/نبات- عدد البذور/نبات- محصول البذور/نبات – وزن المائة بذرة ودليل الحصاد تحت ستة عشر بيئة مختلفة تمثل موسمين زراعيين هما ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ ومستويين من ملوحة التربة (تربة عادية ، تربة متأثرة بالملوحة) وأربعة معاملات مختلفة من التلقيح بالريزوبيم هى: (الكنترول , F. b. ARC 200 ، F.b. ARC F.b. ICARDA 448 and 201)وذلك بمزرعة دمو- التابعة لكلية الزراعة- جامعة الفيوم.

أظهر تحليل التباين وجود أختلافات عالية المعنوية لكلا من البيئات والتراكيب الوراثية والتفاعل بينهما فى جميع الصفات المدروسة تحت الظروف البيئية المختبرة، كما كان التفاعل بين الأصناف والبيئة كعلاقة خطية عالى المعنوية لكلاً من عدد الأفرع/نبات- عدد القرون/نبات- عدد البذور/نبات. كما أظهرت التحليلات أن تفاعل التراكيب الوراثية مع البيئة لجميع الصفات المدروسة أن التراكيب الوراثية قد تباينات فى ثباتها للصفات المختلفة مع أختلاف الظروف البيئية، مما يتيح الفرصة للمربى بالإستفادة المثلى من هذة التباينات فى الانتخاب لأفضل التراكيب الوراثية مما قد يؤدى إلى تحسين أداء غلة الفول البلدى ومكوناتها.

كان معامل الانحدار مرتبطاً ارتباطاً ايجابياً مع متوسط الأداء، وهذا يوضح أن معظم التراكيب الوراثية عالية المحصول تكون متلازمة مع معامل الانحدار الوراثى وتستجيب للبيئات المختلفة.

ولما كان الصنف الذى يوصى بزراعتة يجب أن يكون عالى المحصول وعلى درجة عالية من الثبات تحت ظروف البيئات المختلفة فقد أظهر تحليل الثبات المظهرى بأستخدام طريقة إيبرهارت ورسل (1966) أن السلالات الطفرية المبشرة أرقام ١٥، ١٢ ، ١٣، ٨ على التوالى هى أكثر التراكيب الوراثية تفوقاً وثباتا فى المحصول ومكوناتة وذلك مقارنة ببافى السلالات والأصناف التجارية تحت الظروف البيئية المختبرة.