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EFFECT OF BIO-FERTILIZER (EMA) AND NUTRITIOUS SOLUTION (AL-JAMIA) IN VEGETATIVE TRAITS FOR TWO CULTIVARS OF BROAD BEAN (*VICIA FABA* L.)

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Abstract

A field experiment was conducted during the winter season (2017) in the private experiments fields belonging to Abu Gharq district, 10 km north-west of Babylon province. In the experiment, The Randomized Complete Block Design (RCBD) was used within the Split-Split-Plots design. The main plots included two broad bean cultivars: Hab Luz De Oton (V1) from Spain origin and Extra Hative a Graine (V2) from Italian origin, where the sub-plots included four concentrations of EMa (EM0 represents the control treatment, EM1 represents 100 ml/10 m2, EM2 represents 200 ml/10 m2, EM3 represents 300 ml/10 m2), while the sub-sub-plots included three concentrations of the nutritious solution (Al-Jamia) (F0 represents the control treatment, F1 represents 5 ml/L, F2 represents 10 mL/L). The experiment included The Italian cultivar was excelled on the Spanish cultivar in all studied traits. The fertilization with bio-fertilizer EM3 was excelled in the number of leaflets amounted of (168.48 leaflet.plant^{-1}), leaf area (34.59 cm2), chlorophyll (47.45 SPAD) during the study season. The spraying with the level Fertilizer (F2) was excelled in plant height (83.04 cm), the number of leaflets amounted of (196.63 leaflet.plant^{-1}), leaf area (37.46cm2), chlorophyll (52.13 SPAD). Whereas the triple interaction did not show significant differences in the traits of the plant height, the leaf area, the leaves content of chlorophyll, while the triple interaction treatment (V2*EM3*F2) was excelled by giving it the highest values for the average number of leaflets which amounted to (229.94 leaflets.plant^{-1}).

Key words: Bio-fertilizer, Al-Jamia, broad bean.

Introduction

Broad bean (*Vicia faba* L.) is One of the most important of Fabaceae family in many countries of the world, especially the of North Africa countries, which is second in terms of economic importance after the Poaceae family, It adapted to cold climatic conditions (Hassan 2002). The seeds are grown for fresh, dry green seeds and their seeds contain many important nutrients, especially proteins, carbohydrates, oils, Minerals and vitamins (Matlob *et al.*, 1989). It is also used as animal feed, green fertilizer and its cultivation is not stressful for soil because it works on atmospheric nitrogen fixation by the existence of Rhizobium in their roots, which are used in different stages of growth (Al-Tamimi, 1998). The yield and productivity of Broad bean are affected by many environmental, nutritional and genetic factors (cultivars), Due to the increasing population of the world and the lack of an increase in the production of food, especially vegetables. All this represent as promotion for researchers to devise highly productive and high-value cultivars (Cieslarova *et al.*, 2012). These cultivars require the availability of nutrients in the soil as fertilization is one of the most important processes of service of the crop, which leads to increased production because it regulates the physiological processes within the plant, especially when fertilizing the macro and micro- nutrients (Abu Dhahi *et al.*, 1989) foliar spraying is a method of fertilization that significantly improves growth rates and is adequate in cases where plant roots are less efficient in nutrient uptake for a variety of reasons, such as high salinity, disease infection, etc. (Mengel and Kirby, 1987). Biofertilizers also have one of the modern fertilization techniques, which are added in several ways, including the treatment of seeds or adding them to the soil directly or with irrigation water or spray on the plant. Bio-fertilizer (micro-organisms (EMa) is considered an effective bio-fertilizer in plant nutrition, which is a mixture of beneficial organisms of the plant, most important fungi (Mychorriza) and lactic acid bacteria, which have an important role in improving plant growth characteristics as well as their

role in the analysis of organic matter Inhibiting the activity of pathogens in soil and yeasts containing enzymes and hormones that promote the division of cells and actinomyces containing antibiotic and fungi containing organic matter enzymes as well as their role in increasing phosphorus readiness by secretion of Phosphatase enzyme, They also coexist with Rhizobium in their roots to atmospheric nitrogen fixation (Woodward, 2003). This study aims to study the effect of cultivars, EMa and foliar spraying on vegetative growth traits of broad bean (*Vicia faba* L.)

Materials and Methods

A field experiment was conducted during the winter season (2017) in the private experiments fields belonging to Abu Gharq district, 10 km north-west of Babylon province. The land was prepared for cultivation by conducting plowing, with two orthogonal plows, The soil was then smoothed and settled, Diammonium phosphate (DAP) was then added and its percentage (0-46-18) in one batch (25 kg/dunum) by spreading it on the ground before cultivating which it was mixed with soil, The experiment was divided into three sectors, with 24 experimental units in each sector and the furrow was organized in a homogeneous manner. The cultivating was conducted in the field on 15/10/2017, with three seeds per pit, the area of the experimental unit amounted to 7.5 m2. The area of the cultivated field is 1 dunum, The cultivation was conducted on the lines, the distance between the line and another was 50 cm and between the pit and another was 25 cm (Farhan, 2012). After the germination process was completed, the removal process for the excessive plant was conducted to one plant in the pit. The service operations included manually controlling the thicket and for several times throughout the crop's survival period and the insect control process using the Acetoprid pesticide 0.5 $ml.L^{-1}$ to control black and green Aphid insect and ortus pesticide 5% by 1 $ml.L^{-1}$ to control Mites (Arachnid). The irrigation process took place immediately after planting and the irrigation continued for a continuous period according to the need of the plant. the experiment was conducted according to The Randomized Complete Block Design (RCBD) was used within the Split-Split-Plots design. The main plots included two broad bean cultivars: Hab Luz De Oton (V1) from Spain origin and Extra Hative a Graine (V2) from Italian origin, where the sub-plots included four concentrations of EMa (EM0 represents the control treatment, EM1 represents 100 ml/10 m2, EM2 represents 200 ml/10 m2, EM3 represents 300 ml/10 m2), It was added to the soil before cultivating as it was well mixed with the soil. while the sub-sub-plots included three concentrations of the nutritious solution (Al-Jamia) and locally produced by, collage of Agriculture / University of Basrah contains the following elements (Nitrogen 7%, phosphorus 5%, potassium 7%, magnesium 0.5.0%, potassium humate 5.0% + micro elements) on concteration (F0 represents the control treatment, F1 represents 5 ml/L, F2 represents 10 mL/L). while the sub-sub-plots included three concentrations of the nutritious solution (Al-Jamia), which has been produced locally by college of Agriculture, University of Basra that contains the following elements (7% Nitrogen, 5% phosphorus, 7% potassium, 0.5 % magnesium, 5.0% potassium humate + some microelements) at the concentrations (F0 represents the control treatment, F1 represents 5 ml/L, F2 represents 10 mL/L). for three spraying periods starting from the age of one month and one month periods between one spraying and another

Table 1: Some physical and chemical properties of soil.

Traits		Unit	value
pH		-	7.99
E.C		$ds.m^{-1}$	3.12
Organic matter		$g.k^{-1}$	8.2
The percentage of available nitrogen		$Mg.k^{-1}$	41.00
The percentage of available Phosphorus		$Mg.k^{-1}$	17.00
The percentage of available Potassium		$Mg.k^{-1}$	170.00
The percentage of available Born		$Mg.k^{-1}$	0.45
Soil separates (%)	sand	%	37.1
	silt	%	53.2
	clay	%	9.7
Soil texture		silt loam	

Studied traits

• Plant height (cm): It's Measured using by metric tape from soil surface level to the end of the main branch.

• The average number of leaflets. $Plant^{-1}$: It's the number of leaflets existing on the plant that was calculated as the average number of leaflets on plants taken.

• The average leaf area (cm^2): The digital planimeter was measured on a white paper to measure this trait in the laboratories by taking three leaves randomly.

• The average leaves content of chlorophyll (SPAD unit): The chlorophyll content was evaluated in the leaves of the plant by a Chlorophyll meter of 502-SPAD type, prepared by the Japanese Minolta company, By taken reading for three leaves per experimental unit (plant) and measuring them by SPAD units.

Results and Discussion

Plant height (cm)

The results of table 2, showed that there was a significant effect of the cultivars in plant height. The Italian cultivars (V2)gave the highest rate of plant height of

Table 2: Effect of the cultivars and spraying with bio-fertilizer (EMa), the nutritious solution (Al-Jamia) and their interactions on the average of plant height (cm).

Cultivars (V)	Biofertilizers (EM)	The nutritious solution (Al-Jamia) (F)			Average
		F0	F1	F2	
V1	EM0	63.33	71.00	79.33	71.22
	EM1	66.33	74.67	78.67	73.22
	EM2	69.33	79.00	83.00	77.11
	EM3	70.33	81.33	86.33	79.33
V2	EM0	65.00	74.67	81.67	73.78
	EM1	68.33	76.67	83.00	76.00
	EM2	71.33	80.33	88.00	79.89
	EM3	70.00	79.00	84.33	77.78
Average		143.68	160.69	196.63	
L.S.D 0.05	F=0.764	V*EM*F=NS		V*M=1.593	
Cultivars* The nutritious solution (Al-Jamia)					Average
V1		67.33	76.50	81.83	75.22
V2		68.67	77.67	84.25	76.86
L.S.D 0.05		NS			0.914
Biofertilizers* The nutritious solution (Al-Jamia)					Average
EM0		64.17	72.83	80.50	72.50
EM1		67.33	75.67	80.83	74.61
EM2		70.33	79.67	85.50	78.56
EM3		70.17	80.17	85.33	78.50
L.S.D 0.05		NS			1.127

Table 3: Effect of the cultivars and spraying with bio-fertilizer (EMa), the nutritious solution (Al-Jamia) and their interactions on the average of the average number of leaflets.Plant $^{-1}$.

Cultivars (V)	Biofertilizers (EM)	The nutritious solution (Al-Jamia) (F)			Average
		F0	F1	F2	
V1	EM0	134.59	151.54	169.42	151.85
	EM1	141.04	153.60	173.32	155.99
	EM2	145.37	160.46	206.43	170.75
	EM3	149.77	172.43	228.36	183.52
V2	EM0	137.23	153.72	172.38	154.44
	EM1	143.44	157.65	183.14	161.41
	EM2	147.43	161.40	208.49	172.44
	EM3	150.61	174.75	231.53	185.63
Average		143.68	160.69	196.63	
L.S.D 0.05	F=0.708	V*EM*F=2.001		V*M=0.771	
Cultivars* The nutritious solution (Al-Jamia)					Average
V1		142.69	159.51	194.38	165.53
V2		144.68	161.88	198.88	168.48
L.S.D 0.05		1.001			0.387
Biofertilizers* The nutritious solution (Al-Jamia)					Average
EM0		135.91	152.63	170.90	153.15
EM1		142.24	155.62	178.23	158.70
EM2		146.40	160.93	207.46	171.60
EM3		150.19	173.59	229.94	184.57
L.S.D 0.05		1.415			0.545

76.86 cm, compared with to the Spanish cultivars (V1) which gave 75.22 cm. These results agree with Li-Juan, (1988) and Joseph *et al.*, (2005). The treatment EM2 was significantly excelled by giving it the highest value of 78.56 cm, the sprayed with EMA caused significantly excelled on the plant height. The treatment EM2 was significantly excelled by giving it the highest value of 78.56 cm, which did not differ significantly from the treatment EM3, which gave 78.50 cm, compared with the control treatment which gave 72.50 cm. These results agree with Baldawi, (2004) and Al-Kartani, (2005). They found that when vaccinating chickpea seeds with *Rhizobium spp*, all vaccinated treatments were significantly excelled highest compared with these of non-vaccinated treatments in plant height trait. The treatment F2 was significantly excelled by giving it the highest value of plant height of 83.04 cm. While it compared with the control treatment which gave the lowest value of 68.00 cm. Bi-interaction treatment between the cultivars and Bio-fertilizer (V * EM) had a significant effect on plant height. where treatment (V2 * EM2) recorded the highest average of this trait 79.89 cm, compared with the control treatment (V1 * EM0) which gave the lowest average amount of 71.22 cm. Bi-interaction between (cultivars and the nutritious solution (Al-Jamia) and the interaction between Bio-fertilizer and the nutritious solution (Al-Jamia) were significant excelled in this study. The results indicated in table 2, indicate that there is no significant difference to the triple- interaction treatment between cultivars, Bio-fertilizer and the nutritious solution (Al-Jamia) on the plant height trait.

The average number of leaflets. Plant^{-1}

The results of table 3, showed that there was a significant effect of the cultivars in the average number of

Table 4: Effect of the cultivars and spraying with bio-fertilizer (EMa), the nutritious solution (Al-Jamia) and their interactions on the average of leaf area (cm^2).

Cultivars (V)	Biofertilizers (EM)	The nutritious solution (Al-Jamia) (F)			Average
		F0	F1	F2	
V1	EM0	22.79	28.86	31.06	27.57
	EM1	24.68	30.43	33.75	29.62
	EM2	25.56	30.90	37.21	31.23
	EM3	27.96	32.46	41.08	33.83
V2	EM0	22.17	30.50	34.57	29.08
	EM1	24.41	30.90	37.50	30.94
	EM2	26.15	33.64	40.74	33.51
	EM3	27.90	34.36	43.77	35.34
Average		25.20	31.51	37.46	
L.S.D 0.05	F=1.634	V*EM*F=NS		V*M=NS	
Cultivars* The nutritious solution (Al-Jamia)					Average
V1		25.25	30.66	35.78	30.56
V2		25.16	32.35	39.14	32.22
L.S.D 0.05		0.929			1.634
Biofertilizers* The nutritious solution (Al-Jamia)					Average
EM0		22.48	29.68	32.82	28.33
EM1		24.55	30.67	35.63	30.28
EM2		25.86	32.27	38.97	32.37
EM3		27.93	33.41	42.43	34.59
L.S.D 0.05		1.314			0.548

leaflets.Plant^{-1}. The Italian cultivars (V2) gave the highest average the number of leaflets.Plant^{-1}, compared with to the Spanish cultivars (V1) which gave the lowest value 165.53 leaflets.Plant^{-1}. These results agree with Abdel-Jalil *et al*., (2003) in a study in Egypt for two seasons when studying the effect of different levels of nitrogen and phosphorus fertilizer with the presence of potassium to the superiority of Giza Blanca in the number of leaflets. The treatment EM3 was significantly excelled by giving it the highest value of 184.57 leaflets.Plant^{-1}, compared with the control treatment which gave the lowest value in the number of leaflets 150.14 leaflets.Plant^{-1}, When added *Rhizobium spp.,* to the seeds of peanuts with the use of three levels of nitrogen fertilizer, The results showed an increase in the number of leaflets when the bacterial vaccine was added. The treatment F2 was significantly excelled by giving it the highest value in the number of leaflets 196.63 leaflets.Plant^{-1}. While it compared with the control treatment (F0) which gave the lowest value of 34.68.68 in the number of leaflets.plant^{-1}. These results agree with Shafeek *et al*., (2013). Where Bi-interaction treatment (V2 * EM2) recorded the highest average of this trait 185.63 leaflets.Plant^{-1}. While, compared with the control treatment (V1 * EM0) which gave the lowest average amount of 151.85 leaflets.Plant^{-1}. Bi-interaction treatment V2F2 gave the highest value of 198.88 leaflets.Plant^{-1}. compared with the control treatment V1F0 the lowest value of 142.69 leaflets.Plant^{-1}. The interaction Bio-fertilizer and the nutritious solution (Al-Jamia) were significantly excelled in the number of leaflets. where the treatment combination (EM3F2) gave the highest average of this trait amounted of 229.94 leaflets.Plant^{-1}, While it compared with the control treatment EM0F0 which gave the lowest value of 132.54 leaflets.Plant^{-1}. The results indicated in table 2, indicate that there was a significant difference to the triple-interaction treatment (V*EM*F) ,where the triple- interaction treatment combination V2*EM3*F2 gave the highest average of this trait amounted of 134.59 leaflets.Plant^{-1}.

The average leaf area (cm^2)

The results of table 4, showed that there was a significant effect of the cultivars in the average leaf area (cm^2). The Italian cultivars (V2) gave the highest average the leaf area amount of 23.22 cm^2 , compared with to the Spanish cultivars (V1) which gave the lowest value 30.56 cm^2. These results agree with Al-Jiburi *et al*., (2014) found in his study for six cultivars of broad bean. The treatment EM3 was significantly excelled by giving it the highest of leaf area amounted of 34.59 cm^2, compared with the control treatment which gave the lowest in the leaf area amounted of 28.33 cm^2. These results agree with Al-Jourani and Abbas, (2005) when adding the bacterial vaccine Brady rhizobium on cowpea to the superiority of this trait in the study. The treatment F2 was significantly excelled by giving it the highest value in the leaf area 37.46 cm^2. While it compared with the control treatment (F0) which gave the lowest in the leaf area amounted of 25.20 cm^2, These results agree with Faraj *et al*., (2014) studied when the effect of spraying a mixture of nutrients on the broad bean, where found significant differences of this trait. Bi-interaction between (cultivars and Bio-fertilizer) did not have differ significantly in this trait. Bi-interaction treatment between (F*V) had a significant effect on leaf area (cm^2). where treatment V2F2 recorded the highest average of this trait 39.14 cm^2, compared with the control treatment (V1F0) which gave the lowest average amount of 25.25 cm^2. interaction between Bio-fertilizer and the nutritious solution (Al-Jamia) (EM*F) were significant excelled in the average leaf area (cm^2) where the treatment combination (EM3F2) gave the highest average of this trait amounted

Table 5: Effect of the cultivars and spraying with bio-fertilizer (EMa), the nutritious solution (Al-Jamia) and their interactions on the leaves content of chlorophyll (SPAD unit).

Cultivars (V)	Biofertilizers (EM)	The nutritious solution (Al-Jamia) (F)			Average
		F0	F1	F2	
V1	EM0	33.50	41.60	49.38	41.49
	EM1	36.71	46.37	50.24	44.44
	EM2	37.15	46.80	53.46	45.80
	EM3	38.38	48.05	53.03	46.48
V2	EM0	34.62	43.38	49.96	42.65
	EM1	37.94	47.25	51.03	45.40
	EM2	39.14	49.84	54.39	47.79
	EM3	39.68	50.00	55.56	48.41
Average		25.20	31.51	37.46	
L.S.D 0.05	F=0.662	V*EM*F=NS		V*M=NS	
Cultivars* The nutritious solution (Al-Jamia)					Average
V1		36.44	45.70	51.53	44.56
V2		37.85	47.62	52.73	46.06
L.S.D 0.05		NS			0.620
Biofertilizers* The nutritious solution (Al-Jamia)					Average
EM0		34.06	42.49	49.67	42.07
EM1		37.33	46.81	50.63	44.92
EM2		38.15	48.32	53.92	46.80
EM3		39.03	49.02	54.29	47.45
L.S.D 0.05		1.324			0.817

of 42.43 cm^2 for leaf, While it compared with the control treatment EM0F0 which gave the lowest value of 22.48 cm^2 for the leaf. The results showed that there is no significant difference to the triple- interaction treatment on leaf area trait.

The average leaves content of chlorophyll (SPAD unit)

The results of table 5, showed that there was a significant effect of the cultivars in the average leaves content of chlorophyll (SPAD unit). The Italian cultivars (V2) gave the highest rate of chlorophyll of 46.06 SPAD, compared with to the Spanish cultivars (V1) which gave 44.56 SPAD. These results agree with Abdel-Karim, (2013) and Kamanun *et al.,* (2012). The treatment EM3 was significantly excelled by giving it the highest of chlorophyll amounted of 47.45 SPAD, compared with the control treatment which gave the lowest in chlorophyll amounted of 42.07 SPAD. These results agree with Kalaiarasi Sivakumar, (2014). The treatment F2 was significantly excelled by giving it the highest value in chlorophyll 52.13 SPAD. While it compared with the control treatment (F0) which gave the lowest in chlorophyll amounted of 37.14 SPAD, These results agree with Alag, (2015) and Al-Zubaidi, (2014). Bi-interaction between (cultivars and Bio-fertilizer) (V*EM) and interaction between cultivars and the nutritious solution (Al-Jamia) (V*F) did not have differ significantly in this trait. Bi-interaction treatment between the cultivars and Bio-fertilizer (EM*F) had a significant effect on chlorophyll ,where treatment (EM3F2) recorded the highest average of this trait 54.29 SPAD, compared with the control treatment (EM0F0) which gave the lowest average amount of 34.06 SPAD. The results of table 5, showed that there is no significant difference to the triple- interaction (V*EM*F) on the average leaves content of chlorophyll (SPAD unit).

The results of the vegetative growth trait shown in table 2-5, indicate that the cultivars have a significant effect on the vegetative trait. The Italian cultivar was excelled in the Spanish cultivar in all the indicators of vegetative growth trait and gave the highest averages for this trait. This may be due to differences in the genotypes of the two cultivars and interaction between genetic factors with the surrounding environment (Hamdoun, 2013). The positive effect of bio-fertilizers on vegetative traits may be due to the role of bio-fertilizers in nitrogen fixation, as well as their ability to produce different growth hormones, such as IAA and other Auxins, gibberellins, cytokines, vitamins and iron carriers as well as their effective role in converting nitrogen into ammonia, which may increase the concentration of nitrogen in the leaves and thus improve the process of photosynthesis and secondary metabolic reactions, resulting in an increase in vegetative traits (Kamil *et al*., 2008). The increases in vegetative growth trait may be due to the role of folair nutrition in improving plant metabolism and growth due to the role of potassium and zinc in the plant combination. Potassium affects many physiological processes such as photosynthesis and respiration as well as the formation of green matter. Metabolism through its effect in stimulating the activation of the enzymatic system in the cell and thus promotes cell division and tissue growth (Cakmak, 2005 and Chang *et al*., 2010) Finally, it is positively reflected on vegetative growth trait as well as the role iron plays in oxidation and reduction processes such as photosynthesis in the construction of chlorophyll and its stimulation of photosynthetic enzymes, which activate metabolism of leaf products and their use in the construction of vegetation, Through its effect on RNA function in the cell (Kessel, 2006 and Dunchera, 1998).

References

Abdel-Jalil, Ahmed Anwar, Sayed Mustafa Najjar, Hassan Odeh Awad and Tamer Salah Mukhtar (2003). Response of two cultivers of faba bean to different levels of nitrogen, phosphorus and potassium under sandy soil conditions 1 - Indicators of root formation and growth of root nodes, flowering and falling. Department of Crops, Faculty of Agriculture, Zagazig University. Folder. **30(5):** 1808-1789.

Abdel-Karim, H.A.W. (2013). Effect of different concentrations of iron (Fe EDDHA) in the growth of three varieties of beans. (*Vicia faba* L.). *Diyala Agricultural Sciences Journal.*, **5(2),** 331-337.

Abu Dhahi, Yousef Mohammed and Mayad Ahmad al-Yunis (1988). Plant nutrient Guide. University of Baghdad - Ministry of Higher Education and Scientific Research. Iraq.

Adnan, N. Matlob, Ezzldien Sulton Mohammd and Karim Salih Abdul (1989). Vegetables Production, Part 2, Higher Education Press, Mosul University, Ministry of Higher Education and Scientific Research, Republic of Iraq.

Al-Jiburi, Hatem Mohamed Hassan (2014). Effect of Distances between Al-Mezouz on the Product and its Components for Some of the Classes of *Vicia faba* L., Master Thesis, Faculty of Agriculture, University of Kirkuk.

Al-Jourani, Majid Kazem Mohammed and Jamal Ahmed Abbas (2005). Effect of Bacterial Insemination, Nitrogen Fertilization and Summit Cuts on Vegetative Growth Indicators and Total Crops of the *Vigna Unguicultata* L. (Walp). *Jour. of Iraqi Agricultural Sciences.*, **(1):** 50-43.

Al-Kartani, Rahim Hadi Abdullah (2005). Effect of iron and phosphorus on the efficiency of Rhizobium bacteria and in chickpea growth and yield. Master Degree, Soil and Water Science Department, Faculty of Agriculture, University of Baghdad.

Al-Zubaidi, Ahmed Abdul Hadi Abdul Kadhim (2014). Effect of levels of potassium fertilizer and boron spraying in the growth, yield and quality of the rest. Master degree - Faculty of Agriculture - University of Baghdad Iraq.

Baldawi, Salman Burhan Abdul Hussein (2004). Effect of inoculation with Rizobia bacteria on the growth and yield of pistachios. *Journal of Iraqi Agriculture*., **9(3):** 77-85.

Cieslarova, J., M. Hybli, M. Griga and P. Smykal (2012). Molecular analysis of temporal genetic structuring in pea (*Pisum sativum* L.) cultivars breed in the Czech republic and in former Czechoslovakia since the mid-20th century. Czec. *Genet. Plant Breed*., **48(2):** 61-73.

Joseph, Shadia Joseph and Shadia Bastos Dawood (2005). Studies to improve the performance of some types of beans under irrigation conditions in salty water. Ph.D. thesis. Faculty of Agriculture - Banha University. Egypt.

Kalaiarasi, R. and T. Sivakumar (2014). Effect of bacterial biofertilizers on the growth and yield of *Phaseolus vulgaris* L. *International Journal of Advanced Research in Biological Sciences*., **1(8):** 56-73.

Kamanu, J.K., G.N. Chemining'wa, J.H. Nderitu and J. Ambuko (2012). Growth, yield and quality response of snap bean (*Phaseolus vulgaris* L.) plants to different inorganic fertilizers applications in central Kenya. *Journal of Applied Biosciences*., **55:** 3944-3952.

Li-Juan, L. (1988). As summary on production of faba bean in China . *F.A.B.I.S.*, **21:** 3-6.

Luay D. Farhan (2012). The Effect of Oranic Matter and Potassium Fertilizers on Growth and Yield of Broad Bean (*Vicia faba* L.). *Diyala Journal of Agricultural Sciences.*, **4(1):** 50-61.

Alag, M.K. (2015). Effect of spray on nutritious solution and boron on the growth, yield and quality of the rest (Skoog and Murashige). (*Vicia faba* L.) *Diyala Journal of Agricultural Sciences*., **7(1):** 121-132.

Majid A.H. Al- Jumaily* and A.A. Al-Jebouri Khudair (2005). Effect of Foliar Spray (Al- Nahrain) Fertilizer and Planting Dates on Yield of Two Cultivars of Green Peas (*Pisum sativum* L.). *Anbar Journal of Agricultural Science.*, **8(1):** 125-136.

Mengal, K. and E.A. Kirkby (1982). Principles of plant nutrition. International potash Inst. Bern. Switzerland.

Shafeek, M.R., Y. I. Helmy, M.O. Nadia and F.A. Rizk (2013). Effect of foliar fertilizer with nutritional compound and humic acid on growth and yield of broad bean plants under sandy soil conditions. *Journal of Applied Sciences Research.*, **9(6):** 3674-3680.

Wood ward, D. (2003) . Effective microorganisms as regenerative systems in mearth healing. M.Sc. Dissertation. righton. WWW.Living-soil.co.uk. / Iearning / soilsustain.Htm.