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RESPONSE OF THREE FABA BEAN CULTIVARS (*Vicia faba L.*) TO DIFFERENT NITROGEN SOURCES UNDER P-BIOFERTILIZER AND MICRONUTRIENTS ADDITION

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ABSTRACT

Two field experiments were conducted at the experimental farm of Tag ELEZZ station, Dakahlia Governorate, during 2003/2004 and 2004/2005 seasons. The effect of three nitrogen sources (urea ammonium nitrate and ammonium sulphate), phosphorien, citreen and control as well as their interaction on growth, yield, yield components and macro & micronutrients uptake of three faba bean cultivars namely (Sakha 1, Giza 3 and Giza 2) were studied. A split-split plot design with four replicates were used. The main findings could be summarized as follows:

1- Sakha 1 cultivar surpassed Giza 3 and Giza 2 in seed weight/plant, 100-seed weight and seed yield ardab/fed and on Giza 3 in number of branches/plant in the two seasons, but Giza 3 surpassed on Sakha 1 and Giza 2 on plant height and straw yield.
2- Urea significantly increased the plant height, number of pods/plant, in the two seasons, and surpassed on the number of branched/plant, seed weight ton/plant and seed yield (ardab/fed), in the first season.
3- Phosphorien gave the highly significant increase in number of branches/plant, number of pods/plant, seed weight/plant, 100-seed weight (g) seed yield (ardab/fed). And straw yield (ton/fed), in the two seasons compared with the citreen and control.
4- The interaction between faba bean cultivars and nitrogen sources had a significant effect on plant height (cm), number of pods/plant, seed weight/plant and straw yield (ton/fed), in the two seasons and the increased in 100-seed weight in the first seasons only and significantly increased in seed yield/fed., in the second season.
5- Planting sakha 1 cultivar and fertilizing with 20 kg N/fed, and 1000 g/phosphorien from phosphorein may be the recommended treatment to improve the productivity of faba bean under the condition of the present study.
6- Giza 3 gave the highest values for P uptake (11.74 kg fed^{-1}) and Mn uptake (14.2 g fed^{-1}) as the average of both seasons. While Sakha 1 gave the highest uptake for K (28.91 kg fed^{-1}), while Giza 2 for N (35.43 kg fed^{-1}) and Fe uptake (93.49 g fed^{-1}).
7- Phosphorien as a biofertilizer gave the highest values for N, P, and K uptake by plant respectively in both seasons.
8- It is noticed that, the interactions effect between all treatments with N, P, K, Fe, Zn and Mn uptake by faba bean plants were highly significant in both seasons.

INTRODUCTION

Faba bean *(Vicia faba L.)* is one of the most important food legume crops in Egypt as a source of vegetable protein and carbohydrates. The Egyptian government encourages faba bean producers to raise the

productivity of the cultivated area by replacing the traditional cultivars with the new improved high ones. Amer *et al.*, (1992) found that Giza 461 variety surpassed Giza 3 variety in seed yield/plant, 100-seed weight and number of branches, pods and seeds/plant. Edris (1993) reported that Giza 3 variety surpassed the other varieties such as Giza 1 and Giza 2 in dry matter accumulation in seeds/plant. EL-Bana and Soliman (1994) found that Giza 461 variety was the superior compared with Giza 2 variety in plant height number of pods/plant and seed yield/plant. However, no significant differences were observed between the two varieties respecting number of branches per plant and 100-seed weight. EL-Kaddoussi (1996) stated that Giza variety markedly exceeded Giza 402 variety in plant height, number of pods/plant, number of seed/pod and seed yield/plant as well as/fad.

Plant growth depends on an adequate supply of nitrogen (N) in order to synthesize the amino acids, proteins, nucleic acids and other cellular constituents necessary for plant development (Esteban Sanches *et al.*, 2004). In the biosphere, N is available for plants in different forms, these include molecular N_2, volatile ammonia on No_x, mineral (NO_3 and NH_4) and in well–aerated agricultural soils, mineral N are the most abundant forms of available N (Von Wiren *et al.*, 1997).

Nitrogen fertilization to Faba bean as a starter dose might be useful Kandil (1985) reported that number of pods and seeds/plant, 100-seed weight, seed and straw yield/fed. were significantly increased by increasing N rates up to 20 kg N/fed. EL-Khawaga and Zitton (1986) found that seed yield/fed, significantly increased with increasing nitrogen levels up to 30 or 45 kg N/fed. Abdrobou (1992), revealed that when faba bean sprayed from 40 to 60 days after sowing with 1, 2 or 3% N and 0, 0.3, 0.6 or 0.9% Zn the seed yield in both seasons was highest with 3% N and 0.6% Zn. Saghin (1998) reported that the application rate NP and NPK fertilizers, as well as farmyard manure increased vicia faba seed contents of total nitrogen, crucial nitrogen, phosphorus, potassium, starch and fats.

Phosphorus is considered as one of the essential nutrients for growth and development of faba bean plant. In this connection, Mahmoud and Abd EL-Hafez (1982) found that after fertilization with super phosphate the level of available phosphorus in soil decreases sharply after a short period from application. They added that this case is widespread in alkaline soils, since the available phosphorus in the added fertilizer is rapidly transformed to tricalicium, thus, become unavailable to the plants, Saber (1982) & Saber and Kabesh (1988).

Organic wastes and biofertilizers are the alternate sources to meet the nutrient requirement of crops and to bridge the future gaps. Farming regions that emphasize heavy chemical application lead to adverse environmental, agricultural and health, consequences. Numerous efforts are being exercised every where to combat the adverse consequences of chemical farming

(Shehata and EL-Khawas, 2003). The biofertilized farming system is emphasized, biofertilizer, organic manuring and biocontrol of agricultural pests (Saber, 1998). In recent years, biofertilizers have emerged as a promising component combination with other chemical fertilizers (Seema *et al.*, 2000).

EL-Kalla *et al.*. (1999) reported that, were applied mineral P level with phosphorien 400 g/fed and found that the seed and straw yields in both seasons was highest. Ibrahim and Abbas (2004) reported that the inoculation faba bean seeds with phosphorien at the rate 600 g/fed. increased all studied characters in both seasons compared with other rates phosphorien.

The aim of this work is to study the effect of three mineral nitrogen sources, phosphorien and citreen as a micronutrients fertilizer on yield, growth and mineral uptake of three faba bean cultivars grown on clay soil.

MATERIALS AND METHODS

Two field experiments were carried out at the experimental farm of Tag EL-EZZ Agricultural Research Station, Dakahlia Governorate during 2003/2004 and 2004/2005 seasons to study the effect of nitrogen sources with bio and micronutrients, addition on growth, yield and mineral contents of some faba bean cultivars. Where the nitrogen sources were urea (46%), ammonium nitrate-N (33%) and ammonium sulphate NH_4-N (20.5%). Phosphorien was used as a biofertilizer, which has active bacteria capaple to convert tricalcium phosphate to mono calcium phosphate and cirteen, a trade name, containing Zn:Mn:Fe at 2% for each (bio and micronaurient products were produced by ministry of Agricultural). Two liter/fed added to 600 liters water. Soils samples were taken from the representing 0-30 cm depth from all sites of the trail. All collected sample, were mixture and represented by one was taken for chemical and physical analysis. Soil sample was air-dried, ground and passed through a 2mm sieve. Partical-size distribution was determined by international method (Piper 1950). The soil of the trail field was clayey texture, moderate saline (EC_e = 5.3 dSm^{-1}), pH (8.1), ESP (8.1%), $CaCO_3$ (2.50%) and organic matter (1.60%), all chemical analysis were determined according to Richard, (1954). Available, N, P, K were determined according to Black (1982). Available forms of Zn, Mn and Fe in soil were determined by DTPA method (diethylene triamine penta acetic acid) according to Lindsay and Norvell (1978).

Split-split plot design with four replicates was allocated. The main plots were devoted to the three faba bean cultivars (Sakha 1, Giza 3 and Giza 2). The sub-plots were occupied by the following three nitrogen sources, i.e. urea, ammonium nitrate and ammonium sulphate while the sub-sub plots were assigned to three treatments i.e. phosphorien at the rate of 1000 g/fed inoculating the seeds, microelements i.e. citreen at the of 2000 cm^3 per feddan

spraying on the plants after 50 days from sowing and control without phosphorien and citreen.

The preceding crop was rice in both seasons, phosphorus fertilizer in form of calcium superphosphate (15.5% P_2O_5) was fully added before tillage by the rate of 15 kg. The sowing date was in the first week of November in both seasons. Three seeds of faba bean were sown as usual as dry sowing in hills, 20 cm apart. After thinning (before the first irrigation) nitrogen sources (urea 46%, ammonium nitrate 33% and ammonium sulphate 20.5%) were added by the rate of 20 kg N/fed. All the agricultural practices except studied ones, were exactly carried out as recommended.

At harvest, a random sample of 10 guarded plants were taken from each sub-sub plot to estimate the following characters:

1- Plant height (cm)
2- Number of branches/plant.
3- Number of pods/plant.
4- Seed weight/plant (g.)
5- 100-seed weight (g.)
6- Seed yield (ardab/fed.)
7- Straw yield (Ton/fed).

The final yield of seeds (ardab/fed.) and straw (t/fed) were estimated from three inner ridge of each plot.

Shoot (leaves + stems) sample were taken at harvest (as a physiological stage), where the nutrients going to translocation from leaves to pods. All collected sample were dried at 70 °C in forced-air circulation oven, ground in a porcelain mortar, Macro and micronutirents were determined as wetdigested using H_2SO_4-$HClO_4$ mixture according to (Black 1982). Fe, Zn, Mn were determined by the atomic absorption spectrophotometer (Pirken EL-mer –2380).

Obtained data were subjected to the statistical analysis as the usual technique of analysis of variance (ANOVA) of the split-split plot design using the least significant difference (L.S.D.) according to the procedure outlined by Waller and Duncan (1969).

Correlation studies:

Estimates of correlation coefficient (r) between different faba bean characters were calculated according to the following equation:

Where:

$$r = \frac{SP \times y}{\sqrt{SS_x \cdot SS_y}}$$

$$SP_{xy} = \sum xy \cdot \frac{\sum x - \sum y}{n}$$

$$SS_x = \sum x^2 \quad (\sum x)^2$$

$$SS_y = \sum y^2 - \frac{(\sum y)^2}{n}$$

r = correlation coefficient.
ss = sum of square
x, y = variables
SP = standard deviation
n = total of treatments

RESULTS AND DISCUSSIONS

1- Faba bean cultivars performance:

The results in Tables (1 and 2) show that the significant differences were found among the experimented three faba bean cultivars with respect to all studied characters in the two growing seasons. Sakha 1, and Giza 3 came in the first order for plant height, seed weigh/plant, 100-seed weight, seed and straw yields/fed, but Giza 2 came in the first rank for number of branches/plant and number of pods/plant.

Table (1): Mean values of plant height, number of branches/plant, number of pods/plant and seed weight/plant for faba bean cultivars, mineral fertilizer and biological fertilizer and their interaction during 2003-2004 and 2004-2005 seasons.

Characters	Plant height		No. branches/plant		No. of pods/plant		Seed weight/plant	
Treatments	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05
(A) Cultuvar								
Sakha 1	97.74	123.74	3.60	3.52	24.8	25.3	38.00	43.91
Giza 3	103.31	127.44	3.05	2.99	22.6	26.0	36.05	38.26
Giza 2	95.23	97.68	4.20	3.64	27.1	28.6	33.92	36.19
F. tests	**	**	**	**	**	**	**	**
L.S.D. 5%	1.35	1.46	0.100	0.09	0.73	0.05	0.66	0.86
1%	3.12	3.37	0.230	0.16	1.69	0.12	1.52	1.99
(B) Min-F.								
Urea	107.27	129.73	3.81	3.38	27.0	27.1	37.76	39.03
Ammonium nitrate	95.46	114.90	3.37	3.12	23.9	25.0	34.71	38.94
Ammonium sulphate	93.55	104.48	3.70	3.64	23.5	27.8	35.49	40.40
F. tests	**	**	**	NS	**	**	**	NS
L.S.D. 5%	1.35	1.46	0.100	---	0.73	0.05	0.66	
1%	3.12	3.36	0.230	---	1.69	0.12	1.52	
(C) Bio-fert.								
Control	90.32	114.29	2.83	3.02	20.9	23.0	31.79	34.16
Citreen	103.62	117.46	3.68	3.25	25.1	26.7	36.92	39.11
Phosphorien	102.34	114.36	4.35	3.88	28.4	30.3	39.26	45.10
F. tests	**	NS	**	**	**	**	**	**
L.S.D. 5%	1.35	---	0.100	0.09	0.73	0.05	0.66	0.86
1%	3.12		0.230	0.16	1.69	0.12	1.52	1.99
(D) Interaction								
A x B	*	**	NS	NS	**	**	**	**
A x C	NS	NS	NS	NS	NS	**	*	NS
B x C	NS	NS	NS	NS	NS	**	**	NS
A x B x C	NS	NS	NS	NS	NS	**		NS

The superiority of Sakha 1 could attributed to the genetic potential in proving the lend of resistance to chocolate and rust diseases. Moreover, the variations among the investigated cultivars mainly due to the differences in their genetic constitution. These data agree with that found by Amer *et al.* (1992), Edris (1993), EL-Banna and Soliman (1994), Ibrahim and Abbas and EL-Kaddoussi (1996).

Table (2): Means values of 100-seed weight, seed yield ardab/fed and straw yield ton/fed for faba bean cultivars, mineral fertilizers and biological fertilizer and their interaction during 2003-2004 and 2004-2005 seasons.

Characters	100-seed weight		Seed yield ardab/fed		Straw yield (ton/fed)	
Treatments	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05
(A) Cultuvar						
Sakha 1	74.69	84.72	9.84	9.87	1.900	2.020
Giza 3	75.22	79.56	9.65	9.43	2.054	1.970
Giza 2	61.47	64.47	8.71	8.71	1.880	1.650
F. tests	**	**	**	**	**	**
L.S.D. 5%	0.50	0.80	0.24	0.11	0.03	0.05
1%	1.15	1.84	0.54	0.26	0.06	0.10
(B) Min-F.						
Urea	70.02	77.28	9.73	9.76	1.994	1.870
Ammonium nitrate	70.05	76.06	9.22	9.24	1.936	1.780
Ammonium sulphate	71.30	75.42	9.25	9.02	1.904	1.980
F. tests	NS	NS	NS	**	*	**
L.S.D. 5%	--	--	--	0.11	0.03	0.05
1%	--	--	--	0.26	--	0.10
(C) Bio-micro.						
Control	63.33	71.31	7.50	8.04	1.591	1.730
Citreen	72.77	76.17	10.00	9.39	2.083	1.870
Phosphorien	75.27	81.28	10.70	10.58	2.160	2.030
F. tests	**	**	**	**	**	**
L.S.D. 5%	0.50	0.80	0.24	0.11	0.03	0.05
1%	1.15	1.84	0.54	0.26	0.06	0.10
(D) Interaction						
A x B	**	NS	NS	**	**	**
A x C	*	NS	NS	NS	**	NS
B x C	**	NS	NS	*	*	NS
A x B x C	NS	NS	NS	NS	NS	NS

2- Influence of mineral and micronutrients fertilization:

Results presented in Tables (1 and 2) showed that, the nitrogen source of urea gives the highest values at most studied parameters in both seasons except ammonium sulphate fertilizer gave the highest values for No. of branches/plant, No. of pods/plant, seed weight/plant, and straw yield ton/fed in 2004/2005 and 100-seed weight in 2003/2004 season.

Data in Table (2) illustrated that, Sakha 1 gives the highest values in seed yield/fed with Giza 3 and Giza 2, which the increased in percentages were 1.9% and 13% in the first season respectively while 4.7% and 13.3% in the second season respectively. The previous results agreed with the findings of kindil (1985); EL-Kahwaga and Zitton (1986); Abdrpobou (1992) and Saghin (1998).

Data presented in Tables (1 and 2) reveal that inoculation of faba bean seeds with phosphorien significantly increased in the number of branches/plant, number of pods/plant, seed weight/plant, 100-seed weight, seed yield/fed. and straw yield/fed. compared with citreen and the control without (phosphorien and citreen). The increased in seed yield was 7%, 42% in the first season and 12.7%, 31.6% in the second season to phosphorien over than citreen and control respectively. These results are in agreement with results of Mahmoud and Abd EL-Hafez (1982), Saber (1982), Saber and Kabesh (1988), Abo El-Nour *et al.* (1996), and Ibrahim and EL-Abbas (2004).

The interaction effect between faba bean cultivars and nitrogen sources had a marked effect on number of pods/plant and seed weight/plant in the two seasons as it is shown in Tables (3 and 4). The highest in umber of pods/plant (31.43) in the first season and (30.86)in the second season was produced from Giza 2 variety fertilized with 20 kg N/fed. from urea and ammonium sulphate, respectively. On the other hand, the lowest number of pods/plant (21.35) in the first season and (23.15) in the second season was given by Giza 3 and Sakha 1, respectively variety fertilized by 20 kg N/fed. from urea and ammonium nitrate respectively.

Table (3): Number of pods/plant weight as affected by the interaction between cultivars and source of nitrogen fertilization in 2003/2004 and 2004/2005 seasons.

Characters	Number of pods/plant					
Seasons	2003/2004			2004/2005		
Cultivars	Sakha 1	Giza 3	Giza 2	Sakha 1	Giza 3	Giza 2
Forms of N.						
Urea	28.36	21.35	31.43	27.48	26.38	27.45
Ammonium nitrate	25.93	21.62	23.95	23.15	24.38	27.56
Ammonium sulphate	22.32	24.38	25.95	25.23	27.33	30.86
F. test	**			**		
L.S.D 5%	0.29			0.31		
1%	0.49			0.51		

The highest seed weight/plant (43.68) in the first season and (46.50) in the second season produced from Sakha 1 varitey fertilized with 20 kg N/fed from urea on the other hand, the lowest seed weight/plant (32.92) in the first season was given by Sakha 1 variety fertilized with 20 kg N/fad. from ammonium sulphate and (34.20) was given by Giza 3 variety fertilized with 20 kg N/fed from urea in the 2nd season.

Table (4): Number of seed weight/plant (g) as affected by the interaction between cultivars and source of nitrogen fertilization in both seasons.

Characters	Seed weight/plant (g.)					
Seasons	2003/2004			2004/2005		
Cultivars	Sakha 1	Giza 3	Giza 2	Sakha 1	Giza 3	Giza 2
Forms of nitrogen						
Urea	43.68	35.68	33.95	46.50	34.20	36.38
Ammonium nitrate	37.42	34.40	32.33	45.68	36.59	34.54
Ammonium sulphate	32.92	38.07	35.50	39.56	43.98	37.67
F. test		**			**	
L.S.D 5%		3.822			5.018	
1%		6.353			8.341	

The interaction between faba bean cultivar and source nitrogen sources had a marked effect on plant height and straw yield/fad. in the two season as it is shown in Tables (5 and 6). The highest plant height (108.37 cm) in the first season and (144.47 cm) in the second season was given by Sakha 1 variety fertilized with 20 kg N/fed from urea. On the other hand, the lowest plant height (90.97 cm) in the first was given by Sakha 1 variety fertilized with 20 kg N/fed. from ammonium nitrate and (91.18 cm) in the second season was given by Giza 2 variety fertilized with 20 kg N/fad. from ammonium sulphate. The highest straw yield (2.125 ton/fed) was given by Giza 3 variety fertilized by ammonium nitrate in the first season while it was (2.236 ton/fed) in the second season given by Giza 3 fertilized by ammonium sulphate.

Table (5): Plant height (cm) ton/fed as affected by the interaction between cultivars and source of nitrogen fertilization in 2003/2004 and 2004/2005 seasons.

Characters	Plant height (cm)					
Seasons	2003/2004			2004/2005		
Cultivars	Sakha 1	Giza 3	Giza 2	Sakha 1	Giza 3	Giza 2
Forms of N.						
Urea	108.37	109.72	95.98	144.47	138.57	106.17
Ammonium nitrate	90.97	102.85	96.42	122.87	126.13	95.70
Ammonium sulphate	93.88	07.37	93.28	104.62	117.63	91.18
F. test		**			**	
L.S.D 5%		9.78			8.48	
1%		16.26			14.09	

3- Correlation coefficient:

The correlation coefficients in Table (7) show the interrelationships among yield and yield componants. It is clear that positive and significant correlation coefficients were obtained between seed yield/fed and each of plant height (r = 0.516**), number of branches/plant (r = 0.409*), number of pods/plant (r = 0.517**), seed weight/plant (r = 0.619***) and 100-seed weight (r = 0.662).

Table (6): Straw yield (ton/fed.) as affected by the interaction between cultivars and source of nitrogen fertilization in 2003/2004 and 2004/2005 seasons.

Characters	Straw yield (ton)/fed.					
Seasons	2003/2004			2004/2005		
Cultivars	Sakha 1	Giza 3	Giza 2	Sakha 1	Giza 3	Giza 2
Forms of N.						
Urea	1.911	2.104	1.970	2.006	1.828	1.771
Ammonium nitrate	1.972	2.125	1.712	2.025	1.822	1.503
Ammonium sulphate	1.824	1.954	1.937	2.043	2.236	1.671
F. test	**			**		
L.S.D 5%	0.148			0.262		
1%	0.246			0.436		

100-seed weight was positive and significantly correlated with plant height (r = 0.574**) and seed weight/plant (r = 0.618**) and positive but not significant with r number of pods/plant and negative with r number of branches/plant (r = -0.051).

The seed weight/plant was positive and significantly with r number of pods/plant (r = 0.472*) and positive but not significant with r plant height and number of branches. Number of pods/plant was positive and significantly correlated with number of branches (r = 0.795**) and positive but not significant with r plant/height (r = 0.151). Thus it can be concluded that seed yield can be increased by selection for higher number of pods/plant, heavier seeds weight/plant and heavier 100-seed weight. These results are in agreement with those obtained by Nigem *et al.*, (1983).

Table (7): Correlations coefficient between all parameters.

Character	1	2	3	4	5	6
1- Plant height	1.000					
2- No. of branches	- 0.031^{NS}	1.000				
3- No. of pod/plant	0.151^{NS}	0.793**	1.000			
4- Seed weight/ plant	0.358^{NS}	0.359^{NS}	0.472*	1.000		
5- 100-seed weight	0.574**	- 0.051^{NS}	0.041^{NS}	0.579**	1.000	
6- Seed yield ardab/fed.	0.519**	0.409*	0.517**	0.619**	0.662**	1.000

4- Mineral contents:

Data in Tables (8 and 9) show that, there are highly significant differences between varieties for all studied parameters in both seasons except at 2003/2004 season for both P and Zn uptake, which were insignificant. The calculated average of two seasons showed that Giza 3 give the highest values for P and Mn uptake (11.74 kg fed^{-1},14.2g fed^{-1}), whereas Sakha 1 gave the highest values for K uptake (28.91 kg fed^{-1}), while Giza 2 gave the highest values for both N and Fe uptake(35.43 kg fed^{-1},93.49 g fed^{-1}).

Data illustrated in Table (8 and 9) clearly show that the differences values between nitrogen sources were significant on most macro and micronutrients uptake by broad bean shoots under study in both seasons except P and K uptake in 2003/2004 seasons as well as Zn and Mn in 2004/2005 season.

Table (8): Effect of different cultivars, nitrogen sources and bio & micronutrients fertilizers on micronutrients (kg fed^{-1}) uptake by shoot of broad bean plants in two seasons.

Characters	N uptake		P uptake		K uptake	
Treatments	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05
(A) Cultuvars						
Sakha 1	32.22	32.70	10.82	10.75	25.79	32.02
Giza 3	33.61	33.75	10.95	12.52	26.00	31.73
Giza 2	32.96	37.49	10.89	11.80	24.64	30.15
F. tests	**	**	NS	**	**	**
L.S.D. 5%	0.97	1.46		0.77	0.83	0.61
1%	NS	2.22		1,17	1,26	0.93
(B) Nitrogen source						
Urea	33.50	35.80	10.99	12.04	25.74	31.52
Ammonium nitrate	33.55	34.35	10.94	12.00	25.35	32.26
Ammoniuam sulphate	31.74	33.79	10.73	11.13	25.34	30.12
F. tests	**	**	NS	**		**
L.S.D. 5%	0.75	0.76		0.43	NS	0.90
1%	1.02	1.05		0.50	NS	1.23
(C)Bio-micro fertilizers						
Control	27.16	29.36	8.45	8.58	24.02	28.88
Phosphorien	37.17	37.30	12.42	13.75	27.22	34.26
Citreen	34.45	37.28	11.79	12.83	25.19	30.75
F. tests	**	**	**	**	**	**
L.S.D. 5%	0.72	1.01	0.31	0.52	0.43	0.71
1%	0.96	1.36	0.41	0.70	0.58	0.95

Urea gave the highest average uptake values calculated for both seasons for both N, P and Mn (34.65, 11.52 kg fed^{-1}, 13.98 g fed^{-1}) these data agree with that found by Sarhan *et al.* (2004) on maize, while ammonium nitrate gave the highest uptake values for K and Zn (28.8 kg fed^{-1} and 13.28 g fed^{-1}) but ammonium sulphate gave the highest uptake values for Fe (93.95 g fed^{-1}). Also data from the same Tables ammonium sulphate fertilizer gives the lowest values for N, P, K and Zn uptakes by shoat (32.77, 10.93, 273 kg fed^{-1} and 13.13 kg fed^{-1}) respectively. From the same Tables (8 and 9), the effect of N-sources on nutrient uptake of shoot at harvest reduced in order of urea > ammonium nitrate > ammonium sulphate for both N and P (which their values related as the average of both seasons), where K uptake follow the order ammonium nitrate > urea > ammonium sulphate. But the trend differs and follow this order ammonium sulphate > urea > ammonium nitrate for Fe while for Zn ammonium nitrate > Urea > ammonium Nitrate. sulphate and Mn urea > ammonium sulphate > ammonium

The effects of bio and micronutrient fertilizers on macro and micronutrient uptake by shoot at harvest time are illustrated in Tables (8 and 9) data reveal that, the differences between the two kind of fertilizers were highly significant for all nutrients uptake under study. Also, the differences between them compared with control were a highly significant, phosphorien gave the highest values for N, P and K uptake calculated as the average of both seasons, which their values are: 37.24, 13.09 and 30.74 kg fed^{-1}, respectively.

Table (9): Effect of different cultivars, nitrogen sources and bio & micronutrients fertilizers on micronutrients uptake by shoot of broad bean plants in two seasons.

Characters	Fe uptake		Zn uptake		Mn uptake	
Treatments	2003/04	2004/05	2003/04	2004/05	2003/04	2004/05
(A) Cultuvars						
Sakha 1	83.36	101.49	12.26	15.19	14.74	13.46
Giza 3	82.75	104.15	12.24	15.22	13.82	14.58
Giza 2	81.07	105.91	12.12	12.13	12.78	13.63
F. tests	**	**	NS	**	**	*
L.S.D. 5%	0.95	1.77		1.03	0.42	1.02
1%	1.43	2.68		1.55	0.63	
(B) Nitrogen source						
Urea	82.16	104.91	12.34	14.00	14.14	13.82
Ammonium nitrate	83.03	100.76	12.27	14.29	13.68	13.74
Ammonium sulphate	82.01	105.88	12.00	14.26	13.52	14.12
F. tests	**	**	*	NS	**	NS
L.S.D. 5%	0.44	1.82	0.30		0.36	
1%	0.60	2.50			0.49	
(C)Bio-micro fertilizers						
Control	69.18	80.42	9.92	9.54	10.77	9.20
Phosphorien	85.14	114.57	12.49	15.31	13.92	15.14
Citreen	92.37	116.57	14.22	17.70	16.66	17.34
F. tests	**	**	**	**	**	**
L.S.D. 5%	0.65	1.54	0.22	0.68	0.31	0.68
1%	0.86	2.05	0.30	0.91	0.42	0.91

And citreen gives the highest values for Fe, Zn, and Mn content which their values are: 104.47, 15.96 and 17.00 g fed^{-1}. This is an excepted result where citreen is a micronutrients fertilizer.

The interaction between cultivars and N sources are found in Tables (10 and 11) with macro and micro uptakes by shoot of faba bean plants at harvest time. Data revealed the highly significant effect between treatments and all parameters under study in both seasons. It is clear that from this Tables that G3 × N1 gives the highest values (calculated as the average for both seasons) for P, K, Fe and Mn uptake which are: 21.63, 29.92 kg fed^{-1} and 98.30, 14.83 g fed^{-1} respectively. While the highest value content for N by kg fed^{-1} was found at G3 × N3 (35.64 kg fed^{-1}). But the interaction effect between $S_1 \times N_2$ gave the highest values for Zn (14.73 g fed^{-1}). From the

same tables the interaction effects of cultivars and bio-micronutrionts with all parameters under study were significant. Which G2 × C2 gave the highest values for N uptake (40.11 kg fed^{-1}) and Fe uptake (104.26 g fed^{-1}).

Table (10): The interactions effect between cultivars, bio and micronutrients fertilizers on macronutrients (kg fed^{-1}) uptake in two seasons.

Characters		N uptake		P uptake		K uptake	
Seasons		2003/04	2004/05	2003/04	2004/05	2003/04	2004/05
Treatments							
A × B	S1N1	33.49	35.88	10.62	10.60	26.71	30.74
	S1N2	32.27	30.74	11.00	11.72	25.47	37.58
	S1N3	30.89	31.48	10.85	9.92	26.19	27.73
	G3N1	34.86	34.07	11.29	13.96	26.12	33.71
	G3N2	33.89	36.31	11.13	11.20	26.34	29.22
	G3N3	32.07	30.88	10.41	12.40	25.52	32.26
	G2N1	32.13	37.44	11.05	11.54	24.38	30.10
	G2N2	34.48	36.00	10.68	13.08	24.24	29.97
	G2N3	32.25	39.02	10.93	11.07	25.31	30.37
F. test		**	**	**	**	**	**
L.S.D 5%		1.29	1.32	0.59	0.73	0.79	1.56
1%		1.77	1.82	0.81	1.01	1.09	2.14
A × C	S1C	26.44	27.05	8.48	8.32	24.43	30.21
	S1Ph	36.43	38.54	12.32	12.27	27.24	33.49
	S1C2	33.79	32.51	11.66	11.65	25.71	32.35
	G3C	28.17	31.61	8.45	8.30	24 48	30.07
	G3Ph	37.54	36.07	12.41	14.32	28.17	34.99
	G3C2	35.11	33.58	11.97	14.95	25.34	30.13
	G2C	26.87	29.46	8.41	9.13	23.15	26.38
	G2Ph	37.54	37.30	12.53	14.66	26.26	34.30
	G2C2	34.46	45.75	11.73	11.90	24.54	29.77
F. test		**	**	**	**	**	**
L.S.D 5%		1.25	1.75	0.53	0.91	0.74	1.23
1%		1.66	2.32	0.70	1.21	0.99	1.64
B × C	N1C	27.88	28.08	8.34	9.88	23.90	28.08
	N1Ph	37.32	38.89	12.54	12.83	27.95	34.13
	N1C2	35.29	40.42	12.03	13.40	25.37	32.35
	N2C	27.42	32.14	8.59	9.15	23.88	29.88
	N2Ph	37.38	36.75	12.40	13.66	27.29	36.49
	N2C2	35.85	34.15	11.82	13.19	24.89	30.41
	N3C	26.19	27.86	8.36	6.72	24.27	28.69
	N3Ph	36.81	36.26	12.31	14.76	26.43	32.17
	N3C2	32.22	37.25	11.51	11.91	25.31	29.50
F. test		**	**	**	**	**	**
L.S.D 5%		1.25	1.75	0.53	0.91	0.74	1.23
1%		1.66	2.32	0.70	1.21	0.90	1.64
A × B ×C F. test		**	**	**	**	**	**

S1 = Sakha 1 **C = control** **N2 = ammonium nitrate**
G3 = Giza 3 **C2 = citreen** **N3 = ammonium sulphate**
G2 = Giza 2 **N1 = urea** **A × C = cultivar × bio-micronutrient**
A × B = cultivar × nitrogen forms **B × C = Nitrogen forms× bio-micronutrient**

It is clear that from Tables (10 and 11) the interaction effect of nitrogen sources and bio-micronutrients with all parameter are a heighest significant, where the interaction between N1 × ph, N_2 × ph and N_3 × ph give the highest

value, for N, P and K uptake as an average of both seasons, while $N_1 \times C_2$, $N_2 \times C_2$ and $N_3 \times C_2$ gave the highest values for Fe, Zn, and Mn uptake. It can explain that, phosphoren as a biofertilizers promote plants to uptake macronutrients. This data agree with that found by Mohamed, *et al.*, (2001) on broad bean.

The interaction between all treatments with all parameters studied the highly significant relationships and this was obvious in Table (11).

Table (11): The interactions effect between cultivars, bio and micronutrients fertilizers on micronutrients uptake by g/fed in two seasons.

Characters		Fe uptake		Zn uptake		Mn uptake	
Seasons		2003/04	2004/05	2003/04	2004/05	2003/04	2004/05
Treatments							
A x B	S1N1	82.33	97.76	12.48	14.59	15.07	13.73
	S1N2	84.29	98.55	12.40	17.05	14.62	13.63
	S1N3	83.46	108.17	11.90	13.93	14.54	13.03
	G3N1	83.07	113.53	12.62	15.24	14.21	15.45
	G3N2	83.34	96.05	12.26	15.14	13.38	13.82
	G3N3	81.85	102.88	11.84	15.29	13.87	14.47
	G2N1	81.06	103.43	11.92	12.17	13.15	12.27
	G2N2	81.46	107.69	12.15	10.67	13.04	13.77
	G2N3	80.71	106.59	12.30	13.56	12.16	14.85
F. test		**	**	**	**	**	**
L.S.D	5%	0.77	3.15	0.52	1.26	0.62	1.39
1%		1.05	4.32	0.72	1.73	0.85	1.91
A x C	S1C	70.09	81.43	10.26	9.52	11.85	8.22
	S1Ph	86.89	112.28	12.46	16.09	15.08	14.79
	S1C2	93.11	110.43	14.06	19.97	17.30	17.37
	G3C	69.85	74.32	9.94	10.28	10.61	10.08
	G3Ph	85.44	116.38	12.42	16.57	13.86	15.72
	G3C2	92.98	121.76	14.37	18.82	17.00	17.94
	G2C	69.09	85.15	9.56	8.81	9.86	9.31
	G2Ph	83.11	115.06	12.60	13.28	12.81	14.89
	G2C2	91.02	117.50	14.22	14.32	15.68	16.40
F. test		**	**	**	**	**	**
L.S.D	5%	1.13	2.66	0.39	1.18	0.54	1.18
1%		1.50	3.54	0.52	1.58	0.72	1.58
B x C	N1C	69.71	82.51	10.16	10.63	11.38	9.23
	N1Ph	85.58	119.50	12.51	14.86	14.08	14.80
	N1C2	91.19	112.71	14.35	16.51	16.97	17.43
	N2C	70.14	78.58	9.97	9.13	10.62	9.18
	N2Ph	85.86	110.42	12.49	14.86	13.85	14.81
	N2C2	93.09	113.29	14.36	18.88	16.58	17.22
	N3C	69.18	80.16	9.63	8.85	10.32	9.19
	N3Ph	84.00	113.80	12.47	16.21	13.83	15.80
	N3C2	92.83	123.69	13.93	17.72	16.43	17.37
F. test		**	**	**	**	**	**
L.S.D	5%	1.13	2.66	0.39	1.18	0.54	1.18
1%		1.50	3.54	0.52	1.58	0.75	1.55
A x B x C F. test		**	**	**	**	**	**

S1 = Sakha 1 C = control N2 = ammonium nitrate
G3 = Giza 3 C2 = citreen N3 = ammonium sulphate
G2 = Giza 2 N1 = urea A x C = cultivar x bio-micronutrient
A x B = cultivar x nitrogen forms B x C = Nitrogen forms x bio-micronutrient

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استجابة ثلاثة أصناف من الفول البلدى لمصادر مختلفة من النتروجين تحت التسميد الحيوى بالفوسفور وإضافة العناصر الصغرى

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نفذت تجربتان حقليتان فى محطة البحوث الزراعية بتاج العز دقهلية خلال موسمى ٢٠٠٣/٢٠٠٤ و٢٠٠٤/٢٠٠٥ بغرض دراسة استجابة ٣ أصناف من الفول البلدى سخا ١، جيزة ٣، جيزة ٢ لمصادر مختلفة من النتروجين (يوريا – نترات الأمونيوم – سلفات الأمونيوم) مع إضافة سماد حيوى وهو الفوسفورين وسماد مركب للعناصر الصغرى فى حالة متزنة وهو السترين وتفاعلاتهم على محتوى الأصناف من العناصر الكبرى والصغرى وكذلك الخصائص المحصولية والنمو.

وكان التصميم التجريبى قطع منشقة – منشقة كررت أربع مرات ويمكن تلخيص النتائج كالتالى:

١- لقد تميز صنف سخا ١ عن جيزة ٣ وجيزة ٢ فى وزن البذور/نبات ووزن ١٠٠ بذرة بالجرام ومحصول البذور بالأردب/فدان. وتميز عن جيزة ٣ فى عدد الفروع/نبات فى كلا الموسمين ولكن جيزة ٣ تميز عن سخا ١ وعن جيزة ٢ فى ارتفاع النبات ومحصول القش.

٢- أدى استخدام سماد اليوريا إلى زيادة معنوية فى ارتفاع النبات وعدد القرون/نبات فى كلا الموسمين وتميز فى زيادة عدد والفروع/نبات ووزن بذور/نبات بالجرام ومحصول البذور أردب/فدان فى الموسم الأول.

٣- ولقد أعطى سماد الفوسفورين تأثير عالى المعنوية على عدد الفروع/نبات وعدد القرون/نبات ووزن البذور/نبات بالجرام ووزن ١٠٠ حبة/نبات بالجرام ومحصول البذور/فدان بالأردب وأيضا محصول القش طن/فدان فى كلا الموسمين بالمقارنة بكل من الكنترول وسماد السترين.

٤- وقد أظهر تفاعل أصناف الفول مع المصادر النتروجينية تأثيرا معنويا على ارتفاعات النبات بالسم وعدد القرون/نبات ووزن البذور/نبات ومحصول القش طن/فدان فى كلا السوسمين وإلى زيادة معنوية فى وزن ١٠٠ حبة فى الموسم الأولى فقط وإلى زيادة معنوية فى محصول البذور بالأردب/فدان فى الموسم الثانى.

٥- وقد وُجد أن زراعة صنف سخا ١ مع التسميد ٢٠ كجم نتروجين/فدان و١٠٠٠ جم/فوسفورين/فدان من الفوسفورين يُعطى أفضل محصول للفول فى ظروف هذه الدراسة.

٦- ولقد أعطى جيزة ٣ أعلى القيم للفوسفور (١١,٧٤ كجم/ف) والمنجنيز (١٤,٢ ج/ف) على أساس متوسط الموسمين. بينما أعطى صنف سخا ١ أعلى محتوى للبوتاسيوم (٢٨,٩١ كجم/ف) وأعطى جيزة ٢ أعلى محتوى للنتروجين (٣٥,٤٣ كجم/ف) والحديد (٩٣,٤٩ جم/ف).

٧- أظهر السماد الحيوى الفوسفورين أعلى القيم فى محتوى النباتات من النتروجين والفوسفور والبوتاسيوم فى كلا الموسمين على التوالى.

٨- ولقد أوضحت الدراسة أن التفاعل بين كل المعاملات وامتصاص العناصر الصغرى والكبرى من النتروجين والفوسفور والبوتاسيوم والحديد والزنك والمنجنيز بواسطة نباتات الفول كانت معنوية جدا فى كلا الموسمين على التوالى.