Varietal Faba Bean Differences in Nodulation, N Content and Yield Under Micronutrients Foliar Application

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Abstract

A field experiment was carried out during 2003 growth season at the Experimental Farm of the Faculty of Agriculture, Suez Canal University. The aim of the study was to evaluate the responses of seven faba bean (Vicia faba L.) varieties (Giza 1, Giza 2, Giza 461, Giza 643, Giza 716, Giza 717 and Giza 843) grown on a sandy soil to the individual foliar application of Fe, Mn, Zn, Cu, Mo and B. Faba bean seed, straw and biological yields, nodulation, grain and straw N contents and uptakes were investigated and fixed N was calculated.

Generally, faba bean nodules number and weight, 100-seeds weight, seed, straw and biological yields, seed-N, -protein and straw N contents, seed, straw and total N uptake, seed protein yield and fixed N were significantly increased by micronutrients foliar application as compared with non-sprayed plants. Higher seed N, protein contents, seed N uptake and seed protein yield were obtained when faba bean treated with Mn. Also, higher nodules number and weight, seed, straw and biological yields, straw and total N uptake and fixed N were recorded when faba bean treated with Zn and the higher 100-seed weight and straw N content were obtained when the plant sprayed with B and Cu, respectively. The lowest seed and straw N contents were obtained when the plant treated with Fe and 100-seed weight for the plants treated with Cu, nodules number and weight, seed, straw and biological yield, seed, straw and total N uptake, seed protein yield and fixed N for the plants treated with B.

With regard to the variety effect, there are highly significant differences between faba bean varieties. Seed, straw and biological yields; seed and total N uptakes of Giza 717 variety and nodules number of Giza 843; nodules weight of Giza 643; and seed N and protein contents of Giza 2 and straw N content and uptake and fixed N of Giza 1 were more pronounced by micronutrients foliar application as compared with other varieties, since Giza 2 variety give the lowest seed, straw and biological yields, seed straw and total N uptakes and fixed N; Giza 716 give the lowest nodules number and weight; Giza 643 give the lowest seed N and protein contents and Giza 843 give the lowest straw N content.

Keywords: Faba bean varieties, micronutrients foliar application, nodules, N fixation, biological yield, sandy soil.

Introduction

Faba bean (*Vicia faba* L.) is the most important food legume, which has the potential to provide the Egyptian for food. The national *faba* bean area over last five years was 131,000 ha with an average productivity of 2.86 t ha^{-1}. Faba bean production in Egypt is still limited and fails to face the local increasing consumption of the crop. So increasing crop production is one of target of the agricultural policy and can be achieved by both increasing the cultivated area and its productivity (Omar *et al.*, 2002). So, it is necessary to cultivate this crop in the newly reclaimed land. One of the basis aspects of cultivation in the newly reclaimed land is fertilization especially foliar nutrition with macro- and micro-nutrients (Hafiz and Abdel-Mottaleb, 1998).

Foliar fertilization is convenient alternative to soil application because the nutrients can be taken up rapidly and metabolized by leaves. Abdalla and Mobarak (1992a and b) found that spraying Fe, Mn and Zn induced increases total plant dry weight and N uptake of *faba* bean. Allam (1993) and Hassanein *et al.*, (1993) found that foliar spraying of *faba* bean plants with Zn, Mn, and Fe significantly increased 100-seed weight and seed yield per fadd. Abido *et al.*, (1995) reported that straw yield of *faba* bean was increased by foliar application with Fe, Zn, Mn and B. El-Melegy *et al.*, (1995) found that seed and straw yields of *faba* bean were increased significantly by spraying with Fe, Zn, Mn and Mo. El-Hamdi (1999) reported that the combined foliar application of both urea and ammonium nitrate with the chelated forms of Fe, Mn and Zn were effective for enhancing the growth parameters of broad bean plants. Amara (1999) reported that spraying Fe and Zn increased nodules number and weight of soybean. Attia (1999) found that two foliar sprays of micronutrients or one spray at the pod-filling stage significantly increased *faba* bean seed yield and N contents. The highest seed and straw yields, and N content were obtained with Giza 2.

The main objectives of the present study were to evaluate the yield; N uptake and fixation responses of seven *faba* bean (*Vicia faba* L) varieties (Giza 1, Giza 2, Giza 461, Giza 643, Giza 716, Giza 717 and Giza 843) grown on a sandy soil to the individual foliar application of Fe, Mn, Zn, Cu, Mo and B.

Materials and Methods

A field experiment was carried out during 2003 growth season at the Experimental Farm of the Faculty of Agriculture, Suez Canal University. The aim of the present study was to evaluate the response of seven *faba* bean (*Vicia faba* L) varieties (Giza 1, Giza 2, Giza 461, Giza 643, Giza 716, Giza 717 and Giza 843) grown on a sandy soil to the individual foliar application of Fe, Mn, Zn, Cu, Mo and B. Faba bean seed, straw and biological yields, nodulation, seed and straw N contents and uptakes were investigated and fixed N was calculated. Table 1 showed some characteristics of the used soil.

Soil was treated with superphosphate (15.5% P_2O_5) at rate of 40 kg ha^{-1} before sowing. Plot area was 4m x 3m. The *faba* bean seeds were sown in furrows 4 m long and 60 cm spacing within the furrows. Faba bean seeds inoculated with *rhizobium* were planted at 20 cm apart in one side of the furrow. After germination, nitrogen as $(NH_4)_2SO_4$ (20.5% N) and potassium as K_2SO_4 (48% K_2O) were added to the soil at rates of 50 and 40 kg ha^{-1}, respectively. After three weeks from planting, *faba* bean plants were separately sprayed by Fe (as $FeSO_4.7H_2O$), Mn (as $MnSO_4.H_2O$), Zn (as $ZnSO_4.7H_2O$), Cu (as $CuSO_4.5H_2O$), Mo (as $(NH_4)_6Mo_7O_{24}.4H_2O$) and B (as H_3BO_3) at rates of 20, 10, 15, 5, 2 and 2 kg ha^{-1}, respectively, in addition of the control treatment.

Table 1. Some characteristics of the used soil.

Chemical properties	
pH (in 1: 2.5 water suspension)	7.25
EC, dSm^{-1} (in saturated paste)	1.35
Total N, %	0.12
Total P, %	0.04
Total K, %	0.11
Organic matter, %	0.40
Physical properties	
Coarse sand, %	62.5
Fine sand, %	31.3
Silt, %	3.5
Clay, %	2.7
Textural class	Sand

At the filling pods stage, root samples were taken to determine nodules number and weight. Root samples were collected and washed from soil particles on 1 mm screens within 24 h. Nodules were carefully removed, freshly weighed and counted. At full maturity, *faba* bean pods and straw were taken for measurements of yield. Hundred seeds weight, seed, straw and biological yields were measured. Plant samples were oven dried at 70 °C, ground, digested and analyzed for seed and straw N contents according to Chapman and Pratt (1961) and seed protein content was calculated. Also, Seed, straw and total N uptake and seed protein yield were computed.

Soil samples were prepared and analyzed according to Page *et al.*, (1982). Split-plot design with three replicates was used and Plabstat version 2D computer program was used for statistical analysis.

Results and Discussion

Data obtained for the effect of micronutrients foliar application on nodules number and weight of the different *faba* bean varieties are presented in Table 2. Generally, *faba* bean plants nodules number and weight were significantly increased by micronutrients foliar application as compared with non-sprayed plants. Higher nodules number and weight were obtained when *faba* bean treated with Zn, while the lowest nodules number and weight were obtained when the plant sprayed with B. Regarding to the variety effect, *faba* bean Giza 843 variety give the higher nodules number while Giza 643 give the higher nodules weight comparing with other varieties. However, Giza 716 has the lowest response towards micronutrient foliar application since it gives lower nodules number and weight.

Table 2. Effect of micronutrients foliar application on nodules number and weight (g/plant) of different faba bean varieties.

Treatment	Giza 1	Giza 2	Giza 461	Giza 643	Giza 716	Giza 717	Giza 843	Mean
	nodules number per plant							
Control	102	134	117	111	106	110	187	124
Fe	240	141	156	262	125	134	249	187
Mn	159	261	186	165	142	146	197	179
Zn	164	323	162	162	186	224	285	215
Cu	210	180	166	169	126	177	218	178
Mo	149	180	205	220	174	120	226	182
B	145	178	189	145	162	143	226	170
Mean	167	200	169	176	146	151	227	
	nodules weight (g/plant)							
Control	1.33	1.15	1.81	2.28	2.40	2.13	2.60	1.96
Fe	3.45	4.50	3.55	4.74	4.13	2.87	3.23	3.78
Mn	2.87	5.66	3.62	2.87	3.10	3.97	3.17	3.61
Zn	4.43	3.89	3.21	4.80	2.63	5.30	4.43	4.10
Cu	3.44	3.35	3.80	4.53	3.40	4.17	3.60	3.76
Mo	3.12	3.04	3.79	4.91	2.67	4.30	3.47	3.61
B	2.49	1.37	3.30	2.63	2.43	2.87	3.37	2.64
Mean	3.02	3.28	3.30	3.82	2.97	3.66	3.41	

LSD 0.05 for:	Variety	Element
Nodules number	34.5	25.7
Nodules weight	0.53	0.52

Similar results were obtained by Amara (1999), since he found that spraying Fe and Zn singly or combined with Mn, increased nodule numbers of soybean, but Mn had no effect on this parameter. The weight of nodules increased appreciably after spraying Fe and/or Zn on the plants, while no effect occurred from spraying Mn.

Data obtained for the effect of micronutrients foliar application on 100-seeds weight of different *faba* bean varieties are presented in Table 3. Generally, high significant effect of the micronutrient foliar application was recorded in increasing 100-seeds weight of different *faba* bean varieties compared with the untreated plants. Although *faba* bean plants sprayed with B gives the lower nodules number and weight, their 100-seeds weight was usually the higher as compared with the other treatments. Meanwhile the lowest 100-seeds weight was obtained when *faba* bean plants sprayed with Cu.

Concerning the foliar application with micronutrients, Abd-El-Hady *et al.,* (1985) reported that seed yield of *faba* bean as well as 100-seed weight significantly increased by foliar application of Zn, Mn and Fe. Also, Allam (1993) found that foliar spraying of *faba* bean plants with Zn and Mn significantly increased 100-seed weight.

Table 3. Effect of micronutrients foliar application on 100-seeds weight (g) of different faba bean varieties.

Treatment	Giza 1	Giza 2	Giza 461	Giza 643	Giza 716	Giza 717	Giza 843	Mean
Control	90	85	93	93	107	78	80	89
Fe	101	98	108	107	110	106	98	104
Mn	98	100	109	111	117	103	95	105
Zn	98	102	114	97	133	110	97	107
Cu	126	95	94	102	108	89	84	100
Mo	99	93	117	109	123	91	97	104
B	135	119	107	148	118	80	101	115
Mean	107	99	106	110	117	94	93	

LSD 0.05 for:	Variety	Element
	2.71	1.67

Data obtained on *faba* bean seed yield response for the different varieties influencing by micronutrient foliar application are shown in Table 4. Generally, all selected *faba* bean varieties recorded significant increase in seed yield as compared with non-sprayed plants. The highest seed yield was obtained when *faba* bean sprayed with Zn, since it reached to 1.555 t ha^{-1}, while the lowest seed yield was obtained with B treatment, where the increase was only 0.428 t ha^{-1} over the control treatment. Regarding to the variety effect, there are significant differences between *faba* bean varieties. Seed yield of Giza 717 variety was more pronounced by micronutrients foliar application as compared with other varieties, where Giza 2 variety give the lowest seed yield. Similar results on the *faba* bean seed yield increase as result of micronutrient foliar application were found by El-Sayed *et al.,* (1992), Allam (1993) and Hassanein *et al.,* (1993), however, micronutrients spraying improved plant nutritive status and increased the seed yield.

Similar trend of increase trends was found in straw and biological yields (Table 4) as well as *faba* bean seed yield under micronutrients foliar application. Since the higher straw and biological yields were obtained when *faba* bean sprayed with Zn while the lower values were obtained when the plant sprayed with B. Also, Giza 717 surpassed other varieties in straw and biological yields, while Giza 2 variety give the lowest straw and biological yields.

Table 4. Effect of micronutrients foliar application on seed, straw and biological yields of different faba bean varieties.

Treatment	Varieties							Mean
	Giza 1	Giza 2	Giza 461	Giza 643	Giza 716	Giza 717	Giza 843	
	Seed yield (t ha^{-1})							
Control	2.040	2.320	3.476	2.250	2.050	2.788	3.040	2.566
Fe	3.680	2.431	4.100	2.380	3.451	3.910	3.043	3.285
Mn	3.748	2.728	4.250	4.750	3.816	4.550	4.000	3.977
Zn	3.935	3.697	3.961	4.850	3.774	4.600	4.029	4.121
Cu	4.950	2.397	3.944	4.649	3.163	3.927	4.100	3.876
Mo	4.853	3.170	3.553	4.190	3.366	3.791	4.050	3.853
B	2.303	2.618	3.689	2.300	2.261	4.437	3.349	2.994
Mean	3.644	2.766	3.853	3.624	3.126	4.000	3.659	
	Straw yield (t ha^{-1})							
Control	5.181	5.846	8.757	5.760	5.248	7.110	7.668	6.510
Fe	9.347	6.269	10.332	5.997	8.660	9.890	7.760	8.322
Mn	9.437	6.921	10.625	11.880	9.650	11.695	10.280	10.070
Zn	10.152	9.296	9.979	12.410	9.585	11.775	10.250	10.492
Cu	12.573	6.131	9.889	11.790	8.150	9.930	10.300	9.823
Mo	12.416	7.988	9.027	10.470	8.480	9.550	10.250	9.739
B	5.819	6.668	9.433	5.790	5.785	11.270	8.435	7.600
Mean	9.275	7.017	9.719	9.157	7.937	10.174	9.278	
	Biological yield (t ha^{-1})							
Control	7.221	8.166	12.233	8.010	7.298	9.898	10.708	9.076
Fe	13.027	8.700	14.432	8.377	12.111	13.800	10.803	11.607
Mn	13.185	9.649	14.875	16.630	13.466	16.245	14.280	14.047
Zn	14.087	12.993	13.940	17.260	13.359	16.375	14.279	14.613
Cu	17.523	8.528	13.833	16.439	11.313	13.857	14.400	13.699
Mo	17.269	11.158	12.570	14.660	11.846	13.341	14.300	13.592
B	8.122	9.286	13.122	8.090	8.046	15.707	11.784	10.594
Mean	12.919	9.783	13.572	12.781	11.063	14.175	12.936	

LSD 0.05 for:	Variety	Element
Seed yield	0.0054	0.00559
Straw yield	0.0022	0.00252
Biological yield	0.00715	0.00767

The increases in straw and biological yields as affected by micronutrients foliar application were reported by several workers. Abido *et al.*, (1995) reported that straw yield of *faba* bean was increased by foliar application with Fe, Zn, Mn and B. El-Melegy *et al.*, (1995) found that seed and straw yields of *faba* bean were significantly increased by spraying of Fe, Zn, Mn and Mo. Abdalla and Mobarak (1992a and b) found that spraying either chelated or mineral Fe, Mn and Zn induced increases in root, shoot and total plant dry weight of *faba* bean plant.

Significant increases in seed-N, -protein and straw N contents were recorded as a result of micronutrients foliar application (Tables 5). Manganese spraying was more effective in increasing seed N content as well as seed protein content, while Cu spraying was more effective in increasing straw N content comparing with other treatments. On the other hand, lowest values of seed N content, seed protein content and straw N content were obtained when *faba* bean varieties were treated with Fe. Faba bean Giza 2 variety surpassed other varieties in both seed N and protein contents and Giza 1 surpassed in straw N content. Faba bean Giza 643 was give the lowest response for seed N and protein contents and Giza 843 for straw N content towards micronutrients foliar application. Attia (1999) found that two foliar sprays of micronutrients or one spray at the pod-filling stage significantly increased seed and straw N contents. Also, he found that the highest seed and straw yields, and N content were obtained with Giza 2 sprayed twice with micronutrients.

Table 5. Effect of micronutrients foliar application on seed, N, protein and straw N contents of different faba bean varieties.

Treatment	Varieties							Mean
	Giza 1	Giza 2	Giza 461	Giza 643	Giza 716	Giza 717	Giza 843	
				Seed N content, %				
Control	2.14	2.33	2.24	2.03	2.06	2.23	2.25	2.18
Fe	2.95	3.60	3.29	2.70	2.60	3.64	3.06	3.12
Mn	3.62	3.44	3.22	3.11	3.29	3.68	3.46	3.40
Zn	2.78	3.64	3.18	2.61	3.79	2.77	3.49	3.18
Cu	3.53	3.28	3.48	3.39	2.66	3.11	2.82	3.18
Mo	2.91	3.68	3.49	2.71	3.44	3.71	3.60	3.36
B	3.49	3.26	3.44	2.83	3.01	3.51	3.73	3.33
Mean	3.06	3.32	3.19	2.77	2.98	3.24	3.20	
				Seed protein content, %				
Control	13.38	14.56	14.00	12.69	12.88	13.94	14.06	13.64
Fe	18.44	22.50	20.69	16.88	16.25	22.75	19.13	19.50
Mn	22.63	21.50	20.13	19.44	20.56	23.00	21.63	21.27
Zn	17.38	22.75	19.88	16.31	23.69	17.31	21.81	19.88
Cu	22.06	20.50	21.75	21.19	16.63	19.44	17.63	19.89
Mo	18.19	23.08	21.81	16.94	21.50	23.19	22.50	21.02
B	21.81	20.38	21.50	17.69	18.81	21.94	23.32	20.78
Mean	19.13	20.74	19.95	17.31	18.62	20.22	20.01	
				Straw N content, %				
Control	1.57	1.49	1.54	1.47	1.55	1.49	1.56	1.52
Fe	2.12	2.04	2.04	1.87	2.10	1.72	1.83	1.96
Mn	2.16	1.95	2.02	1.95	2.06	2.17	1.89	2.03
Zn	2.38	1.99	2.09	2.29	2.19	2.06	1.87	2.12
Cu	2.47	2.09	2.04	2.29	2.14	2.23	1.93	2.17
Mo	2.20	2.23	2.07	2.38	2.02	1.76	1.97	2.10
B	2.20	2.50	1.99	1.99	2.35	1.99	1.85	2.12
Mean	2.16	2.05	1.97	2.04	2.06	1.92	1.84	

LSD 0.05 for:	Variety	Element
Seed N content	0.016	0.007
Seed protein content	0.097	0.041
Straw N content	0.017	0.012

Data obtained for the effect of micronutrients foliar application on seed, straw and total N uptakes and seed protein yield are presented in Table 6. Significant increases in *faba* bean seed, straw and total N uptakes and seed protein yield were recorded in all plants sprayed with micronutrients as compared with non-sprayed plants. Manganese spraying was clearly increased seed N uptake as well as protein yield while the effect of Zn was markedly obvious in increasing both straw and total N uptakes. The lowest seed, straw and total N uptakes and seed protein yield were usually recorded when *faba* bean treated with B. Similar trend was found by Abdalla and Mobarak (1992b). Micronutrient foliar application was pronounced seed and total N uptakes and protein yield by *faba* bean Giza 717 variety and straw N uptake by Giza 1. The lowest seed, straw and total N uptakes and seed protein yield responses were usually observed for *faba* bean Giza 2.

Table 6. Effect of micronutrients foliar application on seed, straw and Total N uptakes and seed protein yield of different faba bean varieties.

Treatment	Varieties							Mean
	Giza 1	Giza 2	Giza 461	Giza 643	Giza 716	Giza 717	Giza 843	
	Seed N uptake, kg ha^{-1}							
Control	43.7	54.1	77.9	45.7	42.2	62.2	68.4	56.3
Fe	108.6	87.5	134.5	643	89.7	142.3	93.1	102.9
Mn	135.7	93.8	136.9	147.7	125.5	167.4	138.4	135.1
Zn	109.4	134.6	126.0	126.6	143.8	127.4	140.6	129.7
Cu	174.7	78.6	137.3	157.6	84.1	122.1	115.6	124.3
Mo	141.2	116.7	124.0	113.5	115.8	140.7	145.8	128.3
B	80.4	85.3	126.9	65.1	68.1	155.7	124.9	100.9
Mean	113.4	92.9	123.5	102.9	95.5	131.1	118.2	
	Straw N uptake, kg ha^{-1}							
Control	81.3	87.1	134.9	84.7	81.3	105.9	119.6	99.4
Fe	198.2	127.9	210.8	112.1	181.9	170.1	142.0	163.2
Mn	203.8	135.0	214.6	231.7	198.6	253.8	194.3	204.7
Zn	241.6	185.0	208.6	284.2	209.9	242.7	191.7	223.5
Cu	310.6	128.1	201.7	270.0	174.4	221.4	198.8	215.2
Mo	273.2	185.3	186.7	249.2	171.3	168.1	201.9	205.3
B	128.0	166.7	188.7	115.2	136.0	224.3	156.0	159.3
Mean	205.2	145.0	192.1	192.4	164.8	198.0	172.0	
	Total N uptake, kg ha^{-1}							
Control	125.0	141.2	212.8	130.4	123.5	168.1	188.0	155.6
Fe	306.8	215.4	345.7	176.4	271.6	312.4	235.1	266.2
Mn	339.9	228.8	351.5	379.4	324.1	421.2	332.7	339.6
Zn	351.0	319.6	334.6	410.8	352.9	370.1	332.3	353.0
Cu	485.3	206.7	339.0	427.6	258.5	343.5	314.4	339.3
Mo	414.4	302.0	310.7	362.8	287.1	308.8	347.7	333.6
B	208.4	252.0	314.6	180.8	204.1	380.0	280.9	260.1
Mean	318.6	238.0	315.6	295.5	260.3	329.2	290.2	
	Seed protein yield, kg ha^{-1}							
Control	273.0	337.8	486.6	285.5	264.8	388.7	427.4	352.0
Fe	678.6	547.0	843.0	401.7	560.8	889.5	582.1	643.2
Mn	848.2	586.5	855.5	923.4	784.6	1046.5	865.2	844.3
Zn	683.9	841.1	787.5	791.0	894.1	796.3	878.7	810.4
Cu	1092.0	491.4	857.8	985.1	526.0	763.4	722.8	776.9
Mo	882.8	729.1	774.9	709.8	723.7	879.1	911.3	801.5
B	502.3	533.6	793.1	406.9	425.3	973.5	781.0	630.8
Mean	708.7	580.9	771.2	643.3	596.9	819.6	738.4	

LSD 0.05 for:	Variety	Element
Seed N uptake	0.64	0.25
Straw N uptake	1.47	1.00
Total N uptake	1.99	1.03
Seed protein yield	4.02	1.59

To evaluate the effect of micronutrients foliar application on the amount of N fixed by different *faba* bean varieties, the differences between total N uptake of the sprayed plants and total N uptake of the control treatments were calculated (Table 7). Highly differences in the amount of fixed N were recorded regarding the effects of both micronutrients foliar application and *faba* bean variety. The highest fixed N values were recorded when *faba* bean sprayed with Zn while the lowest values were obtained in case of B. These results were in a good agreement with those obtained on the effect of micronutrients foliar application on nodules number and weight, seed, straw and biological yields, straw and total N uptakes. On the other hand, lowest amount of fixed N was coupled with *faba* bean Giza 2 variety as well as seed, straw and biological yields and seed, straw and total N uptakes. Faba bean Giza 1 surpassed other varieties, since it has the higher ability to fixed N. This was also noticed in its straw N content and uptake.

Table 7. Effect of micronutrients foliar application on fixed N, (kg ha^{-1}) of the different faba bean varieties over the control treatment.

Treatment	Varieties							Mean
	Giza 1	Giza 2	Giza 461	Giza 643	Giza 716	Giza 717	Giza 843	
Fe	181.8	74.2	132.9	46.0	148.1	144.3	47.1	110.6
Mn	214.5	87.6	138.7	249.0	200.6	253.1	144.7	184.0
Zn	226.0	178.4	121.8	280.4	229.4	202.0	144.3	197.5
Cu	360.3	65.5	126.2	297.2	135.0	175.4	126.4	183.7
Mo	289.4	160.8	97.2	232.4	163.6	140.7	159.7	177.7
B	83.4	110.8	101.8	50.4	80.6	211.9	92.9	104.5
Mean	225.9	112.9	119.8	192.6	159.6	187.9	119.2	

Marschner (1998) pointed out that zinc is required for the activity of various types of enzymes, including dehydrogenases, aldolases, isomerases, transphosphorylases and RNA and DNA polymerases. Therefore, Zn deficiency is associated with an impairment of protein synthesis. The accumulation of dry matter in vegetative parts, nodules, and N concentration in nodules and nitrogen accumulation in the whole plants were increased by micronutrient supply in *faba* bean and yellow lupine (Seliga, 1998; Carranca *et al.,* 1999).

Conclusion

Micronutrients foliar application, particularly Zn and Mn, was promoted *faba* bean plant nodules, number and weight, 100-seeds weight, seed, straw and biological yields, seed-N, -protein and straw N contents, seed, straw and total N uptake, seed protein yield and fixed N. There are significant differences of *faba* bean varieties responses for the most investigated characters; however, Giza 717 variety surpassed other varieties in seed, straw and biological yields and seed and total N uptakes.

References

1. ABDALLA, F.E. and MOBARAK, Z.M. (1992a). Shoot intake of nutrients from different micronutrient fertilizer formulation in *faba* bean. African J. for Agricultural Sciences, 19:147-160.
2. ABDALLA, F.E. and MOBARAK, Z.M. (1992b). Uptake of N, P, K and Mg by *faba* bean after foliar treatment with chelated and non-chelated micronutrient fertilizers. African J. for Agricultural Sciences, 19:161-172.
3. ABD-EL-HADY, A.H.; ASY, K.G.; KHADR, M.S.; MOHAMED, Y.H.; MOUSTAFA, A.A. and TAHA, M.E. (1985). Effect of foliar fertilization in different crops under Egyptian condition. Special fertilizer. International Symposium on foliar fertilization, March, 11-14, 1985. Berlin, Germany.
4. ABIDO, Y.M; ABD-EL-MAGID, A.A. and MONGED, N.O. (1995). Field trials on *faba* bean fertilization with some micronutrients. Egypt. J. Appl. Sci., 10:1-14.
5. ALLAM, S.A. (1993). Field bean yields as affected by phosphorus, zinc and manganese application. Annals of Agric. Sci. Moshtohor, 31:113-124.
6. AMARA, M. A. T. (1999). Soybean response to inoculation with biofertilizer and fertilization with micro-nutrients in calcareous soil. Desert Institute Bulletin, Egypt. 48:75-92.
7. ATTIA, K. K. (1999). Yield and nutrient status in seeds of some *faba* bean varieties as affected by farmyard manure and different foliar regimes of micronutrients application. Assiut Journal of Agricultural Sciences. 30:189-201.
8. CARRANCA, C.; DE VARENNES, A. and ROLSTON, D. (1999). Biological nitrogen fixation by *faba* bean, pea and chickpea, under field conditions, estimated by the ^{15}N isotope dilution technique. European J. of Agronomy, 10:49-56.
9. CHAPMAN, H.D. and PRATT, P.F. (1961). "Methods Of Analysis for Soil, Plants and Waters". Barkeley, CA; University of California, Agricultural Publication.

10. EL-HAMDI, A.R.H. (1999). Utilization of nitrogen with some micronutrients as a foliar fertilization for broad bean crop. Annals of Agric. Sci. Moshtohor, 37:2093-21.03.

11. EL-MELEGY, M.A.; Darwish, D.S.; Rizk, N.S.A. and Mohamed, A.F. (1995). Effect of foliar spray with some micronutrients on seed yield of *faba* bean. Egypt. J. Appl. Sci., 10:379-391.

12. EL-SAYED, A.A.; ABDALLA, F.E. and FAWZI, A.F.A. (1992). Increase in *faba* bean yield after micronutrients foliar application under farmers conditions in Fayoum. African J. for Agricultural Sciences, 19:63-72.

13. HAFIZ, S.I. and ABDEL-MOTTALEB, H.M. (1998). Response of some *faba* bean cultivars to foliar fertilization under newly reclaimed sandy soil conditions. Proc. 8th Conf. Agron., Suez Canal Univ., Ismailia, Egypt, 28-29 November, 1998.

14. HASSANEIN, A.M.; FIRGANY, A.H. AZAB, A.M. and ZIEDAN, M. (1993). effect of foliar spraying of micronutrients on yield and yield components of *faba* bean (vicia *faba* L.). Egypt. J. Appl. Sci., 8:367-378.

15. MARSCHNER, H. (1998). Mineral Nutrition of Higher Plants. 3rd Edition. Academic Press, London.

16. OMAR, M.N.A.; MOSTAFA, A.J. and AHMED, A.S. (2002). Concentrated vinasse as a novel diazotrophs growth medium (Biovinasse Inoculant) and soil conditioner to improve *faba* bean yield under dripping irrigation system. Symposium No. 03, Paper No. 137, pp 1-7, 17th WCSS, 14-21 August 2002, Thailand.

17. PAGE, A.L.; MILLER, R.H. and KEENEY, D.R. (1982). "Methods of Soil Analysis". Part 2: Chemical and Microbiological Analysis. Am. Soc., Madison, Wisconsin, USA.

18. SELIGA, H. (1998). Nitrogen fixation in several grain legume species with contrasting sensitivities to copper nutrition. Acta Physiologiae Plantarum. 20:263-267.

الاختلافات في تكوين العقد الجذرية والمحتوي النيتروجيني والإنتاج بين أصناف الفول البلدي تحت ظروف الرش بالعناصر الصغرى

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أجريت تجربة حقلية في المزرعة التجريبية لكلية الزراعة _ جامعة قناة السويس خلال موسم ٢٠٠٣ بهدف تقييم استجابة سبعة أصناف من الفول البلدي (جيزة ١ وجيزة ٢ وجيزة ٤٦١ وجيزة ٦٤٣ وجيزة ٧١٦ وجيزة ٧١٧ وجيزة ٨٤٣) المنزرعة في التربة الرملية للرش الورقي المنفرد بعناصر الحديد والمنجنيز والزنك والنحاس والموليبدنوم والبورون. تم دراسة تقييم محصول البذور والقش والمحصول البيولوجي ووزن مائة بذرة وتكوين العقد الجذرية (عدا ووزنا) ومحتوي وامتصاص عنصر النتروجين وكمية النتروجين المثبتة.

أشارت النتائج إلي:

١- عموما زاد عدد ووزن العقد الجذرية ووزن مائة بذرة ومحصول البذور والقش والمحصول البيولوجي ومحتوي البذور من النتروجين والبروتين والقش من النتروجين وكذلك امتصاص النتروجين والامتصاص الكلي ومحصول البذور من البروتين وكمية النتروجين المثبتة لكل أصناف الفول البلدي تحت الدراسة زيادة معنوية بالرش بالعناصر الصغرى بالمقارنة بمعاملة الكنترول.

٢- أعطت معاملة الرش بالمنجنيز أعلي محتوي نتروجين وبروتين وامتصاص نتروجين للبذور مقارنة ببقية المعاملات. وأعطت معاملة الرش بالزنك أعلي عدد ووزن للعقد الجذرية وأعلي محصول بذور وقش ومحصول كلى (محصول بيولوجي) وأعلي امتصاص كلي وأعلي كمية للنتروجين المثبت. وأعطت معاملة الرش بالبورون أعلي وزن للمائة بذرة وأعطت معاملة النحاس أعلي محتوي للنتروجين في القش.

٣- بينما تم الحصول على أقل قيم لكل من محتوي البذور والقش من النتروجين مع المعاملة بالحديد وأقل وزن مائة بذرة بالمعاملة بالنحاس وأقل عدد ووزن للعقد الجذرية وأقل محصول بذور وقش ومحصول كلي وأقل امتصاص للنتروجين للبذور والقش والامتصاص الكلي وأقل محصول بروتين للبذور وأقل كمية للنتروجين المثبتة بالمعاملة بالبورون.

٤- كانت هناك اختلافات معنوية من حيث استجابة أصناف الفول البلدي تحت الدراسة للرش بالعناصر الصغرى. حيث تفوق الصنف جيزة ٧١٧ في محصول البذور والقش والمحصول الكلى وامتصاص النتروجين في البذور والامتصاص الكلي وتفوق الصنف جيزة ٨٤٣ في عدد العقد الجذرية والصنف جيزة ٦٤٣ في وزن العقد الجذرية والصنف جيزة ٢ في محتوى البذور من النتروجين والبروتين والصنف جيزة١ في محتوى وامتصاص النتروجين في القش والكمية الكلية للنتروجين المثبت والصنف.

أعطي الصنف جيزة ٢ أقل محصول بذور وقش ومحصول كلي وأقل امتصاص نتروجين للبذور والقش وامتصاص كلي وأقل كمية كلية للنتروجين المثبت وأعطي الصنف ٧١٦ أقل عدد ووزن للعقد الجذرية وأعطي الصنف جيزة ٦٤٣ أقل محتوى نتروجين وبروتين في البذور وأعطي الصنف جيزة ٨٤٣ أقل محتوى نتروجين في القش.