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INVESTIGATIONS ON FABA BEANS, *Vicia faba* L. 18-PERFORMANCE OF SOME BREEDING MATERIAL IN SALINE-AFFECTED SOILS

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ABSTRACT

Four field experiments were carried out to explore the performance of fifteen faba bean genotypes in slightly saline soils at Giza and Nubaria locations during 1998/99 and 1999/2000 seasons. Three salinity levels: low (1.5-2.4mmho/cm), medium (2.5-3.4mmho/cm), and high (3.5-4.5mmho/cm) were determined.

Salinity levels and genotypes significantly influenced the performance of faba bean characters. Moreover, faba bean genotypes reacted differently to various levels of salinity, which offered opportunities of selecting an appropriate genotype/s for certain salinity level/s. Salinity levels over seasons, locations and genotypes are the most important factors affecting faba beans. Progress for selecting the top 13.3% could be achieved for most attributes under high level of salinity.

The investigated genotypes varied in tolerance/ susceptibility to salinity from trait to another. But it seems that the most productive genotypes under low salinity conditions are highly susceptible to high salinity. Combining high yielding ability with reliable salinity tolerance may be achieved by using proper breeding program.

Good performance for various traits is significantly related to high variation across environments. Low productive genotypes could response to improving environments. This variability could be of some benefit for improving faba bean reaction to salt stress conditions.

Key words: ***Faba bean, Breeding material, Saline-affected soils, Tolerance, Susceptibility, Stability.***

INTRODUCTION

The sensitivity of faba bean (*Vicia faba*) to salinity affects its expansion and production in saline- affected soils. Salinity is the condition of excess salts in the soil, which affects germination, growth and production of faba bean plants. The effects of salinity varied significantly due to several factors such as the nature of dominating salts, concentrations, soil composition, plant genotype..etc. Lower concentration of $CaCl_2$ was more detrimental than NaCl on faba bean seedling survival (Salem and Caesar 1982a). The effects of NaCl were markedly greater than Na_2So_4 (Khondekar 1984).The germination of faba beans was decreased by 260 mM NaCl and development was hampered by 340 and 710 mM (Pacsai and Szabo 1983). Likewise, Shaddad *et al* (1990) found that the NaCl salinity was tolerated by faba bean up to 240-mM. However, Rabie *et al* (1986) found that 0.3% salinity promoted faba bean plant growth but higher levels inhibited growth and dry matter content of plants. Increasing salinity of soil up to 160 mM NaCl reduced growth and transpiration in pots-grown faba bean (Hamada and El-Enany 1994). The increase of electrical conductivity of the upper 20 cm soil layer up to 4 mmho/cm significantly decreased seed yield (Aly *et al* 1988). Sharma (1995) reported faba bean to be moderately salt tolerant with a salinity threshold of 4.56 ds/m and found 50% reduction in seed yield at 9.51 ds/m.

Wide variability among faba bean genotypes regarding salinity tolerance was reported by several workers (Salem and Caesar 1982a & b, Pacsai and Szabo 1983, Khondekar 1984, Singh and Prakash 1986, Blyth 1987, Yousif and Salih 1989,Dua *et al* 1989 and Melesse and Caesar 1992).

Means of alleviating salinity effects are greatly appreciated. Cultural practices and breeding are two possible approaches that may overcome, to an extent, the salinity problem (Caesar and Rusitzaka 1982). Agronomical approaches involve leaching, irrigation and planting methods. If salinity could not be controlled, cultivation of tolerant crops or varieties is important to overcome salinity effects.

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 salinity levels may provide reliable information for recommending cultivars and planning breeding programs. The present studies throw some light on this aspect.

MATERIALS AND METHODS

Four field trials were conducted during 1998/99 and 1999/2000 seasons at the Experimental and Research Station of the Faculty of Agriculture, Cairo University, Giza (Giza Trials) and Nubaria Research Station, Agricultural Research Center, ARC (Nubaria Trials).

Fifteen faba bean genotypes were used. They included 8 improved varieties, 2 promising lines and 5 introduced stocks. The improved varieties are: Nubaria 1 (formely Giza Blanca), Giza 3, Giza 429,Giza 674, Giza 716 and Giza 843 (ARC, Giza), Cairo 241 and Cairo375 (Agron. Dept. Fac. Agric. Cairo University). The two promising lines are 1002/916/95 and 983/281/95 (ARC, Giza). The introduced stocks comprise ILB 1814, FLIP 84/94, FLIP 84/76, ILB 1813 and FLIP 77/84 (ICARDA, Aleppo).

At each location the same field used in both seasons was selected as salt affected soil according to the determined E.C. of soil samples. The physical and chemical characteristics of the soil are presented in Table (1). To avoid heterogeneity of salt distribution, each field was classified into 15 small strips. Each strip consisted of 30 ridges. The investigated faba bean genotypes were randomly distributed in each strip to give 15 replications. The experimental plot comprised 2 ridges, each 3 m long and 60 cm apart. Sixty seeds were hand planted in each plot at both sides of the ridge in single-seed hills distanced 20 cm. During the vegetative growth stage, the soil salinity of each experimental plot was determined as E.C. Accordingly, the tested plots were classifieds into 3 salinity levels, i.e. low (1.5-2.4mmho/cm), medium (2.4-3.4 mmho/cm), and high (3.5-4.5mmho/cm). Each level contained the 15 genotypes repeated 3 times. The sowing dates at Giza were November, 29 (1998) and 30.(1999). However, at Nubaria the planting dates were November, 18 (1998) and October, 29 (1999). Recommendations of cultural practices were adopted and super phosphate fertilizer was applied as 30 kg P_2O_5/feddan during seedbed preparation.

The number of emerged seedlings at day 21 from sowing relative to planted seeds was considered as emergence %.The numbers of surviving plants at harvest relative to emerged seedlings were denoted as surviving plants %. At harvest a random sample of 10-guarded plants was used for recording the plant dry weight and seed yield /plant. The seed yield of plants in each plot plus those of sampled individuals contributed seed yield / plot (3.6 m2).

Table 1. Characteristics of the soil for the experimental field at Giza and Nubaria in 1998/99 season.

Analysis	Giza	Nubaria
Ca^{++}	4.8	21.57
Mg^{++}	3.0	22.24
Na^{+}	4.31	35.34
K^{+}	0.18	1.42
Co_3	0.00	2.13
HCo_3	0.40	2.31
Cl^{-}	8.0	55.70
So_4	3.89	19.98
Clay %	25.5	3.0
$CaCo_3$%	2.9	21.5
Texture	Sandy clay loam	Calcareous soil
E.C (m mho/cm) at 25°	3.9	4.66
pH	8.5	8.06

The data of low (L) and high (H) salinity levels were used for estimating relative performance and susceptibility index (Sus. I).

$Sus.I_i = [1-(L.S.Y_i/H.S.Y_i)] / [1-(L.S.Y./H.S.Y)]$ where, subscription i indicate values for genotype i and without it denotes the mean of all genotypes.

To explore the stability of performance across different salinity levels in both seasons and locations each salinity level in each location and season was considered as an environment leading to 12 environments. Homogeneity tests allowed combined analysis of variance over environments. The stability of performance was analyzed according to Eberhart and Russel (1966). From this analysis two parameters of dynamic stability were calculated, b and S^2d (regression coefficient and mean square of deviation from regression, respectively). The coefficient of variability (C.V.%) as a static measure of stability was estimated as suggested by Francis and Kannenberg (1978).

RESULTS AND DISCUSSIONS

Variations within salinity levels

Data of mean effects of salinity levels combined over the four trials and the parameters of variations, broad sense heritability (h^2) and the percentage of genetic advance (Gs%) from selecting the top 13.3% are tabulated in Table (2).

Table 2. Parameters of phenotypic and genotypic variation among faba bean genotypes within each salinity level combined over the four trials as well as heritability and the percent of genetic advance due to selecting of the best 13.3%.

Traits	Salinity levels[1]	Mean[2]	Range	Skewness	δ^2g[3]	δ^2ph[3]	h^2[3]	G.C.V%[3]	P.C.V%[3]	G_s %
Emergence %	L.L	75.3a	64.0-84.9	-0.17	38.0	48.4	0.79	8.2	9.2	10.9
	M.L	62.5b	49.2-74.9	-0.15	66.8	80.6	0.83	13.1	14.4	17.8
	H.L	47.1c	35.8-59.0	-0.05	53.7	70.3	0.76	15.6	17.8	20.2
Surviving plants %	L.L	74.2a	69.8-79.1	0.06	0.0	10.0	0.00	0.0	4.3	0.0
	M.L	74.2a	62.8-84.1	-0.07	7.0	28.7	0.24	3.6	7.2	2.6
	H.L	72.3a	64.7-77.6	-1.04	0.0	13.6	0.00	0.0	5.1	0.0
PDW (gm)	L.L	111.3a	88.4-135.1	-0.26	0.0	226.4	0.00	0.0	13.5	0.0
	M.L	81.3b	59.1-101.3	-0.14	50.9	228.0	0.22	8.8	18.6	6.1
	H.L	58.3c	41.0-76.6	0.12	35.3	100.0	0.35	10.2	17.2	9.0
SY/plant (gm)	L.L	51.0a	31.9-67.8	-0.60	45.5	108.4	0.42	13.2	20.4	12.8
	M.L	33.4b	16.8-46.2	-0.37	84.0	114.6	0.73	27.5	32.1	35.0
	H.L	17.8c	8.5-29.8	0.30	38.6	48.5	0.80	34.9	39.2	46.8
SY/Plot (kg)	L.L	2.2a	1.1-3.1	-0.36	0.4	0.5	0.74	27.6	32.0	35.6
	M.L	1.2b	0.4-2.1	-0.06	0.2	0.3	0.84	40.4	44.2	57.9
	H.L	0.6c	0.2-1.0	-0.02	0.1	0.1	0.64	43.1	54.1	50.5

1) L.L=Low, M.L=Medium and H.L=High salinity level.
2) Means followed by the same letter are not statistically differed at 5% (combined analysis over seasons and locations).
3) δ^2g = genotypic variance, δ^2ph =phenotypic variance, h^2 = broad sense heritability, G.C.V.% =genotypic and P.C.V.% =phenotypic coefficients of variability among genotypes within each salinity level, Gs % = genetic advance from selection

Generally, as salinity increased, all attributes significantly decreased except percentage of survived plants. Seed yields per plant and per plot were depressed by about 35 and 50%, respectively at medium salinity level. However, both yields were reduced by about 70% under high salinity. Plant dry weight (PDW) was also greatly depressed by medium salinity (27%) and high salinity (48%) compared to low salinity level. Although about 27 % of the emerging seedlings were lost up to counting the surviving plants at harvest, loss was not statistically significant. The ranges of investigated genotypes within each salinity level exhibited less lower and less higher limits under both medium and high levels of salinity compared to low salinity level for all tabulated traits except one.

The degree of reduction of upper limit of range due to higher salinity varied from trait to another. This proved that the studied genotypes exhibited variable degrees of reduction in their traits as a consequence of reaction to salinity levels.

The distribution mode of genotypes within each salinity level measured by skewness was negative under all salinity levels for emergence %, and seed yield per plot (SY/plot). However, it was positive for surviving plants % under lower salinity level. Similar tendency of distribution was recorded for PDW and seed yield/plant(SY/plant) under high salinity level. Thus, it could be emphasized that the investigated genotypes tended to distribute (or showed more frequency), towards better performance than inferior one. Thus, selection among the present genotypes could be useful for good performance under saline conditions.

The magnitude of both genotypic (σ^2g) and phenotypic (σ^2ph) variances varied due to salinity level and trait. The genotypic variance was lacking for surviving plants % under both low and high levels and for PDW under low salinity level. However, the coefficient of variability either genotypic (G.C.V%) or phenotypic (P.C.V%) was larger under high salinity level than under the other two levels for all traits except surviving plants % (which was higher under medium level). The percentages of heritabilities showed similar trends. This is an indication of the presence of genetic variation among tested genotypes particularly under high salinity level. Therefore, progress from selecting the top 13.3% could be achieved for most attributes under high level of salinity. This is true for all traits except surviving plants %.

Salinity tolerance and susceptibility of faba bean genotypes

The performance of each genotype was computed as a percentage of values under high salinity level relative to their corresponding values under low salinity one and was considered as a measure of tolerance. The significance was estimated by comparing the difference between counterpart performances under both high and low levels to proper LSD. All genotypes showed significant differences between performance under low and high salinity levels for emergence %, plant dry weight and seed yield per plant (Table 3). Generally, the studied genotypes varied in the magnitude of relative performance of various traits. However, Nubaria 1 and FLIP 84/86 genotypes recorded lower relative

Table 3. Performance and Susceptibility index of faba bean genotypes under high salinity level relative to their corresponding values under low one from combined results over seasons and locations.

Genotype	Emergence %		Surviving plants %		PDW (g)		SY/plant (g)		SY/plot (kg)	
	Relative	Sus. I	Relative	Sus. I	Relative	Sus. I	Relative	Sus. I	Relative	Sus. I
Nubaria 1	49.8 *	1.68	88.6*	4.27	46.3*	1.28	21.2*	1.99	11.3*	2.75
Giza 716	73.7 *	0.59	87.8*	4.64	59.1*	0.76	37.3*	0.90	42.8ns	47.0
Giza 3	60.7 *	1.08	107.8ns	-2.41	55.2*	0.89	47.0*	0.60	31.3*	77.0
Giza 843	69.6 *	0.73	100.3 ns	-0.11	51.4*	1.04	38.7*	0.85	32.6*	73.0
L.983/281/95	59.7 *	1.12	101.3 ns	-0.42	49.1*	1.14	37.3*	0.90	26.8*	96.0
L1002/916/95	71.0 *	0.68	104.1 ns	-1.33	50.5*	1.08	37.9*	0.88	31.6*	76.0
Giza 674	59.5 *	1.13	92.7ns	2.64	53.7*	0.95	41.0*	0.77	23.2*	1.16
Giza 429	67.8 *	0.79	99.0ns	0.35	65.2*	0.59	55.3*	0.43	31.5*	0.76
ILB 1814	56.0 *	1.31	95.9 ns	1.41	46.3*	1.27	22.8*	1.81	16.6*	1.76
FLIP 84/94	54.2 *	1.41	100.8 ns	-0.27	51.1*	1.05	24.5*	1.65	16.5*	1.78
Flip 84/86	55.4 *	1.34	92.8ns	2.59	46.0*	1.29	22.4*	1.85	14.8*	2.01
ILB 1813	55.5 *	1.34	102.5ns	-0.83	59.3*	0.75	31.9*	1.14	15.2*	1.96
Flip 77/84	63.0 *	0.98	97.8ns	0.75	50.7*	1.07	36.4*	0.93	31.3*	0.77
Cairo 241	68.2 *	0.78	94.0 ns	2.13	51.0*	1.06	33.3*	1.07	28.8*	0.87
Cairo 375	69.5 *	0.73	97.1ns	1.00	50.0*	1.10	27.5*	1.41	18.0*	1.60

ns and * indicated insignificant and significant difference between low and high level according $LSD_{0.05}$, respectively.

performance for dry weight and seed yields, but Giza 716, Giza 3, L.1002/916/95, Giza 429, FLIP 77/84 and Cairo 241 performed better compared to other stocks.

The susceptibility index was calculated and is considered another criterion for evaluating the reaction of genotypes to salinity according to Fischer and Maurer (1978). This index weighed the relative difference of the ratios under low to those corresponding under high levels of each genotype from unity to the similar difference of all genotypes for same trait (Table 3). Genotypes having indexes lower than unity are considered least susceptible to high salinity level and vice versa. It is obvious that the investigated genotypes varied in susceptibility to salinity from trait to another. Generally, Nubaria 1 showed high susceptibility to salinity for all attributes. However, Giza 843,L.1002/916/95 and

Giza 429 recorded low susceptibility for all traits. Other genotypes exhibited variable degrees of susceptibility of various attributes. The Egyptian cultivars and stocks exhibited somewhat lower susceptibility than exotic genotypes except FLIP 77/84. Moreover, within each category of genotypes, local or exotic considerable variation is observed. Thus the present collection of faba bean genotypes varied in tolerance to soil salinity. But it seems that the most productive genotypes under low salinity are highly susceptible to high salinity. Therefore, using proper breeding program to combine high yield with reliable salinity tolerance could improve both characters.

Stability across salinity levels

The obtained data for emergence %, surviving plants % and SY/plot of each salinity level in each trial was considered as an environment. This resulted in 12 environments. Environments, genotypes and their interaction were highly significant sources of variation for all tabulated traits (Table 4). This means that the environments affected the performance of all studied traits of faba bean genotypes. Also the tested faba bean genotypes varied significantly for all studied attributes over the twelve environments. Moreover, the significance of G x E interaction for all traits indicated that there were differences in ranking among genotypes across environments and stability analysis could be performed for recorded traits

Table 4. Significance of mean squares of the combined analysis for the 15 genotypes across 12 environments (2 locationsx 2 years x 3 salinity levels).

S.O.V.	d.f	Emergence %	Survival plants %	SY/plot
Environments(E)	11	17450.52**	14147.76**	64.53**
Genotypes(G)	14	2194.56**	373.27**	8.89**
G x E	154	151.11**	222.47**	0.78**
Error	360	31.83	77.87	0.12

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

The coefficient of variation (C.V %) considered the genotype to be stable, if its among environment variance is small. However, Eberhart and Russell (1966) considered the regression coefficient (b) as a parameter of response and deviation mean square (S^2_d) as the parameter of stability. According to this model, the stable genotype possesses b= 1 and S^2d= zero. If S^2d significantly differed from zero, this means invalidation of linear predication or unstability of performance. If b is relatively higher than 1, this indicates that the variety is more responsive or be recommended only for highly favorable environments. On the other hand, if b less than 1 (or negative), the variety may be recommended only for poor environments.

For the mean performance over the 12 environments, varieties Giza 843, Cairo 241 and Giza 429 were significantly the best seed yielders per plot (Table 5). Giza 843 and Cairo 241 recorded significantly the highest percentages of emerged plants. In spite of the fact that variety Giza 429 ranked the 8th for emergence %, it was the third for surviving plants %. On the other hand, the exotic three stocks FLIP 77/84, ILB 1813 and ILB 1814 were significantly inferior for the three analyzed traits.

Regarding the parameters of stability, various reactions for different traits could be observed due to the change of environments (Table 5). Varieties Giza 843, Giza 429 and Cairo 241 recorded similar among-environment variance or lesser C.V%. But, the exotic stocks: FLIP 84/94, FLIP 84/76 and ILB 1813 recorded relatively larger C.V%.

Concerning the two parameters of Eberhart and Russell's model, i.e. b and S^{2}d, seven genotypes possessed stable performance for seed yield according to the lack of significance of S^{2}d. These genotypes are Nubaria 1, Giza 3, L.983/281/95,ILB 1814, ILB 1813, FLIP 77/84 and Cairo 241. Three of these stocks (L.938/281/95, ILB 1814 and Cairo 241) showed also stable performance for the other two tabulated traits. Nubaria 1 and FLIP 77/84 behaved stable for surviving plants in addition to seed yield. However, the remaining two stocks are stable only for seed yield per plot. Based on the magnitude of b for productivity, Nubaria 1, ILB 1814, ILB 1813 and FLIP 77/84 could be recommended for poor environments and therefore may be recommended for saline affected soils. The other three stable genotypes, Giza3, L.983/281/95 and Cairo 241 may be recommended for highly favorable environments. The remaining genotypes performed differently for various traits (Table 5).

Table 5. Mean performance and stability parameters of the studied genotypes over the 12 environments.

Genotype	Emergence %				Surviving plants %				S.Y/plot (kg)			
	Mean	C.V%	b	S^2d	Mean	C.V%	b	S^2d	Mean	C.V%	b	S^2d
Nubaria 1	58.5g (10)	37.81 (9)	1.09** (11)	24.77** (8)	72.9c-f(11)	25.06 (5)	0.98** (6)	5.85ns (5)	1.0g (10)	103.14 (11)	0.79** (4)	0.06ns (7)
Giza 716	64.1f (7)	31.99 (6)	1.09** (7)	26.63** (9)	70.6c-f(13)	30.06 (11)	1.15** (12)	15.49 ns (7)	1.3f (9)	101.93 (10)	1.09**(10)	0.15* (10)
Giza 3	64.6ef (6)	36.38 (8)	1.00** (13)	40.17**(11)	73.9b-f (9)	26.67 (9)	0.96** (5)	82.00 ** (14)	1.6de (6)	84.32 (5)	1.09** (9)	0.06ns (6)
Giza 843	72.6a (1)	20.95 (1)	1.14** (1)	23.26* (7)	75.5a-c (4)	34.56 (15)	1.42** (15)	26.33 ns (9)	2.0a (1)	81.63 (4)	1.31**(13)	0.29**(15)
L. 983/281/95	62.6f (9)	31.30 (5)	0.72** (6)	-1.96ns (1)	74.0b-f (8)	26.02 (7)	1.04** (10)	9.64 ns (6)	1.6de (7)	94.14 (7)	1.20**(12)	0.04ns (4)
L. 1002/916/95	68.4cd (4)	34.81 (7)	0.99** (14)	57.75**(13)	74.8a-d (5)	23.06 (4)	0.83** (3)	65.17 ** (13)	1.7cd (4)	78.83 (2)	1.02** (8)	0.23**(14)
Giza 674	69.6bc (3)	25.01 (2)	1.14** (2)	96.40**(15)	65.8g (15)	33.87 (14)	0.99** (7)	180.39 **(15)	1.6de (5)	76.82 (1)	0.96** (6)	0.19**(12)
Giza 429	63.7f (8)	38.37(11)	0.73** (15)	53.46**(12)	75.6a-c (3)	20.92 (3)	0.86** (4)	-5.32 ns (2)	1.8bc (3)	96.53 (8)	1.41**(15)	0.15* (11)
ILB 1814	50.2l (15)	37.86(10)	1.18** (5)	8.35ns (3)	74.5b-e (6)	26.21 (8)	1.03** (9)	22.66 ns (8)	0.6h (15)	119.78 (12)	0.55** (2)	0.01ns (2)
Flip 84/94	52.4hi (13)	39.58(12)	0.94** (8)	4.83ns (2)	70.7d-f(12)	30.19 (12)	1.17** (13)	0.47 ns (3)	0.8g (12)	135.69 (13)	0.91** (5)	0.12* (9)
Flip 84/76	50.7l (14)	42.75(15)	1.04** (10)	19.05ns (4)	78.8a (1)	15.85 (1)	0.53** (1)	48.45 * (12)	0.9g (11)	136.02 (14)	0.96** (7)	0.20**(13)
ILB 1813	53.5h (12)	40.22(13)	1.07** (9)	32.40**(10)	70.2f (14)	29.68 (10)	1.08** (11)	47.67* (11)	0.6h (14)	142.11 (15)	0.73** (3)	0.05ns (5)
Flip 77/84	54.3h (11)	41.04(14)	1.04** (12)	20.89* (6)	73.8b-f(10)	30.99 (13)	1.26** (14)	3.55 ns (4)	0.7h (13)	90.85 (6)	0.50** (1)	-0.02ns(1)
Cairo 241	72.2ab (2)	25.65 (3)	1.10** (3)	19.31ns (5)	74.3b-f (7)	25.63 (6)	1.00** (8)	26.81 ns (10)	2.0ab (2)	81.10 (3)	1.31**(14)	0.03ns (3)
Cairo 375	66.8de (5)	30.48 (4)	0.90** (4)	71.52**(14)	77.7ab (2)	16.94 (2)	0.70** (2)	-7.31 ns (1)	1.5ef (8)	97.97 (9)	1.19**(11)	0.10* (8)

-Means followed by the same letters are not statistically different at 5%.
-Values between brackets are the ranks

The rank correlation coefficients (Sperman's coefficients) were computed to explore the relationships among the mean performance and stability parameters (Table 6). Mean performance over 12 environments and C.V% were positively significantly correlated for all traits. This means that good performance for various traits is significantly related to high variation across environments. The parameter of response (**b**) was negatively significantly correlated with mean performance for seed yield per plot. This proves that low performance for this trait is reflected in high response to environmental changes or the low performed genotypes could response to improving environments.

Table 6. Rank correlation coefficients among means and different stability parameters.

Traits	Mean &CV%	Mean & b	Mean & S^2d	CV % & b	CV% & S^2d	b & $S^{2\prime}d$
Emergence %	0.86**	0.35ns	-0.53*	0.68**	-0.29ns	0.15ns
Survival plants %	0.65**	0.51*	01.19ns	0.85**	0.18ns	-0.17ns
SY/plot	0.77**	-0.84**	-0.50ns	-0.41ns	-0.19ns	0.36ns

ns, * and ** indicate insignificant, significant at 5% and significant at 1 % levels, respectively.

Plant survival % was proportionally correlated to response at upgrading environments. Significant negative rank correlation coefficient was detected among mean performance and $S^{2-}d$ for emergence %. This indicates that a stock with high emergence percentage would be stable for such character than other stocks. C.V% was positively significantly correlated with b for emergence and surviving plants %. Thus, genotypes exhibiting high variation across environments for these traits would be more responsive to the change of environments. The $S^{2-}d$ recorded insignificant correlation with both C.V.% and b for all traits. This may be attributed to the consideration of C.V.% and b as biological measure of stability, whereas $S^{2-}d$ as agronomic measure of stability (Becker 1981).

Finally, it is obvious that salinity 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 salt-stress. Such variation is obvious from the yield performance, in addition to tolerance criteria and stability parameters across different saline conditions. This variability could be of benefit for improving faba bean reaction to salt stress conditions.

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دراسات على الفول البلدى

١٨- أداء بعض السلالات والأصناف فى الأراضى المتأثرة بالملوحة

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نفذت أربع تجارب حقلية لدراسة أداء بعض الاصناف والسلالات من الفول البلدى فى الأراضى المتأثرة بالملوحة خلال موسمى ٩٩/٩٨، ٢٠٠٠/٩٩. فى موقعى الجيزة (كلية الزراعة-جامعة القاهرة) والنوبارية (محطة مركز البحوث الزراعية بالنوبارية) واستخدم لذلك ١٥ مصدراً وراثياً من الفول البلدى تضمنت ستة أصناف محسنة(نوبارية ١، جيزة ٧١٦، جيزة ٣، جيزة ٨٤٣، جيزة ٦٧٤، جيزة٤٢٩) وسلالتين واعدتين (سلالة ٩٥/٩١٦/١٠٠٢، سلالة ٩٥/٢٨١/٩٨٣) من قسم بحوث المحاصيل البقولية-مركز البحوث الزراعية و ٥ مستوردات من الإيكاردا-حلب-سوريا (ILB 1814، FLIP 84/94 ، FLIP 84/76، ILB 1813، FLIP 77/84) وصنفين محسنين (قاهرة ٢٤١ و قاهرة ٣٧٥) من قسم المحاصيل-كلية الزراعة-جامعة القاهرة . وأمكن تقسيم كل حقل الى ٣ مستويات ملوحة هى: منخفض (ملوحة التربة من ١,٥ الى ٢,٤ ملليموز/سم) ومتوسط (من٢,٥ الى ٣,٤ ملليموز/سم) والمستوى المرتفع (من ٣,٥ الى ٤,٥ ملليموز/سم).بحيث احتوى كل مستوى من مستويات الملوحة على ثلاث مكررات من الـ ١٥ مصدرا وراثيا.

كانت مستويات الملوحة والتراكيب الوراثية معنوية التأثير فى أداء الصفات المختلفة. كما أن معنوية التفاعل بين مستويات الملوحة والتركيب الوراثى كانت معنوية لغالبية الصفات المدروسة مما يدل على أن التراكيب الوراثية تباينت فى رد فعل صفاتها لمستويات الملوحة المختلفة. مما يشير الى إمكانية انتخاب تراكيب وراثية قد تكون ذات أداء جيد لكل مستوى ملوحة.

كانت متوسطات مجموع المربعات الراجعة لمستويات الملوحة أكبر من تلك الراجعة للتراكيب الوراثية يليها تلك الراجعة لتفاعلهما لكل الصفات فى الأربع تجارب وذلك يدل على عظم تأثير الملوحة فى أداء الصفات المختلفة عن تأثير التراكيب الوراثية أو تفاعلهما مع مستويات الملوحة. أظهر التحليل التجميعى أن المواسم والمواقع وتفاعلهما كانت مصدرا للتباين عالى المعنوية لغالبية الصفات المدروسة.مما يشير الى أهمية التأثيرات البيئية فى أداء صفات الفول البلدى. كان تفاعل التراكيب الوراثية

مـــع عوامـــل الدراســـة الأخرى معنويا لغالبية الصفات المدروسة مما يبرهن على أن التراكيب الوراثية قد ســلكت سلوكا متباينا بين كل من المواسم أو المواقع أو مستويات الملوحة. مما يدل على صعوبة التوصية بتركيــب وراثـــي معيـــن لمـــدى واسع من الظروف البيئية. إلا أن ذلك يمكن التغلب علية بتوسيع القاعدة الوراثـــية للأصـــناف الممكـــن التوصية بزراعتها فى بيئات مختلفة باستنباط الأصناف التركيبية التى تؤمن الإنتاجية مع تقلبات الظروف البيئية.

وإجمـــالا فـــإن التأثـــيرات الضـــارة للملوحة على محصول الفول البلدى تباينت باختلاف التراكيـــب الوراثـــية فـــيما يتعلق بأداء صفات الغلة ومكوناتها بالإضافة الى معايير التحمل والحساسية والثـــبات ممـــا يشـــير الى ثراء التباينات فى هذه المجموعة من التراكيب الوراثية التي باستخدامها فى برامج تربية لتحسين الأداء تحت الظروف الملحية وخاصة الخفيفة يمكن من الوصول الى درجة مقبولة مـــن ثبات الأداء بالإضافة إلى استجابة بعض التراكيب الوراثية لتحسن البيئة الملحية عن طريق بعض المعاملات الزراعية التي يمكن أن تخفف من التأثيرات الضارة للملوحة.