

GROWTH RESPONSE OF FABA BEAN GENOTYPES TO RHIZOBIUM INCOULATATION IN SALT AFFECTED SOILS

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ABSTRACT

Four field experiments were carried out in 2003/2004 and 2004/2005 seasons at Demo Research Station, Faculty of Agriculture, Fayoum University, Egypt to study the response of 16 faba bean genotypes to inoculation of four Rhizobium under variable salinity soil conditions. Mean squares due to main effects, i.e. salinity (S), Rhizobium treatments (R), genotypes(G) and S x R, S x G, R x G and S x R x G interactions were significant for most studied characters at different growth stages in both seasons. Most growth characters were affected by salinity stress at different growth stages in both seasons. All growth characters were significantly decreased by soil salinity. Faba bean growth characters were significantly affected by seed inoculation with Rhizobium at different growth stages in both seasons. Significant differences were shown between faba bean genotypes for growth characters at different growth stages in both seasons. Mutant lines 252 and 163 were the best with respect to growth characters in the first and the second seasons. Seed yield/plant showed positive and significant associations with all growth traits at all growth stages under normal soil conditions except no. of nodules at the third sample and nodule dry weight/plant at the first sample. On the contrary seed yield/plant showed negative and highly significant association with stem dry weight/plant at the first sample. Under saline soil conditions, seed yield/plant showed positive and highly significant associations with dry matter of stem, leaf and root at the third sample. These traits were considered as having the most direct positive effects on seed yield/plant

Key words: *Faba bean, Rhizobium, Genotypes, Salinity, Growth, Correlation.*

INTRODUCTION

Faba bean (*Vicia faba*, L.) is considered the major food legume crop in Egypt. Also, it is considered one of the basic sources of protein for different strata with relatively low price. In addition it has good role in enriching and improving chemical, physical and biological properties of the soil.

The legume-*Rhizobium* symbiosis is a highly integrated system. Soil - based stress may affect on the symbiosis indirectly by reducing plant growth and available photosynthesis, or directly by affecting the infection process and/or nodule function. Salt affects the symbiosis by curtailing the growth and survival of *Rhizobium* in soil, restricting root colonization, inhibiting processes of infection and nodule development, or impairing active nodule function. These effects may be mediated through the effect of salt on the host, through a specific effect on the host, or through a specific effect on the microsymbiont itself. Rhizobia are also, widely used in

agriculture for crop improvement because of their ability to fix atmospheric nitrogen. On the other hand, many investigators reported high variability among faba bean varieties for growth and yield characters (Ahmed 1994a and b, Abo El-Kheir *et al* 2000 and Hassanein 2000). Correlation analysis is helpful to the breeder to determine the relative importance of growth characters in enhancing seed yield (Hafiz and El-Kholy 2000 and Saad and El-Kholy 2000).

This work was carried out to investigate the response of sixteen faba bean genotypes to *Rhizobium* inoculation under normal and salinity soil conditions in reproductive stages .

MATERIALS AND METHODS

Four field experiments were carried out during 2003/2004 and 2004/2005 seasons at Demo Research Station, Faculty of Agriculture, Fayoum University, Egypt. In each season two experiments were conducted under normal and saline affected soil conditions. The physical and chemical properties of soil of the experimental site showed that, the soil is sandy loamy in texture with EC of 2.47 ds/m (1581 ppm) and 2.90 ds/m (1856 ppm) of normal soil conditions and 4.84 ds/m (3098 ppm) and 4.20 ds/m (2688 ppm) of saline soil conditions in the first and second seasons, respectively. The preceding crop was peanut in the 1st season and maize in the 2nd one. The genetic materials used in each experiment consisted of sixteen genotypes which included seven cultivars, namely; Sakha 2, Giza 40, Giza 429, Giza 3, Nubaria 1, Giza 843 and Giza 716 and nine promising mutant lines selected in 6th mutant generation coded: 248, 258, 244, 252, 278, 332, 336, 285 and 163. These lines were derived from irradiating the faba bean seed of the varieties, Giza 461, Nubaria 1, Giza 643, Giza 461, Giza 717, Giza 714 and Giza 2 with gamma rays, in the same order as shown in Table (1).

Four treatments of *Rhizobium leguminosarum* i.e. control (R1), F.b. ARC 200 (R2), F.b. ARC 201 (R3) and F.b. ICARDA (ARC) 448 (R4) were used as seed inoculants. The experimental design was laid out in a split-plot design with three replications for each experiment. *Rhizobium* inoculation was assigned in the main-plots and genotypes were arranged in the sub-plots. The experimental plot consisted of four ridges, 3m long and 60 cm apart. Plants spaced 20 cm within the row and one plant was left per hill in two sides of the ridge. Seeds were treated with inoculants in the field directly before sowing as recommended. Normally cultural practices were followed as usual in faba bean fields. Faba bean seeds were sown on 19 and 8 November in the 1st and 2nd seasons, respectively. Five bordered and random plant samples were chosen from each treatment at 48, 89 and 115 in the 1st season and 53, 84, and 112 days from sowing in the 2nd season , to determine the effect of soil salinity and *Rhizobium* inoculation on the

following growth characters: number of nodules/plant, stem dry weight/plant (g), leaf dry weight/plant (g), nodule dry weight/plant (g) and root dry weight/plant (g).

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

Statistical procedures

In each season, combined analysis of variance across normal and saline conditions was done according to Snedecor and Cochran (1992) for studied traits. Differences among means were tested using least significant difference (LSD) test.

RESULTS AND DISCUSSION

Analysis of variance

Mean squares for growth characters of sixteen faba bean genotypes at different growth stages from their combined analysis across two soil salinity levels across 2003/2004 and 2004/2005 seasons are presented in Table (2). Mean squares due to normal and salinity soil conditions were highly significant or significant for all studied traits at different growth stages. These characters exhibited variable degrees of sensitivity to salinity as a consequence of reaction to soil salinity levels. According to effect of *Rhizobium* inoculation treatments mean squares were highly significant or significant differences for all studied traits at different growth stages. Mean squares due to genotypes were highly significant for all growth studied traits at different growth stages in both seasons, except leaf dry weight/plant at second sample in the first season. These results indicated that there is enough genetic variance among the tested genotypes for the studied characters. Mean squares due to the interaction between different factors in this study were highly significant or significant for all growth studied traits at different samples in the two seasons, except S x R interaction for leaf dry weight/plant at the first sample, stem and leaf dry weight/ plant at the second sample in the first season and no. of nodules/plant at the third sample in the second season. These results indicate that a great diversity existed among all and within studied treatments. These results are in agreement with those reported by Katerji *et al* (2001), Darwish *et al* (2003), Omar (2003) and Alghamdi and Ali (2004).

Table 2. Mean squares for studied characters of sixteen faba bean genotypes at different growth stages from their combined analysis across two soil salinity levels across 2003/2004 and 2004/2005 seasons

Mean squares						
First season - First sample (48 days from sowing)						
S.O.V.	DF	No. of nodules	Dry weight/plant (g)			
			stem	leaf	nodule	root
Soil salinity (S)	1	51592.1900 **	0.8420 **	1.6910 **	1285866.7730 **	1.4480 **
Replication	4	15.9210	0.0100	0.0130 **	1051.0050	0.0040
Rhizobium (R)	3	308.8430 **	0.3080 **	0.4400 **	31943.2800 **	0.0880 **
SxR	3	118.5440 **	0.0230 *	0.0040	19071.3360 **	0.0340 **
Error	12	21.1220	0.0060	0.0150	409.1650	0.0030
Genotypes (G)	15	236.5610 **	0.0850 **	0.1860 **	15563.1870 **	0.0490 **
SxG	15	150.3400 **	0.0480 **	0.1050 **	14768.6730 **	0.0140 *
RxG	45	130.9630 **	0.0650 **	0.0750 **	12261.4060 **	0.0230 **
SxRxG	45	109.7830 **	0.0700 **	0.0980 **	12095.6290 **	0.0290 **
Error	240	30.0580	0.0160	0.0200	1547.8820	0.0070
Second season - First sample (53 days from sowing)						
Soil salinity (S)	1	600.0000 **	3.0620 **	11.6270 **	83514.5030 **	0.1200 **
Replication	4	38.5650	0.0230	0.0150	418.5810	0.0030
Rhizobium (R)	3	897.6460 **	0.5750 **	0.9900 **	31117.2800 **	0.1930 **
SxR	3	893.3820 **	0.2120 **	0.2710 **	8541.8640 **	0.0700 **
Error	12	28.7680	0.0140	0.0410	1256.1920	0.0030
Genotypes (G)	15	408.4530 **	0.2620 **	0.3420 **	18919.6550 **	0.0740 **
SxG	15	165.2890 **	0.1680 **	0.2600 **	7393.9750 **	0.0150 **
RxG	45	228.2050 **	0.1250 **	0.2790 **	9449.7900 **	0.0260 **
SxRxG	45	159.8040 **	0.1700 **	0.2600 **	9232.0030 **	0.0200 **
Error	240	34.8280	0.0280	0.0470	2103.7950	0.0060

Table 2. Cont.

Mean squares						
First season - Second sample (89 days from sowing)						
S.O.V.	DF	No. of nodules	Dry weight/plant (g)			
			stem	leaf	nodule	root
Soil salinity (S)	1	221472.0940 **	788.2620 **	1393.2980 **	32765908.5940 **	25.8290 **
Replication	4	8.9650	0.6300	0.1870	61857.3440	0.0410
Rhizobium (R)	3	3419.3280 **	9.6030 **	10.7940 **	512098.7260 **	1.1170 **
SxR	3	1057.2940 **	0.5670	2.9860	510176.8230 **	0.2450 *
Error	12	77.3570	0.5670	1.2040	49199.3780	0.0470
Genotypes (G)	15	895.0930 **	4.0600 **	2.2900	273994.0330 **	0.2120 **
SxG	15	633.1180 **	6.7440 **	4.0430 **	173092.7380 **	0.1850 **
RxG	45	585.5440 **	3.6020 **	4.8210 **	323171.7660 **	0.1620 **
SxRxG	45	535.7760 **	3.4290 **	4.6380 **	274610.0410 **	0.1910 **
Error	240	135.6680	1.2880	1.6290	44520.8590	0.0700
Second season -Second sample (84 days from sowing)						
Soil salinity (S)	1	1052.0500 **	122.4980 **	102.4500 **	44520.8590 *	0.5310 **
Replication	4	108.2350	0.1330	0.0260	9164.7210	0.0210
Rhizobium (R)	3	1555.4600 **	6.0330 **	3.7260 **	173097.0300 **	1.0330 **
SxR	3	3339.7240 **	3.3560 **	8.6600 **	298642.2040 **	0.0690 *
Error	12	107.0450	0.0390	0.2680	27654.2210	0.0200
Genotypes (G)	15	1227.1720 **	3.0870 **	4.3820 **	237747.8220 **	0.2610 **
SxG	15	582.2700 **	1.7780 **	1.9730 **	175221.8850 **	0.1270 **
RxG	45	766.1520 **	1.5840 **	1.4720 **	92115.4510 **	0.1670 **
SxRxG	45	440.5990 **	1.3910 **	1.4260 **	100491.4020 **	0.1420 **
Error	240	122.5590	0.3370	0.3580	19363.3520	0.0280

Table 2. Cont.

		Mean squares				
		First season -Third sample (115 days from sowing)				
S.O.V.	DF	No. of nodules	Dry weight/plant (g)			
			stem	leaf	nodule	root
Soil salinity (S)	1	33357.3980 **	3447.5450 **	5490.7150 **	2348127.0420 **	66.8960 **
Replication	4	28.8910 **	6.7780	10.6550	40110.3230	0.0670
Rhizobium (R)	3	761.2940 **	46.7620 **	95.7880 **	220184.4720 **	3.0120 **
SxR	3	515.6000 **	62.3370 **	113.2520 **	116734.4030 *	5.4500 **
Error	12	35.8110	3.9500	8.6090	29386.5310	0.1800
Genotypes (G)	15	326.2070 **	45.3670 **	51.0850 **	183671.6670 *	3.0310 **
SxG	15	211.8710 **	22.5620 *	30.1540 *	199404.7080 **	1.2800 **
RxG	45	132.1740 *	27.4530 **	38.5280 **	150210.7310 **	1.3210 **
SxRxG	45	109.5310 *	30.5690 **	46.5560 **	157340.3660 **	1.3320 **
Error	240	38.4910	13.1750	15.0820	29993.0460	0.4260
		Second season -Third sample (112 days from sowing)				
Soil salinity (S)	1	1180.9050 **	279.8930 **	106.1870 **	626862.5650 **	1.1910 **
Replication	4	97.3310	1.1460	0.9370	13729.9870	0.0270
Rhizobium (R)	3	2651.2200 **	32.8360 **	71.3740 **	64383.5720 *	1.5660 **
SxR	3	273.6910 *	28.1590 **	177.6830 **	113747.6350 **	0.7390 **
Error	12	87.0330	0.8140	0.6190	17592.4520	0.0300
Genotypes (G)	15	2391.4800 **	4.2520 **	10.5720 **	368758.6410 **	0.3250 **
SxG	15	982.2260 **	5.7620 **	6.8590 **	111691.7320 **	0.3840 **
RxG	45	1136.5210 **	5.3710 **	4.8560 **	255595.5160 **	0.3060 **
SxRxG	45	841.5890 **	4.3740 **	7.1780 **	223136.0600 **	0.2090 **
Error	240	147.1680	1.1840	1.0750	28718.1530	0.0740

*and ** denote significance at 0.05 and 0.01 of probability levels, respectively.

Effect of salinity

The respective growth characters response to salinity stress of faba bean plants under normal and salinity soil conditions can be observed in data presented in Table (3). Results clearly indicated that all studied growth traits were significantly differed by exposing faba bean plants to soil salinity stress at different growth stages in both seasons. All studied growth characters were decreased as soil salinity level increased at different growth stages in the both seasons. These responses to salinity are generally consistent with conclusions that N-fixing plants are more sensitive to salinity

Table 3. Mean performance of studied characters under normal and saline soils conditions of sixteen faba bean genotypes at different growth stages during 2003/2004 and 2004/2005 seasons

Studied characters	First season									
	48 days from sowing		LSD	89 days from sowing		LSD	115 days from sowing		LSD	
			0.050			0.050			0.050	
	Normal Salinity			Normal Salinity			Normal Salinity			
Number of nodules/plant	26.615	3.432	1.023	55.438	7.391	1.957	21.479	2.839	1.332	
Stem dry weight/plant (g)	0.643	0.549	0.017	5.693	2.828	0.167	12.832	6.840	0.442	
Leaf dry weight/plant (g)	0.975	0.843	0.028	6.622	2.812	0.244	15.612	8.049	0.653	
Nodule dry weight/plant (g)	0.163	0.048	0.008	0.871	0.287	0.049	0.373	0.216	0.038	
Root dry weight/plant (g)	0.544	0.421	0.013	1.463	0.944	0.048	2.988	2.153	0.094	

Studied characters	Second season									
	53 days from sowing		LSD	84 days from sowing		LSD	112 days from sowing		LSD	
			0.050			0.050			0.050	
	Normal Salinity			Normal Salinity			Normal Salinity			
Number of nodules/ plant	22.719	20.219	1.193	39.594	36.286	2.302	30.480	26.974	2.076	
Stem dry weight/plant (g)	1.036	0.857	0.026	3.375	2.245	0.044	5.620	3.910	0.201	
Leaf dry weight/plant (g)	1.309	0.961	0.045	3.463	2.430	0.115	8.960	7.910	0.175	
Nodule dry weight/plant (g)	0.184	0.155	0.008	0.480	0.411	0.037	0.466	0.385	0.030	
Root dry weight/plant (g)	0.427	0.391	0.012	0.857	0.782	0.031	1.390	1.280	0.039	

than N fertilized plants (Yousef and Sprent 1983 and Cordovilla *et al* 1994 and 1996). Contrarasting results may be due to the effect of salinity on the different morphological processes occurred within plant, decreasing its rates as the salinity increased such as, water absorption from soil, water translocation, cell division, cell enlargements and differentiation, photosynthesis and respiration. These conclusions greed with the results of Cordovilla *et al* (1995), Al-Tahir and Al-Abdulsalam (1997) and Cordovilla *et al* (1999). Osmotic adjustment caused by drought (Berg and Turner 1976) or salinity (Shalhevet and Hsiao 1986) could be an important mechanism for increasing crop tolerance.

Effect of *Rhizobium* inoculation

Table (4) shows that faba bean growth characters were significantly affected by seed inoculation with *Rhizobium* at different growth stages in both growing seasons. In the first season, plants inoculated with strain ARC200 (R2) significantly increased stem, leaf and root dry weight/plant at the first, second and third samples and number of nodules and nodule dry weight/plant at the third sample compared to uninoculated plants and the other treatments. Plants inoculated with strain ICARDA.448 (R4) significantly exceeded the uninoculated plants for no. of nodules/plant at the

Table 4. Mean performance of studied characters under different *Rhizobium* inoculation treatments for sixteen faba bean genotypes at different growth stages during 2003/2004 and 2004/2005 seasons

Studied characters	First season																
	48 days from sowing					LSD	89 days from sowing					LSD	115 days from sowing				LSD
	R-1	R-2	R-3	R-4	0.050	R-1	R-2	R-3	R-4	0.050	R-1	R-2	R-3	R-4	0.050		
Number of nodules/ plant	13.60	14.09	14.78	17.61	1.45	24.40	31.08	31.17	39.01	2.77	10.47	16.35	10.59	11.22	1.88		
Stem dry weight/plant (g)	0.62	0.66	0.53	0.57	0.03	4.26	4.61	3.85	4.33	0.24	10.17	10.48	8.87	9.83	0.63		
Leaf dry weight/plant (g)	0.93	0.99	0.83	0.88	0.04	4.65	5.03	4.27	4.91	0.35	12.27	12.60	10.37	12.09	0.92		
Nodule dry weight/plant (g)	0.09	0.09	0.13	0.12	0.01	0.47	0.58	0.64	0.62	0.07	0.27	0.36	0.25	0.30	0.05		
Root dry weight/plant (g)	0.44	0.52	0.48	0.50	0.02	1.17	1.34	1.09	1.22	0.07	2.50	2.83	2.43	2.53	0.13		
Studied characters	Second season																
	53 days from sowing					LSD	84 days from sowing					LSD	112 days from sowing				LSD
	R-1	R-2	R-3	R-4	0.050	R-1	R-2	R-3	R-4	0.050	R-1	R-2	R-3	R-4	0.050		
Number of nodules/ plant	22.31	25.33	18.30	19.93	1.69	41.74	40.10	32.53	37.39	3.26	24.55	36.42	26.76	27.19	2.94		
Stem dry weight/plant (g)	1.04	0.98	0.89	0.87	0.04	3.02	3.02	2.68	2.52	0.06	5.54	4.88	4.44	4.21	0.28		
Leaf dry weight/plant (g)	1.28	1.04	1.09	1.14	0.06	3.12	3.11	2.74	2.81	0.16	7.79	7.61	9.31	9.04	0.25		
Nodule dry weight/plant (g)	0.18	0.18	0.14	0.17	0.01	0.48	0.46	0.38	0.46	0.05	0.40	0.45	0.45	0.41	0.04		
Root dry weight/plant (g)	0.48	0.38	0.40	0.38	0.02	0.95	0.82	0.81	0.70	0.04	1.45	1.31	1.41	1.17	0.06		

* *Rhizobium* inoculation : R1-Cont., R2- F. b. ARC 200, R3-F.b.ARC 201, R4 - F. b. ICARDA (ARC) 448

first and second samples in the first season. Such effect of seed inoculation may be due to either atmospheric N_2 -fixation or to a greater N-availability for the crop which caused vigorous plant growth. On the contrary, in the second season, control treatment was significantly increased all studied traits at the three samples, except no. of nodules/plant in the first and third samples and nodule dry weight/plant at the third sample which significantly increased with plants inoculated with strain ARC200 (R2), as well as leaf dry weight/plant at the third sample which significantly increased with plants inoculated with strain ARC201 (R3). A favorable *Rhizosphere* environment is highly important to the interaction between root hairs and *Rhizobium*, as it not only encourages the growth and multiplication of *Rhizobium* but also ensures the healthy development of root hairs. Any environmental stress that affects these processes is also likely to influence infection and nodulation (Alexander 1984). It is worthy to mention that the results were different from the first to second season because the preceding crop in the first season was corn; while in the second season was peanut in which could affect the constituent of the soil *Rhizobium*; also the soil salinity level could affect much the foundation level of the *Rhizobium*. These results are in agreement with those obtained by Monib *et al* (1994), Armanios *et al* (1996) and Hussein *et al* (1997) who reported that *Rhizobium* inoculation significantly increased nodulation of faba bean. Also,

Saleh *et al* (2000), Emara *et al* (2002), El-Khawaga *et al* (2003) and AL-Mutawa (2003) reported that poor symbiotic performance was not due to the inhibition of the growth of *R. leguminosarum* by salinity. On the other hand, Hamaoui *et al* (2001) stated that inoculation with *A. brasilense* significantly enhanced nodulation by native *Rhizobium* and improved root and shoot development, when compared with non-inoculated controls. Moreover, the bacterial treatment was shown to significantly reduce the negative effects on plant growth caused by irrigation with saline water. Cordovilla *et al* (1999) indicated that *Rhizobium leguminosarum* strain GRA19 formed an infective and effective symbiosis with faba bean under saline and non saline conditions, respectively.

Mean performance of genotypes

Mean performance of sixteen faba bean genotypes for studied growth characters at different growth stages during 2003/2004 and 2004/2005 seasons were recorded in Table (5). The results indicated that the differences among studied faba bean genotypes were significant for all growth characters at different growth stages in the both seasons, except leaf dry weight/plant at the second sample in the first season. In this concern, the rank of genotypes differed from genotype to another for all studied traits in both seasons. In the first season at the first sample, the highest values were recorded by varieties no. 4 and 1 and promising line no.15 for no. of nodules/plant, varieties no. 1, 3, 5, 6 and lines no. 16, 15 and 12, respectively, for stem dry weight/plant, the promising line no. 15 and varieties no. 1 and 4 for leaf dry weight/plant, variety no. 4 and promising line no. 13 for nodule dry weight/plant and varieties no. 5 and 1 for root dry weight/plant compared with the other genotypes. At the second sample, superior and significant values were recorded by varieties no. 4 and 1 and promising line no. 13 for no. of nodules/plant, varieties no.1, 4, 6 and line no. 10 for stem dry weight/plant, genotypes no. 4 and 9 for nodule dry weight/plant, varieties no. 4 and 5 and lines no. 14 and 15 gave higher mean values for these traits than the other lines and check varieties. At the third sample, high mean values were recorded by genotypes no. 4, 16 and 3 for no. of nodules/plant, promising lines no. 12, 13, 15, 11, 8 and 10 and the two varieties no. 5 and 4 for stem dry weight/plant, promising lines no.13, 15, 12, 8, 9, 11 and 10 and variety no. 4 for leaf dry weight/plant, lines no. 8 and 16 for nodule dry weight/plant and promising line no. 9 and variety no. 4 for root dry weight/plant than the other genotypes. In the second season at the first sample, significantly higher mean values were recorded by promising lines no 15, 10, 16 and 13 for no. of nodules/plant, variety no. 6 and promising lines no. 11 and 16 for stem dry weight/plant, genotypes no. 1, 11, 6, 7 and 15 for leaf dry weight/plant, promising lines no. 12 and 15 and the two varieties no.1 and 3 for nodule dry weight/plant and promising

Table 5. Mean performance of sixteen faba bean genotypes on studied characters at different growth stages during 2003/2004 and 2004/2005 seasons

**Genotypes	First season (2003 / 2004)																LSD
	G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	
Studied characters	First sample (48 days from sowing)																0.05
Number of nodules/ plant	18.75	16.00	16.33	20.54	11.92	9.08	16.88	10.46	14.29	12.92	12.42	14.38	17.00	14.04	18.13	17.25	3.10
Stems dry weight/plant (g)	0.67	0.41	0.65	0.60	0.65	0.61	0.60	0.58	0.57	0.57	0.56	0.61	0.59	0.59	0.64	0.65	0.07
Leaves dry weight/plant (g)	1.02	0.74	0.93	1.02	0.91	0.93	0.90	0.93	0.90	0.88	0.84	0.92	0.82	0.95	1.08	0.78	0.08
Nodules dry weight/plant (g)	0.09	0.10	0.12	0.15	0.08	0.07	0.07	0.10	0.10	0.12	0.11	0.10	0.15	0.09	0.12	0.13	0.02
Roots dry weight/plant (g)	0.54	0.45	0.45	0.53	0.57	0.49	0.51	0.41	0.48	0.48	0.45	0.42	0.51	0.43	0.51	0.50	0.05
	Second sample (89 days from sowing)																
Number of nodules/ plant	41.88	29.67	31.46	42.33	31.92	20.04	27.79	24.58	28.13	31.25	24.63	34.75	38.79	29.13	31.50	34.79	6.59
Stems dry weight/plant (g)	5.14	4.03	4.45	4.83	4.12	4.52	4.47	4.16	4.13	4.51	3.46	4.44	4.29	3.95	3.92	3.76	0.64
Leaves dry weight/plant (g)	5.31	4.38	4.78	5.25	4.92	4.67	4.78	4.61	4.53	4.89	4.09	4.92	4.59	4.40	4.60	4.77	NS
Nodules dry weight/plant (g)	0.52	0.42	0.56	0.79	0.41	0.64	0.46	0.56	0.74	0.64	0.58	0.63	0.67	0.56	0.58	0.49	0.12
Roots dry weight/plant (g)	1.26	1.04	1.11	1.41	1.31	1.05	1.22	1.21	1.20	1.19	1.15	1.17	1.20	1.28	1.29	1.18	0.15
	Third sample (115 days from sowing)																
Number of nodules/ plant	15.08	9.92	15.71	19.17	11.25	8.04	7.50	13.58	10.25	12.96	14.71	12.00	13.79	6.96	7.00	16.63	3.51
Stems dry weight/plant (g)	8.54	7.48	9.71	10.47	10.59	8.14	8.96	10.89	9.57	10.44	10.95	12.03	11.73	8.42	11.02	8.45	2.05
Leaves dry weight/plant (g)	10.16	9.11	12.10	12.52	10.71	9.98	10.76	12.84	12.83	12.44	12.55	13.30	14.30	11.01	13.56	11.12	2.20
Nodules dry weight/plant (g)	0.27	0.23	0.32	0.31	0.26	0.27	0.12	0.49	0.35	0.31	0.22	0.22	0.34	0.37	0.22	0.41	0.10
Roots dry weight/plant (g)	2.22	1.92	2.83	3.08	2.35	2.20	2.42	2.58	3.26	2.38	2.70	2.45	2.85	2.74	2.86	2.30	0.37

Table 5. Cont.....

Second season (2004/ 2005)																	
**Genotypes	G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	LSD
Studied characters	First sample (53 days from sowing)																0.05
Number of nodules/ plant	24.42	18.75	18.88	23.54	17.42	15.50	20.13	16.83	15.00	26.67	22.42	23.67	24.92	21.00	27.79	26.58	3.34
Stems dry weight/plant (g)	0.96	0.76	0.96	0.79	0.80	1.13	0.89	0.89	1.03	0.93	1.08	0.95	0.90	1.01	1.00	1.06	0.10
Leaves dry weight/plant (g)	1.31	0.85	1.14	1.03	1.13	1.27	1.23	1.03	1.14	1.18	1.30	1.13	1.01	1.06	1.20	1.15	0.12
Nodules dry weight/plant (g)	0.22	0.14	0.20	0.15	0.16	0.17	0.13	0.15	0.16	0.16	0.17	0.22	0.16	0.16	0.22	0.16	0.03
Root dry weight/plant (g)	0.44	0.30	0.35	0.40	0.40	0.40	0.39	0.36	0.42	0.42	0.52	0.42	0.44	0.34	0.51	0.42	0.05
Second sample (84 days from sowing)																	
Number of nodules/ plant	44.96	30.67	33.21	40.75	27.46	31.25	33.79	33.42	29.33	43.67	40.46	44.46	43.21	33.08	50.38	46.96	6.26
Stems dry weight/plant (g)	2.95	1.98	2.67	2.72	2.57	2.97	2.77	3.19	2.76	2.57	3.41	2.47	2.81	2.85	3.46	2.81	0.33
Leaves dry weight/plant (g)	3.27	2.13	2.71	2.70	2.31	3.18	2.74	3.15	3.11	2.88	3.75	2.70	2.91	2.85	3.67	3.08	0.34
Nodules dry weight/plant (g)	0.43	0.27	0.52	0.43	0.31	0.34	0.36	0.38	0.44	0.46	0.56	0.53	0.46	0.50	0.65	0.50	0.08
Root dry weight/plant (g)	0.85	0.63	0.76	0.89	0.77	0.80	0.79	0.88	0.82	0.77	0.98	0.69	0.86	0.75	1.06	0.83	0.09
Third sample (112 days from sowing)																	
Number of nodules/ plant	35.75	24.67	22.17	27.04	15.04	20.71	18.58	20.42	17.63	35.38	34.54	40.00	35.13	26.58	33.59	52.46	6.86
Stems dry weight/plant (g)	4.59	4.47	4.13	4.60	5.15	4.95	4.27	5.58	4.87	5.12	4.98	4.30	4.57	4.36	5.39	4.95	0.62
Leaves dry weight/plant (g)	8.48	7.69	7.35	8.48	8.56	8.05	8.20	8.82	8.45	8.62	8.34	7.92	7.92	8.60	10.18	9.35	0.59
Nodules dry weight/plant (g)	0.42	0.42	0.39	0.41	0.17	0.30	0.29	0.51	0.31	0.51	0.50	0.52	0.60	0.31	0.57	0.58	0.10
Root dry weight/plant (g)	1.30	1.13	1.28	1.46	1.32	1.47	1.33	1.39	1.24	1.24	1.49	1.17	1.38	1.26	1.53	1.38	0.15
**Genotypes: Varieties:	G1-Sakha 2, G2-Giza40, G3-Giza 429, G4-Giza 3, G5-Nubaria 1, G6-Giza 843, G7-Giza 716																
Lines:	G8-L. 284, G9-L. 258, G10-L. 244, G11-L. 252, G12-L. 278, G13-L. 332, G14-L. 336, G15-L.285, G16-L.163																

lines no.11 and 15 for root dry weight/plant, at the second sample, promising line no. 15 had significant higher mean values for all studied traits than the other lines and check varieties, at the third sample, the line no. 16 for no. of nodule/plant, genotypes no. 15, 8, 5, 10 and 11 for stem dry weight/plant, line no. 15 for leaf dry weight/plant, lines no. 13, 16, 15, 12, 10 and 8 for nodule dry weight/plant and promising lines no.15, 11 and 8 and the two varieties no. 6 and 4 for root dry weight/plant these genotypes had significantly higher mean values for these traits than the other lines and check varieties. In general, it could be noticed that the superiority of variety no. 4 and promising line no.15 at different samples in both seasons and line no. 11 in the second season across all the rest genotypes for most traits may be due to its superiority in growth traits which led to more physiological and photosynthetic activity, hence more metabolite accumulation, high seed yield/plant and consequently seed yield/fad. Ahmed *et al* (1997) reported that the differences among faba bean cultivars in growth parameters may be due to the differences in number of nodules formed on the roots of the tested cultivars, consequently, the growth of each cultivar may depend mainly on nitrogen fixation. Furthermore, the results of varietal differences, herein are confirmed with those obtained by Hafiz and El-Kholy (2000), Hassanein (2000), Darwish *et al* (2003), El-Khawaga *et al* (2003) and Kassab (2004).

The interaction between soil salinity and *Rhizobium* inoculation

Data in Table (6) showed that the effect of interaction between soil salinity levels and *Rhizobium* inoculation treatments was significant for all growth traits at different growth stages in both seasons, except stem and leaf dry weight/plant at the second sample in the first season and no. of nodules/plant at the third sample in the second season. In general, *Rhizobium* inoculation treatments interacted differently from trait to another under normal soil conditions compared to salinity soil conditions in the first and second seasons. These results are in harmony with those obtained by Cordovilla *et al* (1999), Katerji *et al* (2001) and El-Khawaga *et al* (2003). In general, plants inoculated with strain ARC 200 in the first season and control treatment (uninoculated plants) in the second season significantly showed the highest values for most studied traits at different samples under normal soil conditions.

The interaction between soil salinity levels and faba bean genotypes

Tables (7 and 8) revealed that the interaction between soil salinity levels and faba bean genotypes significantly affects all studied traits at different growth stages in both seasons. Results also reported that there were substantial differences between genotypes in their response to salinity soil conditions in the first and the second seasons. In general, genotypes behaved better under normal soil conditions than under saline soil conditions for all

Table 6. Response of faba bean plants to normal and saline soils and Rhizobium inoculation for recorded characters at different growth stages during 2003/2004 and 2004/2005 seasons

Studied characters	First season									Second season									
	Normal soil				Salinity soil					LSD	Normal soil				Salinity soil				
	* Rhizobium inoculation				R1	R2	R3	R4	* Rhizobium inoculation				LSD						
	R1	R2	R3	R4					R1		R2	R3		R4					
48 days from sowing										53 days from sowing									
Number of nodules/plant	25.833	26.167	24.708	29.750	1.375	2.021	4.854	5.479	2.045	23.479	20.146	19.458	17.792	21.146	30.521	17.146	22.063	2.387	
Stems dry weight/plant (g)	0.685	0.704	0.559	0.624	0.560	0.617	0.505	0.516	0.035	1.084	1.050	1.046	0.963	0.995	0.910	0.738	0.785	0.052	
Leaves dry weight/plant (g)	0.997	1.059	0.888	0.957	0.869	0.917	0.771	0.813	0.055	1.481	1.144	1.308	1.305	1.072	0.940	0.865	0.969	0.090	
Nodules dry weight/plant (g)	0.156	0.149	0.163	0.186	0.025	0.031	0.088	0.047	0.017	0.204	0.201	0.145	0.187	0.161	0.156	0.141	0.161	0.016	
Root dry weight/plant (g)	0.526	0.585	0.532	0.534	0.361	0.446	0.420	0.457	0.025	0.488	0.398	0.451	0.371	0.463	0.365	0.344	0.394	0.025	
89 days from sowing										84 days from sowing									
Number of nodules/plant	45.396	57.854	52.458	66.042	3.396	4.313	9.875	11.979	3.914	46.583	34.667	34.229	29.667	36.896	45.542	30.833	45.104	4.604	
Stems dry weight/plant (g)	5.665	6.217	5.148	5.742	2.848	3.005	2.542	2.916	NS	3.783	3.408	3.356	2.951	2.251	2.637	1.997	2.095	0.888	
Leaves dry weight/plant (g)	6.627	7.106	5.933	6.821	2.679	2.960	2.614	2.994	NS	3.887	3.393	3.531	3.041	2.359	2.824	1.956	2.582	0.230	
Nodules dry weight/plant (g)	0.838	0.929	0.861	0.855	0.112	0.237	0.419	0.379	0.099	0.498	0.391	0.392	0.363	0.463	0.528	0.375	0.553	0.074	
Root dry weight/plant (g)	1.425	1.656	1.278	1.494	0.906	1.027	0.892	0.953	0.096	0.995	0.845	0.885	0.703	0.903	0.794	0.744	0.687	0.063	
115 days from sowing										112 days from sowing									
Number of nodules/plant	18.708	29.146	18.583	19.479	2.229	3.563	2.604	2.958	2.663	24.731	39.792	27.188	30.229	24.375	33.042	26.333	24.146	NS	
Stems dry weight/plant (g)	12.960	14.372	10.864	13.133	7.388	6.583	6.872	6.517	0.885	6.948	5.100	5.619	4.812	4.124	4.661	3.265	3.599	0.401	
Leaves dry weight/plant (g)	16.566	17.482	12.728	15.671	7.971	7.712	8.004	8.511	1.306	9.174	9.516	10.355	9.182	6.409	5.702	8.268	8.896	0.350	
Nodules dry weight/plant (g)	0.333	0.486	0.319	0.353	0.214	0.229	0.172	0.251	0.076	0.400	0.479	0.501	0.489	0.397	0.419	0.393	0.330	0.059	
Root dry weight/plant (g)	2.830	3.535	2.573	3.015	2.161	2.124	2.287	2.041	0.189	1.569	1.386	1.516	1.092	1.332	1.236	1.311	1.238	0.077	

* Rhizobium inoculation : R1 - Control, R2 - F.b.ARC 200, R3 - F.b.ARC 201 Studied characters R4 - F.b. TCARDA (ARC) 448

Table 7. Response of sixteen faba bean genotypes to normal and saline soils for recorded characters at different growth stages during 2003/2004 season

**Genotypes		G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	LSD
Studied characters	**salinity	First sample (48 days after sowing)																0.05
Number of nodules/plant	N	34.42	30.08	28.33	34.92	22.58	16.75	31.33	19.58	26.83	21.08	21.58	25.83	27.25	25.42	32.75	27.08	4.39
	S	3.08	1.92	4.33	6.17	1.25	1.42	2.42	1.33	1.75	4.75	3.25	2.92	6.75	2.67	3.50	7.42	
Stems dry weight/plant (g)	N	0.68	0.45	0.65	0.67	0.65	0.58	0.64	0.69	0.62	0.57	0.59	0.68	0.71	0.61	0.76	0.74	0.10
	S	0.65	0.38	0.65	0.53	0.65	0.63	0.56	0.48	0.51	0.58	0.53	0.54	0.46	0.56	0.53	0.57	
Leaves dry weight/plant (g)	N	1.14	0.74	0.97	1.06	0.93	0.94	0.93	1.06	0.94	0.96	0.90	0.96	0.99	0.96	1.33	0.81	0.11
	S	0.89	0.74	0.90	0.98	0.89	0.92	0.87	0.80	0.86	0.79	0.78	0.88	0.66	0.93	0.84	0.75	
Nodules dry weight/plant (g)	N	0.16	0.16	0.20	0.18	0.14	0.12	0.13	0.19	0.17	0.14	0.17	0.14	0.23	0.16	0.19	0.13	0.03
	S	0.02	0.05	0.03	0.12	0.01	0.02	0.02	0.01	0.02	0.10	0.05	0.06	0.07	0.01	0.05	0.14	
Roots dry weight/plant (g)	N	0.54	0.51	0.53	0.63	0.62	0.58	0.56	0.51	0.54	0.52	0.50	0.46	0.58	0.49	0.58	0.56	0.07
	S	0.53	0.40	0.38	0.42	0.53	0.40	0.45	0.31	0.43	0.43	0.40	0.37	0.44	0.38	0.45	0.44	
Studied characters		Second sample (89 days after sowing)																
Number of nodules/plant	N	78.00	54.42	54.58	72.92	60.67	36.17	49.83	45.58	51.50	52.50	41.25	60.42	67.33	52.92	54.75	54.17	9.32
	S	5.75	4.92	8.33	11.75	3.17	3.92	5.75	3.58	4.75	10.00	8.00	9.08	10.25	5.33	8.25	15.42	
Stems dry weight/plant(g)	N	7.93	5.59	5.28	6.19	5.57	6.12	6.11	6.12	5.47	5.79	4.52	6.10	5.92	4.76	5.41	4.20	0.91
	S	2.35	2.47	3.61	3.47	2.67	2.91	2.82	2.20	2.79	3.24	2.40	2.78	2.66	3.13	2.44	3.32	
Leaves dry weight/plant (g)	N	8.21	5.92	6.42	6.86	7.02	6.66	6.78	7.10	6.06	6.71	5.99	7.03	6.73	5.76	6.57	6.13	1.02
	S	2.41	2.84	3.14	3.64	2.82	2.68	2.77	2.12	2.99	3.06	2.19	2.80	2.45	3.05	2.63	3.40	
Nodules dry weight /plant(g)	N	0.83	0.62	0.81	1.03	0.76	1.00	0.65	0.98	1.09	0.98	0.95	0.88	1.02	0.93	0.81	0.60	0.17
	S	0.21	0.23	0.31	0.55	0.06	0.29	0.26	0.15	0.39	0.30	0.22	0.38	0.33	0.18	0.36	0.38	
Roots dry weight /plant (g)	N	1.49	1.33	1.37	1.69	1.51	1.29	1.41	1.72	1.50	1.39	1.28	1.41	1.53	1.42	1.62	1.45	0.21
	S	1.03	0.76	0.85	1.13	1.10	0.81	1.03	0.70	0.90	0.98	1.01	0.92	0.86	1.14	0.96	0.91	

Table 7. Cont.

**Genotypes		G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	LSD
Studied characters	*salinity	Third sample (115 days after sowing)																0.05
Number of nodules/ plant	N	28.08	17.58	30.00	32.42	21.25	14.83	13.58	22.08	17.58	24.67	25.08	20.08	23.67	12.50	11.50	28.75	4.96
	S	2.08	2.25	1.42	5.92	1.25	1.25	1.42	5.08	2.92	1.25	4.33	3.92	3.92	1.42	2.50	4.50	
Stems dry weight/plant (g)	N	12.92	9.93	12.89	13.18	14.93	11.10	12.32	13.16	11.14	14.17	13.69	16.36	13.66	12.29	13.86	9.72	2.90
	S	4.16	5.03	6.54	7.76	6.25	5.19	5.59	8.61	7.99	6.71	8.21	7.70	9.80	4.54	8.18	7.18	
Leaves dry weight/plant (g)	N	15.18	11.26	16.02	15.97	14.69	14.44	15.15	16.34	15.83	16.03	15.10	19.36	16.46	16.32	17.77	13.86	3.11
	S	5.13	6.96	8.18	9.08	6.72	5.52	6.37	9.34	9.83	8.86	10.01	7.24	12.13	5.69	9.35	8.38	
Nodules dry weight/plant (g)	N	0.28	0.34	0.50	0.36	0.48	0.42	0.15	0.40	0.37	0.40	0.29	0.33	0.38	0.63	0.31	0.46	0.14
	S	0.25	0.13	0.15	0.27	0.05	0.13	0.09	0.57	0.32	0.21	0.15	0.10	0.30	0.12	0.13	0.36	
Roots dry weight/plant (g)	N	2.65	2.53	3.63	3.82	2.72	2.49	2.80	3.01	3.55	2.99	2.93	2.77	2.86	3.35	3.41	2.31	0.52
	S	1.80	1.31	2.03	2.34	1.99	1.90	2.04	2.16	2.98	1.76	2.48	2.14	2.84	2.12	2.30	2.29	

*salinity : N = normal soil S = salinity soil

**Genotypes:

Varieties:

G1-Sakha 2, G2-Giza40, G3-Giza 429, G4-Giza 3, G5-Nubaria 1, G6-Giza 843, G7-Giza 716

Lines:

G8-L. 284, G9-L. 258, G10-L. 244, G11-L. 252, G12-L. 278, G13-L. 332, G14-L. 336, G15-L.285, G16-L.163

Table 8. Response of sixteen faba bean genotypes to normal and saline soils for recorded characters at different growth stages during 2004/2005 season

**Genotypes		G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	LSD
Studied characters	*salinity	First sample (53 days from sowing)																
Number of nodules/plant	N	27.42	22.92	20.50	22.67	19.58	17.33	21.75	18.17	15.75	28.42	23.33	29.50	26.00	27.08	27.17	29.58	4.72
	S	21.42	14.58	17.25	24.42	15.25	13.67	18.50	15.50	14.25	24.92	21.50	17.83	23.83	14.92	28.42	23.58	
Stems dry weight/plant (g)	N	1.12	0.80	1.01	0.80	0.77	1.25	1.01	0.85	1.11	1.06	1.37	0.96	1.02	1.16	1.13	1.17	0.13
	S	0.80	0.73	0.91	0.79	0.84	1.01	0.77	0.94	0.96	0.81	0.79	0.94	0.78	0.85	0.88	0.95	
Leaves dry weight/plant (g)	N	1.61	0.85	1.29	1.31	1.39	1.55	1.36	1.09	1.22	1.48	1.52	1.17	1.17	1.17	1.52	1.26	0.17
	S	1.01	0.86	0.99	0.75	0.88	1.00	1.11	0.96	1.05	0.88	1.08	1.09	0.86	0.95	0.88	1.05	
Nodules dry weight/plant (g)	N	0.25	0.15	0.23	0.17	0.16	0.18	0.14	0.13	0.19	0.18	0.18	0.25	0.14	0.18	0.26	0.17	0.04
	S	0.19	0.12	0.17	0.13	0.15	0.15	0.13	0.17	0.13	0.15	0.16	0.19	0.18	0.14	0.18	0.16	
Roots dry weight/plant (g)	N	0.50	0.31	0.37	0.43	0.41	0.41	0.44	0.36	0.47	0.46	0.51	0.38	0.44	0.38	0.52	0.42	0.06
	S	0.38	0.30	0.34	0.38	0.39	0.39	0.34	0.36	0.38	0.38	0.52	0.46	0.43	0.30	0.50	0.41	
		Second sample (84 days from sowing)																
Number of nodules/plant	N	45.17	36.25	36.08	37.17	30.92	34.17	34.25	32.67	28.92	35.33	39.17	58.25	41.25	39.75	54.67	49.50	8.86
	S	44.75	25.08	30.33	44.33	24.00	28.33	33.33	34.17	29.75	52.00	41.75	30.67	45.17	26.42	46.08	44.42	
Stems dry weight/plant (g)	N	3.86	2.17	3.26	3.64	3.18	3.67	3.28	3.50	3.41	3.17	4.41	2.48	3.27	3.58	4.03	3.08	0.47
	S	2.04	1.79	2.07	1.80	1.97	2.28	2.26	2.89	2.10	1.96	2.41	2.47	2.35	2.12	2.89	2.53	
Leaves dry weight/plant (g)	N	3.91	2.22	3.03	3.65	2.75	3.89	3.12	3.52	3.77	3.62	4.78	2.78	3.47	3.61	4.06	3.25	0.48
	S	2.64	2.04	2.39	1.74	1.86	2.47	2.37	2.79	2.44	2.15	2.73	2.62	2.36	2.09	3.29	2.92	
Nodules dry weight/plant (g)	N	0.51	0.28	0.63	0.34	0.28	0.37	0.42	0.34	0.51	0.46	0.64	0.74	0.39	0.52	0.82	0.44	0.11
	S	0.35	0.25	0.41	0.52	0.34	0.31	0.31	0.42	0.37	0.45	0.48	0.32	0.53	0.47	0.48	0.57	
Roots dry weight/plant (g)	N	0.86	0.51	0.76	0.99	0.83	0.91	0.83	0.99	0.87	0.87	1.10	0.65	0.88	0.81	1.13	0.74	0.13
	S	0.83	0.76	0.76	0.80	0.72	0.68	0.75	0.77	0.78	0.66	0.86	0.73	0.84	0.68	0.98	0.92	

Table 8. Cont.

**Genotypes		G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	LSD
Studied characters	*salinity	Third sample (112 days after sowing)																0.05
Number of nodules/ plant	N	43.92	28.17	21.33	36.75	17.08	26.25	20.08	26.58	19.25	48.67	37.83	31.00	40.92	31.58	33.75	43.25	9.71
	S	27.58	21.17	23.00	17.33	13.00	15.17	17.08	14.25	16.00	22.08	31.25	49.00	29.33	21.58	33.42	61.67	
Stems dry weight/plant (g)	N	5.96	4.73	4.53	5.30	6.70	6.15	4.85	7.57	5.78	6.20	5.42	4.64	5.15	5.41	5.88	5.64	0.87
	S	3.22	4.21	3.73	3.89	3.61	3.75	3.69	3.58	3.96	4.03	4.54	3.96	3.99	3.30	4.90	4.26	
Leaves dry weight/plant (g)	N	8.56	9.24	8.00	9.45	8.59	8.16	9.15	8.95	8.42	9.37	8.88	9.02	9.19	8.28	10.57	9.60	0.83
	S	8.40	6.13	6.70	7.51	8.53	7.93	7.24	8.69	8.48	7.88	7.81	6.82	6.66	8.92	9.80	9.10	
Nodules dry weight/plant (g)	N	0.60	0.44	0.44	0.56	0.24	0.34	0.35	0.51	0.33	0.39	0.54	0.61	0.57	0.30	0.62	0.63	0.14
	S	0.25	0.41	0.34	0.26	0.11	0.27	0.23	0.51	0.29	0.63	0.46	0.42	0.64	0.31	0.53	0.54	
Roots dry weight/plant (g)	N	1.41	1.10	1.24	1.63	1.50	1.56	1.45	1.56	1.31	1.46	1.59	1.25	1.45	1.36	1.63	1.65	0.22
	S	1.19	1.15	1.32	1.30	1.14	1.38	1.21	1.22	1.17	1.02	1.39	1.10	1.31	1.16	1.44	1.11	

*salinity :

N = normal soil

S = salinity soil

**Genotypes:

Varieties:

G1-Sakha 2, G2-Giza40, G3-Giza 429, G4-Giza 3, G5-Nubaria 1, G6-Giza 843, G7-Giza 716

Lines:

G8-L. 284, G9-L. 258, G10-L. 244, G11-L. 252, G12-L. 278, G13-L. 332, G14-L. 336, G15-L.285, G16-L.163

studied traits at different growth stages in both seasons. Data also revealed that the response of different genotypes in this study differed in tolerance to salinity from trait to another. Evidence presented here suggests a need to select under stress. Genetic variation for tolerance in the gene pool of a crop species is of prime importance for the improvement of salt tolerance through selection and breeding. Inter and intra – specific and intra – cultivar variation for tolerance provides a scope for breeding and selection. Similar results are in agreement with the findings of Cordovilla *et al* (1995), El-khawaga *et al* (2003), Hassanein (2000) and Kassab (2004), who found significant differences among the tested faba bean varieties with respect to growth parameters. As for the first order interaction between RxG, significant effects were found for all studied traits at different growth stages in both seasons

The interaction between soil salinity, *Rhizobium* inoculation and genotypes

Results of the three way interaction for all studied characters at different growth stages in the both seasons are presented in Tables (9 and 10). The magnitude of interaction differed from genotype to another. In the first season, results in the Table (9), showed that under normal soil conditions, plants inoculated by strain ICARDA 448 (R4) exhibited superiority with genotype no.7 for no. of nodules/plant and line no.13 for root dry weight/plant at the first sample and line no.9 for nodule dry weight/plant at the second sample as well as genotype no. 8 for nodule dry weight/plant under soil salinity conditions at the third sample. Control treatment (uninoculated plants) gave the highest values under normal soil conditions with genotype no. 1 for stem and leaf dry weight at the first and second samples in both seasons and with mutant line no.8 for root dry weight at the second sample, whereas plants inoculated by strain ARC 201 (R3) had the highest mean values with promising line no.16 under soil salinity conditions for nodule dry weight at the first sample and with genotypes no. 4 for root dry weight/plant and no.1 for no. of nodules/plant at the first and second samples, respectively. At the third sample, control treatment showed superiority with mutant line no. 8 under normal soil conditions for stem, leaf and root dry weight. In the second season, under normal soil salinity conditions, control treatment had the highest mean values with promising lines no. 16 and 11 for stem and leaf dry weight/plant at the first and second samples, respectively, and with promising line no. 15 for nodule dry weight/plant at the first sample as well as with root dry weight/plant at the second and third samples, and the promising line no.13 for no. of nodules/plant at the second sample. Whereas plants inoculated with ARC 201 (R3) showed superiority with line no.15 for root dry weight at the first sample, with line no.8 and Nubaria 1 cv. for stem and leaf dry 201

Table 9. Response of sixteen faba bean genotypes to normal and saline soils and Rhizobium inoculation for recorded characters at different growth stages during 2003/2004 season

Studied characters	salinity level	*Rizo bium	First sample (48 days from sowing)													LSD			
			G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13		G-14	G-15	G-16
Number of nodules/plant	Normal	R-1	43.67	29.33	20.67	46.67	20.33	14.67	35.33	24.33	25.33	25.00	23.00	18.00	29.33	17.00	23.67	17.00	8.77
		R-2	26.00	24.67	27.67	31.67	29.33	23.33	27.33	18.67	28.67	13.00	35.33	33.67	26.33	23.00	22.00	28.00	
		R-3	30.67	31.67	36.33	34.00	20.33	11.67	11.00	10.33	15.67	20.33	18.00	24.00	24.33	27.00	41.33	38.67	
		R-4	37.33	34.67	28.67	27.33	20.33	17.33	51.67	25.00	37.67	26.00	10.00	27.67	29.00	34.67	44.00	24.67	
	Salinity	R-1	4.00	1.00	0.00	3.33	0.00	1.00	1.33	0.00	1.67	1.67	0.00	1.00	0.67	0.67	1.67	4.00	
		R-2	0.67	1.00	3.33	8.33	0.67	0.67	2.00	0.67	2.33	1.67	1.00	0.00	3.67	0.00	5.00	1.33	
		R-3	0.33	0.33	3.00	4.33	1.33	0.67	1.67	0.00	0.00	10.33	2.67	7.00	15.00	5.67	4.33	21.00	
		R-4	7.33	5.33	11.00	8.67	3.00	3.33	4.67	4.67	3.00	5.33	9.33	3.67	7.67	4.33	3.00	3.33	
Stems dry weight/plant(g)	Normal	R-1	1.10	0.42	0.73	0.83	0.77	0.47	0.87	0.64	0.76	0.51	0.54	0.68	0.83	0.44	0.64	0.72	0.20
		R-2	0.54	0.45	0.79	0.75	0.76	0.68	0.84	0.67	0.57	0.43	0.62	0.81	0.69	0.75	0.88	1.04	
		R-3	0.47	0.57	0.54	0.61	0.47	0.41	0.36	0.58	0.38	0.65	0.63	0.72	0.54	0.56	0.81	0.64	
		R-4	0.62	0.37	0.55	0.49	0.61	0.77	0.49	0.88	0.76	0.67	0.56	0.52	0.78	0.69	0.70	0.54	
	Salinity	R-1	0.66	0.47	0.52	0.46	0.44	0.64	0.59	0.40	0.63	0.70	0.68	0.59	0.56	0.60	0.56	0.46	
		R-2	0.76	0.22	0.72	0.54	0.70	0.83	0.64	0.44	0.40	0.80	0.48	0.79	0.54	0.56	0.75	0.70	
		R-3	0.50	0.41	0.71	0.76	1.03	0.62	0.49	0.41	0.42	0.27	0.38	0.31	0.30	0.59	0.42	0.45	
		R-4	0.66	0.40	0.64	0.38	0.43	0.41	0.50	0.65	0.61	0.55	0.56	0.46	0.46	0.49	0.41	0.66	
Leaves dry weight/plant(g)	Normal	R-1	1.57	0.65	0.96	1.12	1.09	0.87	1.09	1.23	0.99	0.78	0.88	0.88	1.08	0.74	1.35	0.69	0.23
		R-2	1.07	0.86	1.13	1.26	1.00	0.72	1.26	0.95	1.11	0.81	0.91	1.14	0.98	1.20	1.33	1.22	
		R-3	0.96	0.69	0.93	0.97	0.64	0.83	0.51	0.88	0.77	1.07	1.12	1.01	0.76	0.95	1.37	0.74	
		R-4	0.95	0.76	0.87	0.88	0.97	1.32	0.85	1.17	0.88	1.18	0.69	0.80	1.15	0.96	1.25	0.61	
	Salinity	R-1	0.94	0.72	0.87	0.95	0.76	0.93	0.81	0.70	0.94	0.83	0.82	1.11	0.76	1.09	0.96	0.71	
		R-2	0.88	0.74	1.02	1.03	0.74	1.16	0.94	0.89	0.80	0.96	0.96	1.07	0.76	0.88	0.95	0.88	
		R-3	1.10	0.79	0.74	1.21	1.13	0.70	0.82	0.69	0.79	0.70	0.70	0.62	0.39	0.81	0.61	0.55	
		R-4	0.65	0.70	0.95	0.74	0.95	0.90	0.93	0.92	0.89	0.69	0.63	0.70	0.71	0.95	0.86	0.84	

Table 9. Cont.

Studied characters	salinity level	*Rizo bium	**Genotypes															LSD	
			G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	0.050	G-11	G-12	G-13	G-14	G-15	G-16		0.050
Nodules dry weight/plant(g)	Normal	R-1	0.22	0.16	0.32	0.22	0.12	0.08	0.11	0.14	0.23	0.13	0.16	0.05	0.10	0.09	0.20	0.18	0.06
		R-2	0.11	0.10	0.17	0.15	0.17	0.17	0.14	0.14	0.15	0.04	0.16	0.20	0.13	0.20	0.17	0.18	
		R-3	0.18	0.14	0.18	0.20	0.12	0.12	0.10	0.24	0.13	0.17	0.14	0.16	0.33	0.15	0.19	0.05	
		R-4	0.13	0.24	0.15	0.16	0.16	0.11	0.15	0.23	0.18	0.20	0.21	0.17	0.36	0.21	0.18	0.13	
	Salinity	R-1	0.03	0.11	0.00	0.05	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.01	0.01	0.00	0.03	0.09	
		R-2	0.01	0.05	0.03	0.19	0.00	0.01	0.01	0.00	0.03	0.01	0.01	0.00	0.03	0.00	0.10	0.01	
		R-3	0.01	0.00	0.03	0.18	0.01	0.00	0.01	0.00	0.00	0.30	0.02	0.19	0.21	0.02	0.03	0.41	
		R-4	0.02	0.05	0.07	0.07	0.02	0.04	0.04	0.05	0.04	0.06	0.15	0.03	0.04	0.02	0.03	0.04	
Roots dry weight/plant(g)	Normal	R-1	0.58	0.45	0.46	0.66	0.59	0.41	0.55	0.52	0.60	0.37	0.68	0.35	0.56	0.52	0.51	0.62	0.13
		R-2	0.53	0.57	0.66	0.54	0.70	0.74	0.66	0.54	0.63	0.56	0.50	0.61	0.60	0.49	0.57	0.47	
		R-3	0.50	0.56	0.44	0.76	0.69	0.55	0.65	0.50	0.50	0.52	0.40	0.53	0.41	0.38	0.63	0.50	
		R-4	0.56	0.44	0.55	0.58	0.50	0.60	0.37	0.49	0.42	0.65	0.43	0.37	0.76	0.56	0.61	0.66	
	Salinity	R-1	0.51	0.35	0.32	0.41	0.33	0.31	0.37	0.24	0.29	0.36	0.38	0.34	0.28	0.28	0.53	0.47	
		R-2	0.61	0.40	0.34	0.41	0.65	0.54	0.54	0.35	0.25	0.44	0.43	0.41	0.41	0.47	0.43	0.47	
		R-3	0.44	0.29	0.40	0.49	0.61	0.35	0.38	0.27	0.59	0.44	0.41	0.28	0.55	0.43	0.35	0.44	
		R-4	0.56	0.54	0.46	0.38	0.51	0.42	0.52	0.37	0.56	0.47	0.38	0.44	0.50	0.32	0.47	0.40	

Table 9. Cont

Studied characters	salinity level	* Rizo bitum	** Genotypes														LSD 0.050	
			G-1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14		G-15
Second sample (29 days from sowing)																		
Number of nodules/plant	Normal	R-1	55.67	43.00	33.67	69.00	38.33	34.33	52.00	75.33	35.33	39.67	32.00	37.00	63.00	27.33	48.67	42.00
		R-2	83.67	35.33	64.33	91.33	68.67	48.33	36.33	29.67	66.67	28.00	75.67	84.00	68.33	44.33	26.00	75.00
		R-3	109.00	58.33	52.67	86.33	53.00	21.00	33.33	24.33	27.67	55.33	31.00	53.00	62.67	56.33	76.67	61.67
		R-4	63.67	84.00	67.67	65.00	82.67	41.00	77.67	53.00	76.33	87.00	26.33	67.67	75.33	83.67	67.67	38.00
	Salinity	R-1	2.33	2.00	1.33	6.00	0.33	3.00	3.33	0.00	5.00	5.33	1.33	4.67	1.00	1.33	6.67	10.67
		R-2	1.00	2.33	6.00	15.67	2.00	3.33	3.67	2.00	3.67	2.00	5.67	2.67	5.00	0.00	9.00	5.00
		R-3	2.67	0.67	5.67	9.33	3.33	1.67	5.00	1.67	2.00	19.33	12.00	19.00	22.67	9.33	9.00	34.67
		R-4	17.00	14.67	20.33	16.00	7.00	7.67	11.00	10.67	8.33	13.33	13.00	10.00	12.33	10.67	8.33	11.33
Stems dry weight/plant (g)	Normal	R-1	9.73	3.74	5.51	6.54	5.49	8.85	5.28	8.57	3.26	5.95	4.76	5.47	6.60	2.14	6.47	2.27
		R-2	8.08	6.37	7.17	5.84	5.99	5.80	6.32	5.30	7.61	5.15	5.76	5.18	6.03	7.89	5.08	5.89
		R-3	7.37	8.22	4.85	7.85	4.69	4.83	6.32	4.97	3.84	4.87	3.95	6.07	5.71	3.73	5.51	3.89
		R-4	6.56	7.04	3.90	4.82	6.09	5.31	6.82	6.03	7.19	7.18	3.62	7.67	5.34	5.27	4.57	4.76
	Salinity	R-1	1.79	2.07	3.19	2.71	2.34	2.55	3.14	2.55	3.15	3.87	1.77	2.73	3.80	2.67	3.63	3.60
		R-2	2.61	2.41	3.00	4.72	1.80	4.01	2.80	2.47	3.29	3.50	2.65	3.06	2.90	3.44	2.56	2.78
		R-3	2.84	2.34	3.73	3.69	2.76	1.88	2.71	1.66	1.82	3.07	2.43	2.22	2.19	3.03	1.31	3.02
		R-4	2.14	3.05	4.52	2.75	3.78	3.23	2.96	2.10	2.92	2.53	2.74	3.10	1.74	3.40	2.24	3.87
Leaves dry weight/plant (g)	Normal	R-1	9.41	3.30	7.86	5.31	6.61	8.60	4.44	9.14	5.99	6.24	5.45	6.64	7.61	3.03	8.20	6.61
		R-2	9.42	6.95	8.11	6.91	8.82	7.22	8.01	6.69	4.84	5.23	7.07	7.17	7.93	8.16	5.61	8.86
		R-3	6.50	5.61	5.36	8.89	5.38	6.88	8.41	5.25	4.76	6.03	6.68	6.70	5.53	4.14	5.89	3.76
		R-4	7.58	7.82	4.33	6.32	7.57	4.80	7.24	7.32	9.05	9.36	4.77	7.61	5.86	7.70	6.99	5.30
	Salinity	R-1	2.41	2.24	1.99	2.97	2.47	2.98	3.02	2.17	3.43	3.07	1.65	3.01	3.56	2.24	3.39	3.27
		R-2	2.99	3.37	2.77	4.47	1.66	3.20	2.34	2.33	3.38	3.62	2.65	2.94	2.78	3.34	2.89	2.63
		R-3	2.65	1.99	4.36	4.22	3.21	1.93	3.00	1.67	2.27	2.80	1.98	2.36	1.92	3.44	1.37	3.45
		R-4	1.98	3.76	3.63	3.30	3.51	3.42	2.74	2.29	2.89	2.76	2.88	2.90	1.55	3.18	2.85	4.26

Studied characters	Salinity - E ₂		Cultivars														LSD			
	Level	Mean	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	G12	G13	G14		G15	G16	
Nodules dry weight/plant (g)	Normal	R-1	1.18	0.65	0.63	0.77	0.39	1.42	0.70	1.41	0.51	1.10	0.91	0.86	1.29	0.43	0.84	0.42		
		R-2	0.93	0.41	1.05	1.00	0.40	1.05	0.50	1.27	1.14	0.74	0.65	0.95	1.30	1.07	0.67	0.74		
		R-3	0.60	0.00	0.25	1.55	1.05	0.56	0.76	0.84	0.62	1.06	1.077	0.60	1.04	0.64	1.08	0.87		
		R-4	0.54	0.02	0.40	0.79	1.17	0.57	0.64	0.39	2.00	1.03	1.25	1.04	0.65	1.09	0.65	0.65		
	Salinity	R-1	0.05	0.20	0.02	0.13	0.01	0.37	0.05	0.00	0.31	0.03	0.00	0.13	0.01	0.05	0.20	0.16	0.24	
		R-2	0.01	0.11	0.45	0.70	0.00	0.45	0.17	0.20	0.30	0.05	0.05	0.32	0.06	0.00	0.07	0.00		
		R-3	0.10	0.02	0.24	0.70	0.04	0.05	0.17	0.11	0.34	1.05	0.30	0.58	0.03	0.44	0.02	1.20		
		R-4	0.20	0.20	0.20	0.22	0.10	0.27	0.07	0.10	0.54	0.00	0.40	0.40	0.07	0.24	0.10	0.10		
	Roots dry weight/plant (g)	Normal	R-1	1.20	1.10	1.20	1.56	1.90	1.05	1.20	2.10	1.32	1.34	1.35	1.45	1.70	1.16	1.00	1.27	
			R-2	1.00	1.62	1.02	1.00	1.45	1.50	1.30	1.00	1.00	1.17	1.02	1.30	1.05	1.00	1.00	2.07	
			R-3	1.10	1.17	1.00	2.04	1.20	1.00	1.30	1.30	0.90	1.32	1.20	1.27	1.30	0.90	1.00	1.10	
			R-4	1.71	1.40	1.45	1.57	1.02	0.99	1.59	1.71	1.90	1.74	0.00	1.92	1.45	1.04	1.17	1.27	
Salinity		R-1	1.15	0.90	0.62	0.91	0.75	0.90	0.82	0.60	0.94	0.85	0.94	1.00	0.90	1.02	1.04	0.70		
		R-2	1.10	1.05	0.60	1.00	1.24	0.80	1.40	0.80	0.70	1.20	1.22	0.97	0.90	1.12	0.90	0.94		
		R-3	0.95	0.90	1.17	1.40	1.00	0.66	0.94	0.95	0.90	0.92	0.75	0.75	1.02	0.94	0.70	0.90		
		R-4	0.90	0.90	1.01	1.00	1.42	0.70	0.97	0.77	0.90	0.75	1.15	0.99	0.82	0.95	1.05	1.00		

Table 9. Cont.

Studied characters	salinity level	Rice bloom	**Genotypes																LSD 0.050
			G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	
			Third sample (115 days from sowing)																
Number of nodules/plant	Normal	R-1	35.00	8.00	36.33	28.33	15.67	16.33	12.67	21.33	13.00	15.67	32.33	9.67	12.33	9.00	7.67	26.00	9.93
		R-2	25.67	31.33	35.00	35.33	45.00	20.00	16.00	18.67	20.67	29.33	35.00	31.33	25.33	17.33	21.33	39.00	
		R-3	20.67	9.00	35.33	29.33	18.33	9.00	7.00	32.33	18.67	16.00	23.00	19.67	36.00	9.33	6.00	15.67	
		R-4	31.00	22.00	13.33	16.67	14.00	14.00	18.67	16.00	18.00	37.67	10.00	19.67	21.00	14.33	11.00	34.33	
	Salinity	R-1	1.67	1.33	1.00	6.00	2.67	0.33	1.67	2.33	5.33	1.00	0.33	0.67	0.33	0.00	3.00	8.00	
		R-2	3.67	4.00	2.67	6.33	0.00	1.67	1.33	1.33	0.67	2.00	15.33	7.00	5.33	1.33	3.67	0.67	
		R-3	0.00	0.00	2.00	1.67	2.33	0.67	2.67	9.33	3.33	1.67	0.00	3.00	7.67	0.00	2.67	4.67	
		R-4	3.00	3.67	0.00	9.67	0.00	2.33	0.00	7.33	2.33	0.33	1.67	5.00	2.33	4.33	0.67	4.67	
Stems dry weight/plant (g)	Normal	R-1	14.47	5.03	12.16	15.94	18.56	10.81	8.23	23.74	9.32	12.22	11.94	16.91	13.15	15.00	11.68	7.41	5.81
		R-2	13.06	15.16	19.67	14.62	10.24	10.23	19.96	12.89	13.39	14.70	16.67	18.48	10.33	12.40	12.88	16.07	
		R-3	9.02	7.91	10.96	11.23	18.03	10.82	10.65	6.36	4.94	11.06	16.41	13.45	11.60	9.33	14.87	7.18	
		R-4	15.13	11.63	8.77	10.94	12.00	13.32	10.44	10.45	16.91	17.89	9.75	16.99	19.58	11.64	15.99	8.22	
	Salinity	R-1	3.19	3.57	6.53	10.20	4.84	3.82	6.86	9.63	6.06	9.43	9.28	7.68	11.04	3.61	11.60	10.00	
		R-2	5.34	8.02	8.66	6.15	3.75	5.05	4.64	5.43	4.99	4.65	7.84	10.87	12.23	6.78	7.47	3.87	
		R-3	3.91	3.29	5.66	7.83	6.03	8.22	6.12	10.45	8.44	8.08	7.90	7.45	9.78	3.96	7.34	8.48	
		R-4	4.20	5.24	5.30	7.66	10.39	6.66	4.74	8.94	12.07	3.88	7.84	4.81	6.13	3.82	6.30	6.30	
Leaves dry weight/plant (g)	Normal	R-1	16.37	5.24	17.50	18.97	18.45	16.97	12.05	28.42	21.69	9.61	14.05	20.97	14.47	23.49	15.23	14.57	6.22
		R-2	15.76	20.36	19.17	18.16	12.42	12.03	22.92	17.69	15.34	20.00	16.81	19.84	17.30	15.54	16.80	19.41	
		R-3	9.69	9.13	16.83	12.31	15.24	10.85	11.45	6.74	6.90	13.41	18.77	16.94	11.89	11.18	22.85	9.46	
		R-4	18.90	10.32	10.56	14.44	12.66	17.89	14.19	15.82	19.39	21.02	10.77	19.67	22.12	15.09	16.21	11.90	
	Salinity	R-1	2.88	6.31	6.72	11.74	5.66	3.06	7.30	7.68	4.80	7.90	11.90	7.01	13.03	3.00	12.09	14.79	
		R-2	5.89	10.72	13.23	8.03	4.57	5.32	3.66	7.86	5.64	4.79	9.29	8.00	14.56	8.53	7.81	5.49	
		R-3	5.43	4.32	6.72	8.20	4.38	5.66	9.02	9.85	12.68	8.76	10.07	8.32	13.95	6.05	7.64	7.82	
		R-4	6.34	6.51	6.05	8.34	12.27	8.02	5.49	12.79	16.22	13.90	8.76	5.63	6.97	4.39	9.08	5.41	

Table 9. Continued

Studied characters	salinity * level	Rise blum	**Genotypes																LSD
			G-1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	0.050
Nodules dry weight/plant (g)	Normal	R-1	0.21	0.07	0.69	0.45	0.12	0.55	0.05	0.64	0.43	0.21	0.22	0.27	0.19	0.59	0.38	0.27	0.28
		R-2	0.34	0.58	0.53	0.36	0.57	0.89	0.32	0.36	0.31	0.20	0.44	0.50	0.48	0.74	0.53	0.64	
		R-3	0.20	0.40	0.47	0.31	0.44	0.88	0.89	0.23	0.49	0.41	0.33	0.15	0.58	0.38	0.25	0.28	
		R-4	0.25	0.30	0.29	0.30	0.77	0.16	0.16	0.39	0.26	0.79	0.19	0.40	0.26	0.79	0.10	0.24	
	Salinity	R-1	0.55	0.01	0.04	0.11	0.13	0.80	0.34	0.23	0.67	0.26	0.01	0.01	0.20	0.00	0.11	0.75	
		R-2	0.03	0.27	0.19	0.10	0.00	0.29	0.01	0.31	0.25	0.13	0.55	0.13	0.78	0.16	0.39	0.05	
		R-3	0.00	0.00	0.37	0.15	0.05	0.88	0.01	0.44	0.04	0.45	0.00	0.20	0.09	0.00	0.00	0.88	
		R-4	0.54	0.23	0.80	0.72	0.00	0.13	0.00	1.31	0.34	0.02	0.02	0.08	0.12	0.33	0.03	0.14	
Roots dry weight/plant (g)	Normal	R-1	2.10	1.20	3.55	4.39	2.79	2.24	2.20	5.07	3.34	2.04	2.20	2.74	3.05	2.84	2.62	2.93	1.05
		R-2	3.48	2.66	3.99	3.45	3.15	3.73	4.30	2.62	4.39	3.77	3.96	3.34	3.35	4.13	3.04	3.20	
		R-3	2.00	3.63	3.60	4.11	2.15	1.96	1.79	1.86	3.19	2.56	2.97	1.92	2.31	2.13	3.55	1.45	
		R-4	3.01	2.62	3.37	3.35	2.78	2.04	2.91	2.51	3.27	3.60	2.57	3.08	2.73	4.32	4.45	1.66	
	Salinity	R-1	2.22	0.79	2.11	2.81	1.86	1.50	2.34	1.79	1.95	1.82	2.88	1.96	3.12	1.97	2.22	3.23	
		R-2	1.83	2.05	2.06	2.39	1.54	1.55	1.83	2.03	1.86	1.67	2.49	2.66	3.56	2.82	1.87	1.78	
		R-3	1.45	1.09	2.16	2.05	1.68	2.11	2.54	2.22	4.86	2.06	2.58	2.56	3.04	1.55	2.46	2.18	
		R-4	1.69	1.30	1.77	2.12	2.87	2.42	1.47	2.58	3.24	1.50	1.96	1.36	1.64	2.13	2.64	1.97	

Table 10. Response of sixteen faba bean genotypes to normal and saline soils and Rizobium inoculation for recorded characters at different growth stages during 2004/2005 season

Studied characters	salinity * Rizo		**Genotypes																LSD
	level	bium	G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	
			First sample (53 days from sowing)																0.050
Number of nodules/plant	Normal	R-1	18.67	9.00	18.67	39.67	22.00	20.33	26.00	22.00	14.67	24.67	30.00	29.33	40.33	19.67	18.00	45.00	9.44
		R-2	35.00	40.33	42.00	30.67	25.67	27.33	32.67	21.33	19.00	25.67	20.33	44.00	23.67	28.67	36.00	30.67	
		R-3	19.67	9.33	20.00	25.67	14.33	14.33	16.00	10.00	12.00	36.00	15.00	16.00	23.00	33.00	30.33	13.00	
		R-4	45.67	17.33	14.33	8.67	13.33	12.00	20.67	19.33	17.33	27.33	20.67	33.00	20.33	27.00	24.33	29.67	
	Salinity	R-1	13.33	8.67	16.67	12.33	19.33	15.00	13.67	9.67	14.00	17.33	26.00	25.00	37.00	16.33	40.00	31.67	
		R-2	31.00	22.67	18.00	23.67	14.00	13.33	23.67	19.00	13.33	33.00	26.33	10.00	17.33	21.67	20.00	20.67	
		R-3	6.00	14.67	2.67	22.33	11.00	8.00	20.33	19.33	9.00	24.33	21.33	11.67	27.67	11.33	41.33	27.00	
		R-4	26.00	28.00	18.67	25.33	19.67	13.67	8.00	14.00	20.67	25.00	19.67	20.33	10.00	10.33	12.33	15.00	
Stems dry weight/plant (g)	Normal	R-1	0.99	1.00	1.11	0.91	1.15	1.35	0.76	1.19	1.18	1.24	1.70	1.16	1.12	1.08	1.20	1.73	0.27
		R-2	0.55	0.81	0.94	0.76	0.63	1.09	1.20	0.86	1.18	1.35	1.32	0.40	1.13	1.38	1.03	1.22	
		R-3	0.81	0.48	1.04	0.75	1.04	1.25	1.12	0.56	1.18	0.70	1.16	1.29	1.18	1.24	1.49	1.03	
		R-4	0.83	0.61	0.94	0.94	0.74	1.53	0.94	0.78	0.88	0.96	1.28	0.99	0.66	0.96	0.79	0.71	
	Salinity	R-1	0.63	0.72	1.06	0.75	0.65	1.12	0.61	1.13	1.17	0.81	0.75	0.90	0.86	0.89	1.13	1.21	
		R-2	1.46	0.87	0.95	0.74	1.00	0.76	1.01	1.03	0.84	0.62	1.06	1.13	0.95	0.91	1.13	1.07	
		R-3	0.87	0.83	0.73	0.72	0.51	1.03	0.75	0.66	0.94	0.94	0.71	0.76	0.47	1.04	0.61	0.65	
		R-4	1.52	0.77	0.90	0.77	0.69	0.88	0.70	0.93	0.87	0.86	0.65	0.95	0.85	0.55	0.64	0.87	
Leaves dry weight/plant (g)	Normal	R-1	1.43	0.93	1.71	1.53	1.20	1.88	1.30	1.50	1.39	1.94	1.84	1.37	1.43	1.33	1.49	2.17	
		R-2	1.95	1.07	1.03	1.03	1.09	1.29	1.39	0.81	0.92	1.58	1.21	0.56	0.92	1.10	1.62	1.07	
		R-3	1.01	0.60	1.09	1.54	1.75	1.30	1.40	1.19	1.74	1.02	1.63	1.60	0.94	1.26	2.03	0.82	
		R-4	2.04	1.24	1.60	1.12	1.52	1.72	1.34	0.87	1.23	1.37	1.39	1.17	1.38	1.00	0.93	0.98	
Salinity	R-1	1.13	0.69	1.46	0.94	0.79	1.40	1.17	0.75	1.13	1.05	0.88	1.32	0.90	1.12	0.56	1.12		
	R-2	1.27	0.88	0.90	0.67	0.82	0.46	1.08	0.79	0.75	1.38	1.11	0.84	0.64	1.07	1.27			
	R-3	0.99	0.50	0.53	0.58	0.77	1.12	1.28	1.32	0.66	0.62	1.03	0.88	0.96	0.82	1.03	0.75		
	R-4	0.65	0.93	0.80	0.81	1.13	1.01	0.91	1.00	1.25	1.09	1.01	1.05	0.73	1.22	0.86	1.04		

Table 10. Cont.

Studied characters	salinity * Rizo		**Genotypes																LSD
	level	bium	G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	0.050
Nodules dry weight/plant (g)	Normal	R-1	0.36	0.17	0.30	0.16	0.21	0.18	0.16	0.20	0.26	0.19	0.18	0.22	0.19	0.19	0.39	0.24	0.07
		R-2	0.21	0.13	0.19	0.16	0.16	0.16	0.14	0.25	0.16	0.18	0.15	0.24	0.18	0.16	0.27	0.12	
		R-3	0.17	0.10	0.09	0.09	0.12	0.15	0.15	0.08	0.11	0.18	0.19	0.27	0.19	0.18	0.19	0.14	
		R-4	0.16	0.18	0.22	0.13	0.13	0.16	0.14	0.14	0.12	0.14	0.10	0.38	0.16	0.20	0.20	0.12	
	Salinity	R-1	0.22	0.08	0.17	0.14	0.18	0.15	0.08	0.09	0.17	0.14	0.14	0.14	0.15	0.13	0.16	0.10	
		R-2	0.20	0.17	0.37	0.15	0.19	0.22	0.16	0.11	0.11	0.14	0.21	0.06	0.19	0.13	0.22	0.24	
		R-3	0.12	0.15	0.04	0.21	0.12	0.13	0.11	0.16	0.09	0.14	0.23	0.17	0.09	0.17	0.16	0.10	
		R-4	0.31	0.11	0.21	0.16	0.14	0.20	0.11	0.15	0.26	0.20	0.13	0.26	0.12	0.14	0.16	0.23	
Roots dry weight/plant (g)	Normal	R-1	0.50	0.28	0.57	0.59	0.45	0.63	0.44	0.54	0.53	0.56	0.59	0.50	0.56	0.34	0.59	0.61	0.13
		R-2	0.57	0.31	0.31	0.36	0.32	0.43	0.50	0.31	0.31	0.47	0.55	0.51	0.41	0.36	0.56	0.47	
		R-3	0.35	0.36	0.41	0.41	0.60	0.38	0.41	0.32	0.56	0.39	0.45	0.52	0.52	0.48	0.70	0.34	
		R-4	0.59	0.31	0.38	0.35	0.28	0.34	0.46	0.27	0.49	0.44	0.46	0.27	0.38	0.34	0.31	0.28	
	Salinity	R-1	0.43	0.26	0.38	0.43	0.34	0.50	0.41	0.38	0.43	0.47	0.59	0.44	0.54	0.30	0.58	0.46	
		R-2	0.25	0.28	0.26	0.39	0.40	0.26	0.37	0.28	0.38	0.25	0.50	0.28	0.32	0.25	0.49	0.50	
		R-3	0.44	0.31	0.20	0.33	0.47	0.31	0.24	0.35	0.23	0.40	0.41	0.44	0.26	0.34	0.50	0.26	
		R-4	0.41	0.31	0.31	0.38	0.36	0.38	0.32	0.41	0.47	0.42	0.58	0.39	0.49	0.31	0.35	0.41	

Table 10. Cont.

Studied characters	salinity level	* Rizo biom	Second sample (84 days from sowing)														LSD		
			** Genotypes																
			G-1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14		G-15	G-16
Number of nodules/plant	Normal	R-1	31.33	19.33	37.33	62.67	34.67	50.00	41.33	40.67	29.33	60.67	77.00	47.00	85.67	34.67	67.00	75.33	17.72
		R-2	63.67	51.67	57.33	46.00	19.00	43.00	47.33	27.00	33.00	33.33	39.33	59.67	41.67	42.67	54.67	44.33	
		R-3	29.67	15.67	38.33	45.00	20.33	24.67	33.00	29.67	28.33	68.00	31.67	28.00	39.67	44.33	47.67	31.00	
		R-4	70.00	46.00	35.33	41.33	40.67	25.67	28.33	39.33	28.33	46.00	31.33	100.33	35.00	44.33	76.00	47.33	
	Salinity	R-1	30.00	15.33	31.33	19.67	32.67	46.67	32.00	15.00	27.33	25.00	54.33	45.00	48.67	27.67	40.33	50.67	
		R-2	59.67	30.67	31.33	49.33	36.00	18.00	40.00	35.00	21.33	41.67	32.33	18.00	36.00	38.33	37.67	54.33	
		R-3	15.67	28.00	14.33	38.33	14.33	18.00	36.33	43.67	28.00	34.33	24.67	23.00	41.00	16.00	63.67	46.67	
		R-4	59.67	38.67	20.33	23.67	22.00	24.00	12.00	37.00	39.00	40.33	33.00	34.67	18.00	16.67	16.00	26.00	
Stems dry weight/plant (g)	Normal	R-1	3.53	2.38	3.11	3.92	3.70	4.36	3.40	3.54	4.73	3.64	6.47	2.82	3.97	3.64	4.94	3.04	0.93
		R-2	4.76	2.34	3.34	3.54	2.78	2.88	4.89	3.49	3.03	2.57	4.39	2.54	3.44	4.30	3.44	2.93	
		R-3	2.74	2.73	2.81	4.72	3.18	3.39	2.43	3.74	2.63	3.29	3.56	2.82	2.74	4.44	5.02	3.45	
		R-4	4.41	2.03	3.79	2.38	3.05	4.04	2.41	3.21	3.27	3.18	3.21	1.75	2.93	1.95	2.70	2.90	
	Salinity	R-1	2.54	1.70	1.84	2.28	3.16	2.99	2.77	2.39	1.70	2.01	1.99	2.40	2.44	1.53	1.80	1.80	
		R-2	3.18	2.21	3.28	1.45	1.78	2.01	3.28	2.60	1.79	1.93	2.69	2.42	3.16	2.43	4.30	3.55	
		R-3	0.90	1.14	1.64	1.74	1.27	2.37	1.83	3.28	2.58	2.03	1.59	2.75	1.47	2.45	2.54	2.38	
		R-4	1.54	1.32	1.54	1.72	1.65	1.75	1.17	3.30	2.32	1.87	3.38	2.30	2.33	2.05	2.90	2.39	
Leaves dry weight/plant (g)	Normal	R-1	4.11	1.52	2.99	3.61	2.72	4.32	3.82	3.03	5.28	4.67	6.75	2.88	3.90	3.95	5.39	3.25	0.96
		R-2	5.51	2.08	3.33	3.39	2.69	3.08	3.61	3.03	2.93	2.68	4.56	2.85	3.43	4.68	3.16	3.29	
		R-3	2.61	2.48	2.34	5.24	3.13	4.04	2.55	4.08	3.49	4.01	3.63	2.94	3.44	3.60	5.04	3.88	
		R-4	3.39	2.81	3.45	2.36	2.46	4.13	2.48	3.92	3.39	3.12	4.17	2.45	3.10	2.19	2.65	2.58	
	Salinity	R-1	2.73	2.34	2.79	2.28	1.34	3.41	2.55	2.10	2.05	2.58	2.27	2.36	2.42	1.78	2.72	2.03	
		R-2	3.54	3.05	2.59	1.35	2.38	2.73	2.87	2.41	2.76	1.87	3.42	3.32	2.43	2.63	4.43	3.42	
		R-3	1.75	1.25	1.95	1.28	1.76	2.01	2.46	2.64	2.24	1.76	1.56	2.43	1.94	1.53	2.43	2.28	
		R-4	2.53	1.52	2.24	2.05	1.97	1.74	1.61	4.00	2.70	2.38	3.66	2.35	2.63	2.40	3.58	3.95	

Table10. Cont.

Studied characters	salinity * Rizo		**Genotypes														LSD		
	level	bium	G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14	G-15	G-16	0.050
Nodules dry weight/plant (g)	Normal	R-1	0.48	0.28	0.46	0.60	0.44	0.50	0.61	0.76	0.48	0.70	0.71	0.52	0.58	0.59	0.97	0.34	0.22
		R-2	0.51	0.32	1.17	0.62	0.29	0.37	0.50	0.35	0.38	0.55	0.45	0.82	0.38	0.40	0.98	0.78	
		R-3	0.30	0.22	0.23	0.51	0.27	0.39	0.21	0.28	0.28	0.30	0.49	0.68	0.27	0.55	0.67	0.38	
		R-4	0.74	0.32	0.65	0.35	0.38	0.22	0.35	0.27	0.32	0.25	0.29	0.95	0.33	0.34	0.43	0.70	
	Salinity	R-1	0.45	0.26	0.33	0.31	0.36	0.35	0.34	0.25	0.44	0.40	0.47	0.33	0.87	0.42	0.46	0.30	
		R-2	0.27	0.18	0.28	0.43	0.25	0.28	0.34	0.28	0.43	0.28	0.33	0.20	0.41	0.62	0.36	0.89	
		R-3	0.40	0.19	0.54	0.33	0.24	0.24	0.32	0.40	0.33	0.30	1.20	0.29	0.51	0.41	0.37	0.16	
		R-4	0.29	0.36	0.48	0.31	0.25	0.35	0.23	0.40	0.83	0.86	0.58	0.46	0.33	0.63	0.96	0.46	
Roots dry weight/plant (g)	Normal	R-1	0.86	0.54	1.42	1.23	0.84	1.18	0.98	0.92	1.23	1.11	1.31	0.91	1.28	0.92	1.46	1.29	
		R-2	1.09	0.65	0.74	1.03	1.10	0.66	0.70	1.32	0.69	0.58	1.12	0.69	0.81	0.92	1.11	0.92	
		R-3	0.65	1.26	0.67	1.12	0.85	0.96	0.90	0.94	0.74	0.85	1.20	0.75	0.94	0.79	1.34	0.88	
		R-4	0.86	0.57	0.79	0.56	0.53	0.85	0.71	0.78	0.81	0.96	0.77	0.62	0.67	0.61	0.63	0.63	
	Salinity	R-1	0.57	0.46	0.97	0.71	0.41	1.17	0.83	0.85	0.83	0.82	0.96	0.66	1.11	0.76	1.08	0.69	0.27
		R-2	0.74	0.48	0.60	1.13	0.58	0.50	0.96	0.84	0.63	0.49	1.03	0.58	0.79	0.68	1.33	0.75	
		R-3	1.28	0.61	0.41	0.85	1.20	0.61	0.64	0.63	0.81	0.50	0.56	0.80	0.50	0.75	0.69	0.41	
		R-4	0.73	0.48	0.47	0.52	0.69	0.44	0.55	0.76	0.83	0.83	0.88	0.51	0.77	0.55	0.83	1.05	

Table 10. Cont.

Studied characters	salinity level	Rise blan	Third sample (112 days from sowing)													LSD		
			Genotypes															
			G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13		G-14	G-15
Number of nodules/plant	Normal	R-1	24.00	11.00	14.67	12.67	17.67	24.67	7.33	39.67	20.33	18.67	24.33	80.67	33.33	48.00	41.03	79.67
		R-2	91.33	51.33	59.67	66.67	5.00	5.33	44.00	40.00	31.33	44.67	58.00	32.33	43.67	47.67	25.67	69.33
		R-3	29.67	12.00	7.67	37.67	32.00	68.33	11.00	12.67	14.00	66.67	25.00	20.00	68.67	15.00	36.33	65.67
		R-4	46.67	33.33	44.00	30.00	13.67	6.67	18.00	14.00	16.33	64.67	57.00	63.00	41.67	29.67	38.67	32.00
	Salinity	R-1	8.00	8.00	3.67	4.67	2.00	24.00	7.33	3.00	18.00	17.00	18.33	49.00	14.00	5.33	34.67	71.00
		R-2	21.67	37.33	38.00	36.67	15.67	14.67	38.00	28.67	18.00	52.33	26.00	29.33	20.00	18.00	39.67	34.67
		R-3	43.67	3.67	1.00	4.33	2.33	15.33	13.00	9.00	9.33	7.67	23.67	26.00	41.67	36.33	43.67	42.00
		R-4	21.00	18.67	16.67	23.67	32.00	6.67	18.00	16.33	13.67	11.33	44.00	19.67	18.00	12.67	17.00	25.33
Stems dry weight/plant (g)	Normal	R-1	4.84	5.30	5.07	6.78	9.94	8.10	5.79	8.27	6.41	7.76	7.37	7.82	5.88	5.64	8.33	8.43
		R-2	8.55	4.03	4.28	5.38	3.33	3.90	6.18	6.57	5.01	6.10	4.77	3.58	5.83	5.30	4.24	4.65
		R-3	4.72	3.53	3.44	6.16	8.19	8.06	3.87	10.01	4.80	5.34	4.72	4.57	4.14	5.43	6.80	6.11
		R-4	5.96	6.05	5.99	2.97	5.34	4.53	3.65	5.45	6.89	5.61	4.82	2.60	4.76	5.28	4.14	3.37
	Salinity	R-1	4.99	3.53	4.83	3.09	4.76	5.05	4.64	2.76	4.37	2.86	3.88	4.66	4.26	3.66	5.43	3.13
		R-2	4.22	5.44	4.40	6.38	3.27	4.05	3.63	3.37	4.99	3.73	5.90	5.08	4.34	3.16	7.61	5.80
		R-3	1.88	2.98	3.00	3.13	3.76	3.13	3.29	4.57	3.65	3.38	3.11	3.28	2.53	3.38	2.90	4.27
		R-4	1.91	4.09	2.47	2.96	2.64	2.75	3.20	3.61	3.23	6.16	5.65	2.80	4.83	3.00	3.66	3.83
Leaves dry weight/plant (g)	Normal	R-1	9.44	9.05	10.67	9.55	8.69	9.53	9.48	8.81	9.34	3.89	8.83	9.25	7.68	8.03	11.64	9.16
		R-2	8.95	10.27	7.06	11.53	8.98	8.13	9.74	9.02	9.09	8.14	9.80	10.56	9.67	7.44	12.56	11.02
		R-3	10.99	8.14	7.35	11.56	14.28	12.89	9.23	13.24	10.73	10.94	8.23	8.88	6.19	9.85	12.64	10.03
		R-4	10.28	10.19	10.81	8.94	9.06	7.95	8.23	10.27	11.39	7.75	9.01	7.94	8.80	9.68	9.39	8.30
	Salinity	R-1	6.51	2.99	4.63	5.51	6.71	6.82	5.98	6.29	6.76	6.43	8.48	6.69	5.72	6.72	7.66	8.30
		R-2	5.80	3.21	4.80	4.03	4.07	4.37	5.51	4.97	5.04	6.39	5.41	3.78	5.94	9.44	9.52	9.75
		R-3	8.02	8.12	6.93	7.14	8.81	7.16	7.41	8.57	7.78	10.03	9.06	8.16	10.48	9.10	8.19	8.94
		R-4	7.83	9.52	7.34	9.18	8.74	7.83	9.98	9.41	7.45	11.31	7.93	8.12	8.91	8.53	9.88	9.30

Table 10. Continued

Studied characters	salinity level	* Rizo bium	**Genotypes														LSD		
			G1	G-2	G-3	G-4	G-5	G-6	G-7	G-8	G-9	G-10	G-11	G-12	G-13	G-14		G-15	G-16
Nodules dry weight/plant (g)	Normal	R-1	0.42	1.21	0.35	0.09	0.32	0.27	0.20	0.42	0.35	0.45	0.48	0.92	0.19	0.46	1.02	0.94	0.27
		R-2	0.79	0.70	0.71	0.66	0.07	0.54	0.81	0.43	0.31	0.64	0.28	0.35	0.91	0.18	0.33	0.61	
		R-3	0.47	0.27	0.25	0.73	0.41	0.95	0.09	0.67	0.17	0.89	0.62	0.64	0.83	0.19	0.59	0.82	
		R-4	0.71	0.52	0.75	0.96	0.16	0.07	0.30	0.51	0.49	0.85	0.78	0.86	0.88	0.39	0.52	0.26	
	Salinity	R-1	0.27	0.29	0.05	0.08	0.02	0.26	0.12	0.05	0.35	0.44	0.31	0.60	0.16	0.26	0.60	0.81	
		R-2	0.14	0.30	0.46	0.46	0.07	0.09	0.28	0.19	0.47	0.32	0.79	0.17	0.74	0.29	0.86	0.41	
		R-3	0.50	0.03	0.19	0.03	0.01	0.24	0.22	1.24	0.09	0.31	0.29	0.42	0.75	0.36	0.42	0.63	
		R-4	0.07	0.08	0.36	0.25	0.32	0.01	0.30	0.56	0.26	0.17	0.47	0.18	0.37	0.32	0.23	0.16	
Roots dry weight/plant (g)	Normal	R-1	1.34	0.95	1.80	1.62	1.40	1.78	1.50	1.59	1.48	1.66	2.11	1.79	1.87	1.32	2.41	1.14	0.43
		R-2	1.60	1.21	1.30	1.77	1.67	1.35	1.29	1.60	1.33	1.32	1.60	1.05	1.43	1.35	1.39	1.13	
		R-3	1.26	1.55	1.14	1.99	1.72	2.22	1.79	1.60	1.32	1.45	1.69	1.13	1.03	1.32	1.75	1.30	
		R-4	1.45	0.99	1.07	1.12	1.20	0.95	1.13	1.46	1.11	1.42	0.95	1.01	0.93	1.52	0.96	0.88	
	Salinity	R-1	0.75	0.85	1.44	1.07	1.03	1.71	0.90	1.41	1.46	1.17	1.23	1.54	1.63	1.11	1.48	1.78	
		R-2	1.00	1.01	1.05	1.65	0.88	0.97	1.41	1.27	1.30	0.65	1.63	1.03	1.42	0.80	1.75	1.75	
		R-3	1.53	1.54	1.40	1.61	1.61	1.25	1.40	1.19	0.87	0.92	1.27	1.12	1.08	1.78	1.15	1.17	
		R-4	1.48	0.92	1.03	0.85	1.03	1.51	1.07	1.00	1.06	1.32	1.42	0.69	1.66	0.86	1.37	1.09	

* Rhizobium inoculation : R1 - Control ; R2 - F.B. ARC 200, R3 - F.B. ARC 2001, R4 - F.B. TCARDA (ARC) 448

**Genotypes:

Varieties:

G1-Sakha 2, G2-Giza40, G3-Giza 429, G4-Giza 3, G5-Nubaria 1, G6-Giza 843, G7-Giza 716

Lines:

G8-L. 284, G9-L. 258, G10-L. 244, G11-L. 252, G12-L. 278, G13-L. 332, G14-L. 336, G15-L.285, G16-L.163

weight/plant, respectively, at the third sample. Plants inoculated with ARC showed superiority under soil salinity conditions with the promising lines no. 11 and 8 for nodule dry weight/plant at the second and third samples, respectively. Plants inoculated by strains IAKDA 448 (R1) and ARS 200 (R2) had the highest mean values with Sakha 2cv. for no. of nodule/plant at the first and third samples, respectively.

In general, in the both seasons results showed that high values were obtained from mutant lines no. 11 and 16 under normal soil as well as control treatment of *Rhizobium* inoculation. On the other hand, Sakha 2 cv. and line no. 8 gave the highest values under soil salinity conditions and control treatment of *Rhizobium* inoculation. Finally, evidence presented here suggests the need for selecting faba bean genotypes that are tolerant to salt stress for breeding programs in order to improve the symbiotic performance of *R. leguminosarum* biovar. *viciae*

Correlation analysis

Estimates of simple correlation coefficients between seed yield/plant and studied characters across all treatments at different growth stages under normal and saline soils across two seasons are presented in Table 1. The results obtained under normal soil conditions revealed that seed yield/plant was positively and highly significant correlated with root dry weight/plant at the first sample; with all studied characters at the second sample and with stem, leaf and root dry weight/plant at the third sample. Under salinity soil conditions, the results indicated not significant correlated were found between seed yield/plant and all studied characters at the three samples except stem and root dry weight/plant at the third sample. These results agreed with those of Amer (1986), Saad and El - Kholy (2000) and Hatiz and El - Kholy (2006).

Table 1. Simple correlation coefficients between seed yield/plant and studied characters across all treatments at different growth stages under normal and saline soils across two seasons

Studied characters	Normal soil			Sample 3	NS
	Sample 1	Sample 2	Sample 3		
Number of nodules/plant	0.167	0.220	0.060	0.060	NS
Stem dry weight/plant (g)	-0.163	0.221	0.278	0.378	**
Leaf dry weight/plant (g)	0.122	0.220	0.511	0.511	**
Nodule dry weight/plant (g)	0.038	0.127	0.511	0.511	NS
Root dry weight/plant (g)	0.342	0.314	0.114	0.114	NS
		0.314	0.334	0.334	**
		saline soil			
Number of nodules/plant	0.001	0.002	0.002	0.045	NS
Stem dry weight/plant (g)	-0.120	0.063	0.063	-0.415	NS
Leaf dry weight/plant (g)	-0.112	0.079	0.079	0.195	**
Nodule dry weight/plant (g)	0.025	0.131	0.131	0.178	NS
Root dry weight/plant (g)	0.082	0.131	0.131	0.284	NS
		0.090	0.090	0.284	**

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استجابته صفات النمو لبعض النراكيب الوراثيه من الفول البلى لسليح باريزوييم فى أراضى متأثرة بالملوحة

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نفذت أربع تجارب حقلية خلال موسمى ٢٠٠٣/٢٠٠٤ و ٢٠٠٤/٢٠٠٥ بمحطة بحوث نمو- لتابعة لكلية الزراعة - جامعة الفيوم. لدراسة استجابة بعض صفات النمو لسنة عشر تركيب ورثى من الفول البلى (سبعة اصناف تجارية وتسع سلالات طفرية مباشرة) لتأثير التلقيح بأربع سلالات مختلفة للريزوييم تحت ظروف التربة العادية والتربة المتأثرة بالملوحة على. ويمكن تلخيص اهم النتائج فيما يلى:-

١- أوضح تحطوالت التباين لمستويات ملوحة التربة والتلقيح بالريزوييم والتركيب الوراثية وكذلك التفاعلات المختلفة بينها وجود تأثيرات معنوية لمعظم الصفات المدروسة عند مراحل النمو المختلفة فى الموسمين.

٢- تأثرت نباتات الفول البلى بالإجهاد الملحي معنوياً فى جميع الصفات المدروسة عند مراحل النمو المختلفة خلال الموسمين. كما حدث نقص معنوي لجميع الصفات المدروسة بزيادة ملوحة التربة فى جميع مراحل النمو المختلفة للموسمين.

٣- ظهرت أختلافات معنوية لجميع الصفات المدروسة باستخدام التلقيح بالريزوييم خلال مراحل النمو المختلفة فى الموسمين.

٤- وجدت أختلافات معنوية بين التركيب الوراثية المستخدمة للصفات المختلفة فى جميع مراحل النمو فى الموسمين - مما يبرهن على وجود أختلافات وراثية بين هذه التركيب . كما أوضحت النتائج أن السلالات المباشرة أرقام ١٦ و ١١ على التوالي هى أكثر التركيب الوراثية التى يمكن الأستفادة منها فى برامج التربية لتحسين المحصول.

٥- أوضحت النتائج ان تباين التفاعلات المختلفة بين المعاملات المستخدمة فى الدراسة كان معنوياً لمعظم الصفات المدروسة خلال المراحل المختلفة للنمو فى الموسمين . كما أوضحت النتائج تفوق السلالتين رقم ١١ و ١٦ تحت ظروف التربة العادية ومعاملة الكنترول للريزوييم . بينما تفوق الصنف التجارى سفا ٢ والسلالة رقم ٨ عند معاملة الكنترول للريزوييم تحت ظروف التربة الملحية

٦- أوضحت نتائج معامل الأرتباط تحت ظروف التربة العادية أن هناك أرتباط موجب وعالى المعنوية بين محصول البذور بالنبات والوزن الجاف للجنور عند العينة الأولى. جميع الصفات المدروسة عند العينة الثانية وكذلك الوزن الجاف لكل من الساق، الأوراق والجنور عند العينة الثالثة. على الجانب الآخر أوضحت النتائج تحت ظروف التربة الملحية أن هناك أرتباط موجب وعالى المعنوية بين محصول البذور بالنبات والوزن الجاف لكل من السيقان والأوراق و الجنور عند العينة الثالثة. لذلك تعتبر هذه الصفات أكثر الصفات أسهلاً فى المحصول مما يجعل الأنتخاب لهذه الصفات أو أياً منها مجدياً فى تحسين الكفاءة المحصولية للفول البلى.

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