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Effect of Bio-Fertilization and Foliar Spraying with some Micro-Elements on Growth and Productivity of Two Faba Bean Cultivars

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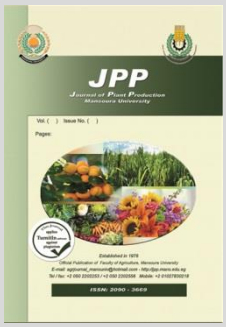

ABSTRACT

The aim of this study was to investigate the response of two faba bean cultivars (Misr-1 and Giza-40) to bio-fertilizers (*Bacillus megatherium var. phosphaticum* and *Psedomonas*) and foliar spraying with some micro- elements (Fe- Zn and Mn) on growth, yield and seeds quality. Two field experiments were carried out during winter seasons of 2017/2018 and 2018/2019 at the Experimental Farm of Agricultural Res. Center, Al-Azhar University , Assuit Governorate, Egypt. Split-split plot design was used with three replicates , where faba bean cultivars were assigned to the main plots , foliar spraying were distributed randomaly in the sub plots and bio-fertilizers were located in the sub-sub plots . Results concluded that faba bean cultivars exhibited significant difference in plant height, number of branches/plant, number of pods/plant, seed yield/plant, 100-seed weight , straw yield/fed , protein and phosphorus percentage of seeds in both seasons while faba bean cultivars exhibited significant difference in seed yield/fed in first season only. Where, cultivar Misr-1 superior to Giza-40 in all studied characters. Also, micro elements foliar application caused a signification increases in all studied characters. Where, the highest values were recorded with Fe spraying in both seasons. Also, application of phosphorein induced significant increases in all previous characters in both seasons. Therefore , this study recommends that Misr-1 cultivar inoculation with phosphorein and foliar spraying with Iron in order to improve the production of faba bean under the condition of Assuit Governorate, Egypt.

Keywords: Faba bean- Foliar-Bio fertilization -Micro elemnts- Cultivars

INTRODUCTION

Faba bean (*Vicia faba L.)* is an important feeding leguminous crop grown in winter season in Egypt. Ripe seeds of faba bean have high percentage of protein (average protein content of dried seeds being 20 - 36%), moreover a food of high calorific and nutritive value especially in the diet of low income people. In Egypt the production of faba bean just covered about 60 % of the national demands. Due to efforts should be directed towards increasing and improving the faba bean yield. (Rezk *et.al* 2016).

Khalil *et al*. (2004) found that the faba bean cultivar Misr-1surpassed Giza-40 cultivar in number of pods/plant, weight of 100-seeds, seed yield /fed., straw yield /fed. and protein percentage in seeds. However, Giza-40 cultivar exceeded Misr-1 in plant height. EL-Said(2012) deduced that faba bean bean cultivars exhibited significant differences in plant height and 100-seed weight ,number of branches/plant. while , number of pods/plant no significant in both seasons . Plant of Misr-1 were superior to Giza-40 and Giza-429 in number of branches/plant , number of pods/plant, seed yield/plant and ,100-seed weight. Nabila *et al*.(2017) concluded that the Sohag-104 cultivar gave higher number of pods/plant, weight of pods(g/ plant), seed yield (kg/fed.) and straw yield (kg/fed.) than Giza-6 cultivar.

The Egyptian soil is suffering from shortage of micro-nutrients after constructing of the high dam. The deficiency of Fe in plants causes significant changes in the plant metabolism and induces chlorosis, especially in young leaves and leads to very low reutilization, . Zinc (Zn) is an essential trace element for every living organism. About 200 enzymes and transcription factors require Zn as a functional component (Kabata-Pendias and Pendias, 1999). Manganese (Mn), in turn, is regarded as an activator of many different enzymatic reactions and takes part in photosynthesis. Teixeira *et al*.(2004) stated that the combined application of Mn caused an increase in plant height, number of pods per plant. Jasim (2007) showed that foliar Fertilization (Manganese 300 ppm) caused an increase in plant height, branches number /plant, pod numbers / plant,. It caused also an increase dry seeds yield significantly as compared with control. Knany *et al*.(2009) summarized spraying with Fe produced the highest seeds yield of 3753.9 and 3772.0 kg ha-1 in the both seasons and increased 100 seeds weight, N% and P% in the seeds, protein % in the seeds. El-Gizawy and Mehasen*(*2009) concluded that there were significant differences between foliar applications of zinc treatments in (plant height, No. of branches and pods/plant, 100-seed weight, seed yield/plant, seed and straw yields/fed, and protein%,) . Fouda and Abd-Elhamied(2017) demonstrated that treatment (foliar application with Fe) significantly increased plant height (cm) , No. of branches/plant, No. of pods/plant, 100 seed weight (g) and seed yield Kg/fed.), as well as quality composition (protein) and increased 100 seeds weight and protein % in the seeds. Praveena *et.al*(2018) deduced that growth parameters viz. plant height (64.16cm), No. of branches per plant (7.80), plant dry weight (8.48) and yield attributes viz. no. pods per plant (23.86), grain yield (2.18t h-1), straw yield (2.96 t ha-1) were significantly recorded higher under treatment (0.2% foliar spray) of boron+5.0kg ha-1 of zinc .

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Plant nutrients are essential for plant life and yield, therefore bio-fertilizer is an important for legume as well as for faba bean because it supplies plants with a part of the requirements form essential nutrients. Moreover, is to saves a great amount of mineral fertilizers and reduces environmental pollution and costs of crop production. Phosphate dissolving bacteria are considered as biological fertilizers which have an important role in the solubility of phosphorus and enhancing, its absorption by plants. Yakout and Greish (2002) reported that bio-fertilizer or without bio-fertilizer Microbein significantly increased number of pods/plant, seed yield /ha. and seed protein. Abd-El-Aziz (2005) obtained that applications of phosphorein induced significant increases in most of the studies characters, i.e. plant height, number of branches/ plant, number of pods /plant, 100-seed weight, seed yields /plant as well as seed and straw yield /fed. Also, such treatment increased protein content of faba bean seeds. El-Gizawy and Mehasen(2009) demonstrated that adding 30 kg P2O5 mixed with PDB markedly increased plant height, No. of branches and pods/plant, 100-seed weight, seed yield/plant, seed and straw yields/fed, protein% of Faba bean (*Vicia faba* L.). Bayoumi and Selim(2012) noticed that the characters of faba bean plants such as , plant height (cm), 100-seed weight (g), seed yield (ard/fed), dry weight of seedling (g) and chemical composition of seeds(protein content as%) were significantly by application of the (humic acid and bio-fertilization treatment) compared to the control treatment. EL-Said(2012) deduced that application of phosphorein induced significant increases in plant height, total weight/ plant , number of branches /plant , number of pods/plant , seed yield /plant and 100-seed weight., as well as induced significant increases in seed and straw yield /fed, ,protein content and phosphorus content of faba bean seed. Shakori and Sharifi (2016) indicated that the effect of phosphate bio-fertilizer was significant on number of pods per plant, plant height and hundred seed weight of faba bean(*Vicia faba* L.).*Rhizobacteria* group of *Pseudomonas* (P. *fluorescens*, P. *putida*, and P.*aeruginosa*) is known to be beneficial to plants. Some strains have long been known as a biological control agent. The bacteria are also known as plant growth promoting rhizobacteria (PGPR), either directly or as a result of its ability to control the disease. An explanation of some strains of *Pseudomonas* spp. Widnyana and Javandira (2016) associated with the plant, which can encourage the growth of plants or suppress plant diseases continues to grow, and knowledge of the mechanisms involved continue to increase.

The objective of the present work is to study the response of two faba bean cultivars (Misr-1 and Giza-40) to application of foliar spraying with some micro elements and bio- fertilizers under Assiut Governorate conditions.

MATERIALS AND METHODES

Two field Experiments were carried out at the Experimental Farm Faculty of Agriculture, Al-Azhar University at Assiut ,Egypt during two successive growing seasons 2017/2018 and 2018 /2019, to study the effect of bio-fertilization (*Pseudomonas.*(B1) and phosphorein (B2).) and foliar of some micro- elements (Fe, Zn and Mn) on growth productivity of two faba bean cultivars (Misr-1 and Giza-40) . The experimental design was A Randomized Completed Blocks Design (RCBD) as split-split plot arrangement of treatments with three replications. Faba bean cultivars were assigned to the main plots, foliar spraying were distributed randomly in the sub plots and bio- fertilizers were located in the sub-sub plots. The experimental unit comprised five ridgs. Each 3.5 m longth and 0.6 m width (or 10.5m^2 in area =1/400/ fed) were sown on the two sides of ridge , in hills 25 cm apart and thinned to two plants/hill. Seed were sown on 3rd Nov. in 2017 and 30th Oct.in 2018, respectively. The preceding summer crop was Sorghum Sudan grass in both seasons. Fertilization foliar was used in the form of chelated and added on foliar spraying after 40 and 70 days of sawing at a rate of (0.5g/L) for every element alone in the first and the second seasons. The bio – fertilizer *Pseudomonas.*(B1) The bacteria are also known as plant growth promoting rhizobacteria (PGPR), and the bio-fertilizer phosphorein (B2) is a phosphate solubizing bacteria (PSB)*Bacillus megatherium* var. *phosphaticum* and were provided by the biological amendments project , Agriculture Research Center, Egypt. The inoculation was performed by coating faba bean seed at the rate of 1 kg/fed. using a sticking substance (Arabic gum 5%) just before sowing every one alone.

Soil analysis:-

Some physical and chemical properties of the soil of the experimental site were analyzed according to the methods described by Black(1965) for available nitrogen , Jackson (1973) for pH, organic matter and EC Olsen and Sommers(1982) for available phosphorus and presented in Table (1).

Table 1. The physical and chemical analyses of soil field experiments.

Soil properties	2017/2018 season	2018/2019 season
	physical analysis	
Sand (%)	25.20	25.50
Silt (%)	39.20	39.35
Clay (%)	35.60	35.15
Soil texture	Clay loam	Clay loam
	Chemical analysis	
Organic matter (%)	0.99	1.04
Available N (ppm)	75.50	74.30
Available P (ppm)	9.80	10.26
Available K (ppm)	349.15	351.25
Available Fe (ppm)	4.55	4.62
Available Mn(ppm)	3.44	3.49
Available Zn(ppm)	.35	.39
Available Cu(ppm)	2.55	2.60
PH (s.p. 65)	7.90	7.95
E.C (ds. m^{-1})	1.16	1.15
Total Ca Co_3 (%)	2.73	2.50

Studied traits:

A-Yield components:

Data was recorded at harvest samples of 10 plants were chosen randomly from the inner rows and the following characters were recorded:

1- **Plant height at harvest (cm).**
2- **Number of branches /plant.**
3- **Number of pods/plant.**
4- **Seed yield/plant (gm).**
5- **100-seed weight(seed index) :** the weight of 100-seed was calculated as an average of five random samples for each plot . It was weighed in grams.

B-Yield traits:-

1-Seed yield (ard/fed.)(ard=155kg).

2-Straw yield (ton/fed.). seed and straw yields were recorded on plot basis . The recorded values were used to estimate the corresponding value per fed.

C- Chemical content(%):

1 –Protein content (%).

Total nitrogen content in seed was estimated by using microkjeldahl method as described by A.O.A.C(1980) and percentage of protein was calculated by multiplaying the nitrogen percentage by 6.25.

2- Phosphorus content(%).

Total phosphorus was determined in the seed digest colorimetrically using the spectrophotometer according to the method described by Chapman and pratt(1961).

Statistical analysis:

The results were statistically analyzed according to Gomez and Gomez (1984) using the computer MSTAT-C statistical analysis package by Freed *et al.*(1989). The least significant differences (LSD)test at probability level of 0.05 was manually calculated to compare the differences among means.

RESULTS AND DISCUSSION

A-Yield components:

1-cultivars:

Data presented in Tables (2,3,4 ,5 and 6) observed that faba bean cultivars significantly differed in plant height, number of branches/plant, number of pods /plant, seed yield/plant and 100-seed weight in both seasons .Where, Misr-1 cultivar surpassed Giza-40 cultivar in all studied characters in both seasons . The difference between faba bean cultivars in all studied characters was due to the genetic differences and its response to the environmental conditions as a result of the interaction between genetics and the environment . This result was in line with the work of EL-Said (2012).

Table 2. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on plant height (cm) of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	147.3	149.4	160.3	152.3	149.5	151.7	162.2	154.5
	Fe	152.7	156.3	164.1	157.7	156.6	160.3	168.4	161.8
	Mn	150.3	152.3	162.5	155.0	152.3	154.3	164.1	156.9
	Zn	151.5	154.5	163.5	156.5	154.5	157.1	166.5	159.4
Mean		150.5	153.1	162.6	155.4	153.2	155.8	165.3	158.1
Giza-40	Co	145.4	147.6	158.2	150.4	147.4	149.3	160.8	152.5
	Fe	150.2	155.5	163.5	156.4	154.3	159.5	167.3	160.4
	Mn	148.8	150.6	160.5	153.3	150.4	152.4	162.4	155.1
	Zn	149.3	152.5	161.6	154.5	152.3	155.3	164.3	157.3
Mean		148.4	151.6	160.9	153.6	151.1	154.1	163.7	156.3
Mean for Micro elements	Co	146.4	148.5	159.3	151.4	148.5	150.5	161.5	153.5
	Fe	151.4	155.9	163.8	157.0	155.5	159.9	167.8	161.1
	Mn	149.6	151.5	161.5	154.2	151.4	153.3	163.3	156.0
	Zn	150.4	153.5	162.5	155.5	153.4	156.2	165.4	158.3
Mean		149.5	152.3	161.8		152.2	155.0	164.5	
L.S.D. at 5% for									
F-test Cultivars (C)		**		**					
Micro elements (M)		**0.768**		**0.891**					
Bio-fertilizer (B)		**0.573**		**0.676**					
C X M		**N.S**		**N.S**					
CXB		**N.S**		**N.S**					
MXB		**1.15**		**1.35**					
CXMXB		**N.S**		**N.S**					

Table 3. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on number of branches/plant of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	1.383	2.600	3.700	2.561	1.700	2.750	4.000	2.817
	Fe	2.800	3.700	4.800	3.767	3.100	3.950	4.900	3.983
	Mn	1.750	2.800	3.900	2.817	1.950	2.950	4.200	3.033
	Zn	2.200	3.300	4.300	3.267	2.700	3.600	4.500	3.600
Mean		2.033	3.100	4.175	3.103	2.363	3.313	4.400	3.359
Giza-40	Co	1.200	2.300	3.500	2.333	1.300	2.550	3.850	2.567
	Fe	2.500	3.500	4.650	3.550	2.700	3.700	4.750	3.717
	Mn	1.500	2.550	3.750	2.600	1.650	2.750	4.000	2.800
	Zn	2.000	3.050	4.200	3.083	2.150	3.200	4.400	3.250
Mean		1.800	2.850	4.025	2.892	1.950	3.050	4.250	3.083
Mean for Micro elements	Co	1.292	2.450	3.600	2.447	1.500	2.650	3.925	2.692
	Fe	2.650	3.600	4.725	3.658	2.900	3.825	4.825	3.850
	Mn	1.625	2.675	3.825	2.708	1.800	2.850	4.100	2.917
	Zn	2.100	3.175	4.250	3.175	2.425	3.400	4.450	3.425
Mean		1.917	2.975	4.100		2.156	3.181	4.325	
L.S.D. at 5% for									
F-test Cultivars (C)		**		**					
Micro elements (M)		**0.036**		**0.03**					
Bio-fertilizer (B)		**0.029**		**0.031**					
C X M		**N.S**		**0.042**					
CXB		**0.042**		**0.044**					
MXB		**0.059**		**0.063**					
CXMXB		**N.S**		**N.S**					

Table 4. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on number of pods/plant of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	14.30	15.20	16.40	15.30	14.70	15.40	16.60	15.57
	Fe	15.70	16.40	17.95	16.68	16.00	16.90	18.15	17.02
	Mn	14.80	15.45	16.90	15.72	14.95	15.70	17.35	16.00
	Zn	15.10	15.95	17.45	16.17	15.30	16.20	17.60	16.37
Mean		14.98	15.75	17.18	15.97	15.24	16.05	17.43	16.24
Giza-40	Co	14.00	14.80	15.90	14.90	14.25	15.00	16.10	15.12
	Fe	15.50	16.35	17.80	16.55	15.70	16.50	17.95	16.72
	Mn	14.60	15.20	16.60	15.47	14.75	15.45	16.80	15.67
	Zn	14.85	15.70	17.30	15.95	15.00	15.95	17.50	16.15
Mean		14.74	15.51	16.90	15.72	14.93	15.73	17.09	15.91
Mean for Micro elements	Co	14.15	15.00	16.15	15.10	14.48	15.20	16.35	15.34
	Fe	15.60	16.38	17.88	16.62	15.85	16.70	18.05	16.87
	Mn	14.70	15.33	16.75	15.59	14.85	15.58	17.08	15.84
	Zn	14.98	15.83	17.38	16.06	15.15	16.08	17.55	16.26
Mean		14.86	15.63	17.04		15.08	15.89	17.26	
L.S.D. at 5% for									
F-test Cultivars (C)	******		******						
Micro elements (M)	**0.042**		**0.040**						
Bio-fertilizer (B)	**0.027**		**0.028**						
C X M	**0.059**		**0.056**						
CXB	**N.S**		**N.S**						
MXB	**0.054**		**0.056**						
CXMXB	**0.076**		**0.080**						

Table 5. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on seed yield /plant(gm) of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	26.09	28.08	35.18	29.78	27.86	30.04	38.25	32.05
	Fe	31.40	34.29	42.63	36.11	33.58	37.19	44.85	38.54
	Mn	27.48	30.85	38.21	32.18	29.81	33.39	40.72	34.64
	Zn	29.73	32.59	40.37	34.23	31.09	35.69	42.54	36.44
Mean		28.68	31.45	39.10	33.08	30.58	34.08	41.59	35.42
Giza-40	Co	23.57	26.44	33.45	27.82	25.83	29.04	35.92	30.26
	Fe	28.08	32.56	40.79	33.81	30.67	35.10	42.06	35.94
	Mn	24.85	28.33	37.66	30.28	25.60	31.85	39.62	32.36
	Zn	26.36	30.84	39.64	32.28	28.12	33.79	41.47	34.46
Mean		25.72	29.54	37.89	31.05	27.56	32.45	39.77	33.26
Mean for Micro elements	Co	24.83	27.26	34.32	28.80	26.85	29.54	37.08	31.16
	Fe	29.74	33.43	41.71	34.96	32.13	36.15	43.46	37.25
	Mn	26.17	29.59	37.94	31.23	27.71	32.62	40.17	33.50
	Zn	28.05	31.72	40.00	33.26	29.60	34.74	42.01	35.45
Mean		27.20	30.50	38.49		29.07	33.26	40.68	
L.S.D. at 5% for									
F-test Cultivars (C)	******		******						
Micro elements (M)	**0.094**		**0.108**						
Bio-fertilizer (B)	**0.107**		**0.098**						
C X M	**0.133**		**0.152**						
CXB	**0.152**		**0.139**						
MXB	**0.214**		**0.197**						
CXMXB	**0.030**		**0.277**						

Table 6. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on 100-seed weight(gm) of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	65.02	68.73	69.85	67.87	66.80	69.58	70.55	68.98
	Fe	70.14	74.60	75.70	73.48	71.74	74.80	75.95	74.16
	Mn	67.65	70.69	71.75	70.03	68.30	71.90	72.43	70.88
	Zn	69.53	72.88	73.17	71.86	70.17	73.13	74.80	72.70
Mean		68.08	71.73	72.62	70.81	69.25	72.35	73.43	71.68
Giza-40	Co	60.39	64.19	65.54	63.37	62.08	66.37	66.25	64.90
	Fe	66.96	70.28	71.05	69.43	67.03	71.45	72.26	70.25
	Mn	63.19	66.84	67.46	65.83	64.82	67.64	68.33	66.93
	Zn	65.51	68.14	69.90	67.85	66.88	69.08	71.90	69.29
Mean		64.01	67.36	68.49	66.62	65.20	68.64	69.69	67.84
Mean for Micro elements	Co	62.71	66.46	67.70	65.62	64.44	67.98	68.40	66.94
	Fe	68.55	72.44	73.38	71.46	69.39	73.13	74.11	72.21
	Mn	65.42	68.77	69.61	67.93	66.56	69.77	70.38	68.90
	Zn	67.52	70.51	71.54	69.86	68.53	71.11	73.35	71.00
Mean		66.05	69.54	70.55		67.23	70.49	71.56	
L.S.D. at 5% for									
F-test Cultivars (C)	******		******						
Micro elements (M)	**0.077**		**0.070**						
Bio-fertilizer (B)	**0.077**		**0.064**						
C X M	**0.091**		**0.097**						
CXB	**0.109**		**0.088**						
MXB	**0.154**		**0.124**						
CXMXB	**0.218**		**0.176**						

2-micro elements:

The results in Tables (2,3,4,5 and 6) observed that application of foliar with some micro elements to faba bean plants exerts a significant influence on plant height, number of branches/plant, number of pods /plant, seed yield/plant and 100-seed weight, in both seasons . The highest values were found in the Fe treatment in 2017/2018 and 2018/2019 seasons. The positive effect of iron may be due to the physiological role of iron on the meristematic activity of plant tissues and consequently increasing plant height . These results are in harmony with this obtained by Teixeira *et al*.(2004) Jasim (2007), and Fouda and Abd-Elhamied(2017)

3- bio-fertilizers:

It is clear from the results as shown in the Tables (2,3,4,5 and 6) that significant differences between the treatment of inoculation and non inoculation with phosphorein for plant height, number of branches/plant, number of pods /plant, seed yield/plant and 100-seed weight in the two seasons . In general, application of *Bacillus megatherium var.phosphaticum* (phosphorein) produced the highest values of all studied characters as compared to the control and inoculation with *pseudomonas* in both seasons. These results it could be due to the effect of nutrients mobilizing microorganisms which help in availability of metals and increased levels of extractable mineral bring a soluble phosphate in soluble forms secreting organic acids which lower the PH and bring about the dissolution of bonds forms of phosphate and render then available for growing plant. Similar results were found by Abd-El-Aziz (2005) , El-Gizawy and Mehasen(2009) and Shakori and Sharifi (2016)

4-Interactions:

The data in the Tables (2,3,4,5 and 6) notice that the interaction between cultivars × micro elements for the number of branches/plant was significant in the second season only, number of pods /plant , seed yield/plant and 100-seed weight was significant in the both seasons, while plant height was in-significant in the both seasons. Also, the interaction between cultivars and bio-fertilizers for the number of branches/plant, seed yield/plant and 100-seed weight was significant in the both seasons, while for plant height and number of pods /plant was in- significant in the both seasons. Also, the interaction between micro elements and bio-fertilizers for plant height, number of branches/plant, number of pods /plant , seed yield/plant and 100-seed weight was significant in the both seasons. Also, the interaction among cultivars , micro- elements and bio-fertilizers for number of pods/plant and 100-seed weight was significant in the both seasons, while plant height and number of branches/plant was in significant in the both seasons.

B-Yield attributes (Seed yield and straw yield/fed):-

1- Cultivars:

It is obvious Tables (7 and 8) that seed yield /fed was significantly differences between cultivars in first seasons only. While, straw yield /fed was significantly differences between cultivars in 2017/2018 and 2018/2019 seasons . Results indicated that Misr-1 cultivar surpassed in seed yield /fed theGiza-40 cultivar in first seasons only. while straw yield /fed in the both seasons. These results it could be concluded that varietal differences between faba bean cultivars may be due to genetical differences between cultivars and differences between genotypes concerning partition of dry matter . Also, may be due to it's highest values of number of pods/plant and seeds weight particularly in both seasons , these results are in agreement with those obtained by Nabila *et a*l.(2017).

Table 7. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on seed yield(ard/fed) of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	10.10	11.30	12.20	11.20	10.20	11.49	12.38	11.36
	Fe	10.60	11.90	12.80	11.77	10.82	12.05	12.97	11.95
	Mn	10.20	11.50	12.40	11.37	10.40	11.75	12.68	11.61
	Zn	10.40	11.70	12.60	11.57	10.58	11.83	12.85	11.75
Mean		10.33	11.60	12.50	11.48	10.50	11.78	12.72	11.67
Giza-40	Co	9.95	11.15	12.05	11.05	10.12	11.36	12.22	11.23
	Fe	10.50	11.85	12.65	11.67	10.70	11.98	12.85	11.84
	Mn	10.10	11.35	12.35	11.27	10.33	11.50	12.52	11.45
	Zn	10.30	11.55	12.45	11.43	10.49	11.74	12.63	11.62
Mean		10.21	11.48	12.38	11.36	10.41	11.65	12.56	11.54
Mean for Micro elements	Co	10.03	11.23	12.13	11.13	10.16	11.43	12.30	11.30
	Fe	10.55	11.88	12.73	11.72	10.76	12.02	12.91	11.90
	Mn	10.15	11.43	12.38	11.32	10.37	11.63	12.60	11.53
	Zn	10.35	11.63	12.53	11.50	10.54	11.79	12.74	11.69
Mean		10.27	11.54	12.44		10.46	11.71	12.64	
L.S.D. at 5% for									
F-test Cultivars (C)	*	**N.S**							
Micro elements (M)	**0.062**	**0.093**							
Bio-fertilizer (B)	**0.064**	**0.074**							
C X M	**N.S**	**N.S**							
CXB	**N.S**	**N.S**							
MXB	**N.S**	**N.S**							
CXMXB	**N.S**	**N.S**							

Table 8. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on straw yield (ton/fed) of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	2.080	2.190	2.270	2.180	2.110	2.210	2.310	2.210
	Fe	2.150	2.260	2.370	2.260	2.180	2.290	2.410	2.293
	Mn	2.100	2.220	2.300	2.207	2.140	2.250	2.340	2.243
	Zn	2.130	2.240	2.330	2.233	2.160	2.270	2.370	2.267
Mean		2.120	2.230	2.320	2.223	2.150	2.260	2.360	2.257
Giza-40	Co	2.060	2.170	2.250	2.160	2.090	2.200	2.290	2.193
	Fe	2.120	2.230	2.340	2.230	2.160	2.260	2.380	2.267
	Mn	2.080	2.190	2.280	2.183	2.110	2.220	2.320	2.217
	Zn	2.100	2.210	2.300	2.203	2.140	2.230	2.340	2.237
Mean		2.090	2.200	2.290	2.193	2.130	2.230	2.330	2.230
Mean for Micro elements	Co	2.070	2.180	2.260	2.170	2.100	2.205	2.300	2.202
	Fe	2.135	2.245	2.355	2.245	2.170	2.275	2.395	2.280
	Mn	2.090	2.205	2.290	2.195	2.125	2.235	2.330	2.230
	Zn	2.115	2.225	2.315	2.218	2.150	2.250	2.355	2.252
Mean		2.103	2.214	2.305		2.136	2.241	2.345	
L.S.D. at 5% for									
F-test Cultivars (C)	*****	*****							
Micro elements (M)	**0.019**	**0.033**							
Bio-fertilizer (B)	**0.019**	**0.019**							
C X M	**N.S**	**N.S**							
CXB	**N.S**	**N.S**							
MXB	**N.S**	**N.S**							
CXMXB	**N.S**	**N.S**							

2- Micro elements:

The presented results in the same Tables (7 and 8) observe that the foliar application with micro-elements was exerted a significant differences on seed yield /fed and straw yield /fed in two seasons . The highest seed yield /fed and straw yield /fed were obtained Fe in the first and second seasons, respectively. The increase in seed yield/fed due to Iron application could possibly be due to the enhanced synthesis of carbohydrates and protein and their transport to the site of seed formation . The results agreed with those obtained by, El-Gizawy and Mehasen*(*2009) ,Knany *et al.*(2009) and Praveena *et.al*(2018).

3- Bio-fertilizer

It could be concluded that varying the applied phosphorein had a significant effect on seed yield/fed and straw yield /fed in both seasons . In general, application of phosphorein produced higher seed yield/fed and straw yield /fed as compared to the control in the two seasons. The effected of bio-fertilizer may be increase the capacity of plant in utilizing light ,water, mineral nutrients and carbon dioxide building great amount of metabolites which are easily translocate from source to sink and finally accumulation in pods and seed of faba bean plant. These results are in harmony with those found by El-Gizawy and Mehasen(2009)

4- Interactions:

The data in Tables(7 and 8) notice that all possible interactions had no significant influence on seed yield/fed and straw yield /fed in 2017/2018 and 2018/2019 seasons.

C- Chemical content (Protein and phosphorus percentage):-

1- Cultivars:

Results illustrate in Tables (9 and 10) reveal that difference between faba bean cultivars was significant for protein and phosphorus content in seeds in two successive growing seasons. Where, Misr-1cultivar achieved the highest protein and phosphorus percentage in 2017/2018 and 2018/2019 seasons , respectively. This results may be due to difference in genetic makeup between cultivars. It is worthy to mention that our results are in good agreement with obtained by Khalil *et al*. (2004) and Nabila *et a*l.(2017).

2- Micro elements:

It is clear from these results in Tables (9 and 10) that protein and phosphorus content in seeds was affected by the foliar application of micro elements in the two seasons . Where , the highest protein and phosphorus content were obtained at Fe treatment in the first and second seasons, respectively. These results could be due to an essential role of Fe element for electron transport in photosynthesis and important electron acceptor in redoxe actions and an activator for several enzymes . These results are in line with those found by . Knany *et al.*(2009) El-Gizawy and Mehasen*(*2009) and Fouda and Abd-Elhamied (2017).

3-Bio-fertilizer

Results in the Tables(9 and 10) illustrate that application of phosphorein to faba bean plants exerted a significant influence on protein and phosphorus content in seeds in 2017/2018 and 2018/2019 seasons . The inoculation with phosphorein bacteria surpassed the un inoculation in the first and second seasons, respectively. This results may be due to the role of microorganisms of nitrogen mobilization and enhancing the nitrogen uptake by faba bean plants. Those results are in accord with observation of Abd-El-Aziz (2005), EL-Said(2012) and Bayoumi and Selim(2012).

4- Interactions:

The presented results illustrate that protein content in seeds was significantly affected by the interaction between (cultivars × micro elements)in 2017/2018 and 2018/2019 seasons .Where the highest protein content (25.53% and 26.18%) were obtained from Misr-1 cultivar when received Fe was applied in the first and second

seasons, respectively. Also, was significantly affected by the interaction between (cultivars × bio-fertilizer) in the both seasons. where the highest values (27.77% and 27.88%) were obtained from Misr-1cultivar when inoculation with phosphorein in the first and second seasons, respectively. Also, protein content in seeds was significantly affected by interaction between (micro elements ×bio-fertilizer) in the two seasons. Where the highest values (28.34% and 29.13%) were obtained from faba bean plants when received Fe and inoculation of phosphorein in the first and second seasons, respectively. The second order interaction was exerted a significant influence on protein content in seeds in 2017/2018 and 2018/2019 seasons. Where the highest values (28.89% and 29.52%) were obtained from Misr-1 cultivar when received Fe treatment and inoculation of phosphorein in the first and second seasons, respectively. While the interaction were no significant influence on phosphorus content in seeds in both seasons.

Table 9. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on protein content of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	21.70	23.33	25.58	23.54	22.46	24.23	26.23	24.31
	Fe	22.76	24.93	28.89	25.53	23.67	25.35	29.52	26.18
	Mn	21.83	23.88	26.64	24.12	22.73	24.44	27.43	24.87
	Zn	22.43	24.69	27.77	24.96	23.33	25.16	28.33	25.61
Mean		22.18	24.21	27.22	24.54	23.05	24.80	27.88	25.24
Giza-40	Co	20.17	22.26	24.32	22.25	21.34	23.29	25.50	23.38
	Fe	21.73	23.89	27.78	24.47	22.78	24.82	28.74	25.45
	Mn	20.41	22.73	25.46	22.87	21.76	23.68	26.51	23.98
	Zn	21.43	23.39	26.53	23.78	22.31	24.59	27.55	24.82
Mean		20.93	23.07	26.02	23.34	22.05	24.10	27.07	24.41
Mean for Micro elements	Co	20.94	22.80	24.95	22.90	21.90	23.76	25.86	23.84
	Fe	22.25	24.41	28.34	25.00	23.23	25.09	29.13	25.82
	Mn	21.12	23.30	26.05	23.49	22.25	24.06	26.97	24.43
	Zn	21.93	24.04	27.15	24.37	22.82	24.87	27.94	25.21
Mean		21.56	23.64	26.62		22.55	24.45	27.47	
L.S.D. at 5% for									
F-test Cultivars (C)		**		**					
Micro elements (M)		**0.036**		**0.036**					
Bio-fertilizer (B)	**0.045**	**0.052**							
C X M		**0.051**		**0.051**					
CXB		**0.054**		**0.73**					
MXB		**0.90**		**0.104**					
CXMXB		**0.128**		**0.146**					

Table 10. Effect of foliar spraying with some micro elements, bio-fertilizers and their interaction on phosphorus content of some faba bean cultivars in 2017/2018 and 2018/2019 seasons.

Cultivars	Some micro elements	2017/2018 season				2018/2019 season			
		Bio fertilizers				Bio fertilizers			
		B0	B1	B2	Mean	B0	B1	B2	Mean
Misr-1	Co	0.403	0.450	0.537	0.463	0.410	0.470	0.520	0.467
	Fe	0.460	0.530	0.570	0.520	0.470	0.540	0.580	0.530
	Mn	0.437	0.470	0.530	0.479	0.430	0.520	0.540	0.497
	Zn	0.440	0.490	0.550	0.493	0.450	0.550	0.560	0.520
Mean		0.440	0.490	0.550	0.493	0.440	0.520	0.550	0.503
Giza-40	Co	0.381	0.450	0.527	0.453	0.396	0.460	0.510	0.455
	Fe	0.445	0.510	0.560	0.505	0.453	0.520	0.570	0.514
	Mn	0.419	0.470	0.543	0.477	0.410	0.493	0.530	0.478
	Zn	0.452	0.490	0.540	0.494	0.431	0.527	0.550	0.503
Mean		0.420	0.480	0.540	0.480	0.420	0.500	0.540	0.487
Mean for Micro elements	Co	0.392	0.450	0.532	0.458	0.403	0.465	0.515	0.461
	Fe	0.453	0.520	0.565	0.513	0.462	0.530	0.575	0.522
	Mn	0.428	0.470	0.537	0.478	0.420	0.507	0.535	0.487
	Zn	0.446	0.490	0.545	0.494	0.441	0.538	0.555	0.511
Mean		0.430	0.483	0.545		0.431	0.510	0.545	
L.S.D. at 5% for									
F-test Cultivars (C)	*		**						
Micro elements (M)	**0.022**		**0.016**						
Bio-fertilizer (B)	**0.014**		**0.014**						
C X M	**N.S**		**N.S**						
CXB	**N.S**		**N.S**						
MXB	**N.S**		**N.S**						
CXMXB	**N.S**		**N.S**						

CONCLUSION

This study recommends that Misr-1 cultivar inoculation with phosphorein and spraying with Iron in order to improve the production of faba bean under the condition of Assuit Governorate, Egypt.

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تأثير التسميد الحيوي والرش الورقي ببعض العناصر الصغرى علي نمو و انتاجية صنفين من الفول البلدي

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أجريت تجربتان حقليتان خلال الموسمين ٢٠١٧/٢٠١٨ و ٢٠١٨/٢٠١٩ في المزرعة البحثية لكلية الزراعة ، جامعة الأزهر فرع اسيوط ، مصر بهدف دراسة استجابة صنفين من الفول البلدي (مصر-١و جيزة-٤٠)للتسميد الحيوي والرش الورقي ببعض العناصر الصغرى (حديد و زنك ومنجنيز) واثر ذلك على انتاجية المحصول. حيث استخدم التصميم القطاعات الكاملة العشوائية في قطع منشقة مرتين في ثلاث مكررات ، حيث وزعت أصناف الفول البلدي في القطع الرئيسية ، وتم توزيع معاملات الرش الورقي عشوائياً في قطع الشقية الاولي وتم وضع الأسمدة الحيوية في القطع الشقية الثانية.وخلصت النتائج إلى أن أصناف الفول البلدي أظهرت اختلافًا كبيرًا ومعنويا في ارتفاع النبات ، وعدد الفروع / النبات ، وعدد القرون / النبات ،ومحصول البذور لكل نبات, ووزن ١٠٠ بذرة ، ومحصول القش / فدان ونسبة البروتين والفوسفور من البذور في الموسمين. بينما أظهرت اصناف الفول البلدي اختلافا معنويا في محصول البذور/فدان في الموسم الأول فقط . و تفوق الصنف مصر -١ على الصنف الجيزة ٤٠ في جميع الصفات المدروسة. أيضا أدي الرش الورقي بالعناصر الصغرى الي زيادة معنوية في جميع الصفات التي شملتها الدراسة. حيث تم تسجيل أعلى القيم برش الحديد في كلا الموسمين. أيضا أدي تلقيح الفسفورين الي زيادات كبيرة في جميع الصفات السابقة في كلا الموسمين. لذلك ، توصي هذه الدراسة بزراعة صنف مصر -١ والتلقيح بالفوسفوريين والرش بالحديد لتحسين إنتاج الفول البلدي تحت ظروف محافظة أسيوط ، مصر.