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GROWTH AND YIELD OF BROAD BEAN *(Vicia faba* L.) AS AFFECFTED BY CHEMICAL AND / OR NATURAL PHOSPHORUS WITH DIFFERENT BIOFERTILIZER.

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ABSTRACT

Two field experiments were carried out at Kafr El - Wekala Sherbein Town Mansoura, Dakahlia Governorate, during the winter seasons of 2011 and 2012. The study aimed to investigate the effect of rock phosphate and Ca superphosphate with different sources of bio fertilizer (phosphorein, Microbein, mixture of each as 1: 1 and control) on broad bean plant growth, N and P uptake, yield and its pods quality. It was found that Ca superphosphate application gave rise to higher plant growth characters as well as increased N and P uptake, total yield and its pods characters and dry seeds than plants treated with the rock phosphate.

An increase in plant growth and more uptake of N and P in leaves and branches and increased total yield were found by inoculation of broad bean seeds before sowing by the mixture of microbein and phosphorein at rate of 1 : 1. Treatments of the interaction between phosphorus forms with different inoculation bio-fertilizer had no great effect on the nutritional values.

The obtained results showed that the application of microbein and phosphorein at rate of 1: 1 to maximize the yield and it may be suitable for broad bean growing under similar conditions.

INTRODUCTION

In most developing countries, legumes are often an intergral part of agricultural ecosystems. Broad bean (*Vicia faba* L.) C.V. Koprosay is one of the most important legumes in Mediterranean agricultural areas Buttery *et al*., (1992). In Egypt it is consumed in huge quantities as human food.

Phosphorus is an essential element for both growth and yield of broad bean plant. Therefore, the supply of P is required for sustainable crop production. Therefore, the environmental pollution caused by over use of manufactural fertilizers could be reduced.

Hence, the use of natural rock phosphate as a source of P to crops has become the subject of investigation in the recent years to overcome ground material of this rock as a direct source of P fertilization can be a reasonably effective source of P supplies, under natural and alkaline soil environment, and the effect is almost nonexistent Akintokum *et al*., (2003). Significant response of broad bean plant to phosphate fertilization was recorded by Ahmed *et al.,* (2002). Moreover Abo El-Soud *et al.,* (2003) and Mohammed, (2004) found that phosphorus application gave a highly significant increase in dry weight of shoots, number of pods per plant, number of seeds per pod, pod length and weight as well as NPK content of cowpea and broad bean plants as compared to those obtained by rock phosphate. Moreover, Kole and Hajra (1999) reported that no significant differences

between Ca superphosphate or rock phosphate were detected on growth and yield of broad bean plant. On the other hand, El-Gizawy and Mahasen, (2009) found that plant took up more phosphorus in the presence of phosphate dissolving microorganisms.

Bio fertilization is more effective for legumes supplying with nitrogen and phosphorus than chemical fertilization.

Microbein has greater amounts of symbiotic and non – symbiotic bacteria which were responsible for fixation N. The effect of inoculation of broad bean seeds with such bacteria led to increased growth, yield and productivity. Abo El- Soud *et al.,* (2003) found that application of it decreasing the amount of mineral by 25 % and an increasing the availability of various nutrients by plant due to microbein.

Soil inoculation with phosphate dissolving bacteria (phosphorein) improved soil fertility and plant productivity Dubey, (2000), Mohammed (2004) on bean plant mentioned that utilizing of P bio fertilizer (phosphorein) with or instead of mineral markedly increased the available P concentrate ions in soil and plants and hence increased plant growth and yields. Eman *et al*., (1993) found that inoculation of faba bean plants with phosphate solubilizing bacteria significantly increased weight of plants compared with the untreated treatment. Saber *et al.*, (1983) found that the use of phosphate dissolving bacteria led to increasing P uptake and yield of *Vicia faba* cultivated in a calcareous soil.

The significant effect of bio fertilizers may be due to the effect of different strain groups and nutrient mobilizing microorganisms which help in availability of elements and their forms in the composted material and increased levels of extractable minerals. El-Kamony *et al*., 2000, Ibrahim and Abd El-Aziz 1977 observed that using of phosphate dissolving microorganisms which include phosphate dissolving bacteria (phosphorein or microbein) may have an additional benefit such as mobilizing phosphate and micronutrients through the production of organic acids such as formic acid, lactic acid and propionic acids. These acids lower the pH and bring about the dissolution of bounds forms of phosphate and render than available for growing plants.

This work was performed to investigate the effect of chemical and natural phosphorus with different bio fertilizer treatment (microbein or phosphorein on growth and yield of broad bean plants cv. Koprosey.

MATERIALS AND METHODS

Two field experiments were conducted at Kafr El-Wekala Sherbein Town, Mansoura, Dakahlia Governorate, during the winter seasons of 2011 and 2012 to investigate the effect of Ca superphosphate and rock phosphate with different bio fertilizer treatment (microbein, phosphate dissolving bacteria (phosphorein) and plus a mixture of 1 : 1 from them on growth and yield of broad bean plants c.v. Koprosey. Microbein and phosphorein were produced by Ministry of Agriculture and were used at the rate of 700 g / 100 kg seeds with using Arabic gum (16%) as a sticking agent. Randomized samples were

collected from the experimental soil at 0.0 to 50.0 cm deep, before plantation to determine the physical and chemical soil properties in accordance to the methods of Black, (1965) and Jackson, (1967). Some soil properties, as means of two seasons are presented in Table (1).

The experiments are designed as split plot with three replicates. The experimental plot area was 10.5 m^2 and included 5 rows (each was 3.5 m length and 60 cm width) and the distance between plants was 20 cm.

Table 1: Some physical and chemical properties of experimental soil as means of two seasons.

Soil properties	value	Soil properties	value
physical		**Soluble anions (meq/ L)**	
Coarse sand	7.71	CL	3.51
Fine sand	8.14	HCO_3	3.18
Silt	33.61	CO_3	0.00
Clay	40.11	SO_4	5.19
Texture	Clay loam	**Soulable cations (meq/ L)**	
Chemical		Ca	4.02
Organic matter (%)	1.92	Mg	1.32
$Caco_3$	4.53	Na	1.21
E.C.(dsm4 at 25^0)	1.13	K	5.34
pH(1:2.5 w/v)	8.11	**Available micronutrients (ppm)**	
Total. N (%)	0.20	Fe	3.62
Available P (ppm)	11.73	Mn	1.52
Exchangeable K(ppm)	202	Zn	1.36
		Cu	0.51

The experimental included 8 treatments which were the possible combination of two sources of phosphate (Ca superphosphate 15.5 % P_2O_5 or rock phosphate 7.5 % P_2O_5) and 4 bio fertilizer (control, microbein, phosphorein and a mixture of 1 : 1. The phosphorus applications were applied at rate 30 kg of P_2O_5 / fed. Broad bean seeds cv. Koprosy were sown on 15 and 20 October in 2011 and 2012 seasons respectively. The sources of P application were assigned in the main plots and bio fertilizers were devoted with the sub plots. The normal cultural practices i.e.; irrigation, fertilization and pest control for the broad bean productions were followed.

After two months from sowing plants were harvested where five chosen from each sub plot and the following data were recorded: plant height (cm), number of shoots and leaves per plant, fresh and dry weight of leaves and shoots.

Yield of each sub plot was weighted and expressed as tons per feddan. Some physical proprieties of broad bean pods were measured in samples of 20 pods taken from each sub plot. Length, width, weight / number of seeds / pod and 100 seeds weight were recorded.

At the same time, chemical analysis, i.e., total Nitrogen (%) was measured as described by A.O.A.C. (1990), phosphorus (%) which was determined colorimeticaly using the method described by John, (1970) and

potassium (%) was determined using a flame photometer as reported by Brown and Lilland, (1946).

Moreover, the content of Fe, Mn, Zn, and Cu were measured using atomic spectrophotometer (Champman and Partt 1978).

All recorded data were subjected to statistical analysis of variance and least significance differences (L.S.D) was used to separate means, as mentioned by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

A) Growth character:

1. Effect of phosphorus forms:

The statistical analysis of the obtained data show that, only dry weight of leaves and average number of leaves per plant had significant values had generally, the application of phosphorus fertilizers in two forms had generally non significant effect on the most plant growth characters. Data presented in Table (2) show that, the plants which received the chemical phosphorus were more vigor than plants which received the natural one. These findings were similar in the two experimental seasons. The superiority in plant growth of broad bean with the application of P chemical fertilizers may be attributed to one or more the following factors a) the unknown minerals in rock phosphorus which could be inhabited plant growth and caused an inhibition in the absorption of other minerals b) present of calcium and sulpher in the chemical phosphorus form c) the low water solubility of rock phosphate in this respect Mohammed, (2004) reported that the performance of rock phosphate on legume crops growth was significantly lower than that of super phosphate, because it could not possibly maintain higher P concentration in soil solution due to its lower solubility. The previous study reported that application of P element play a great role in activation of photosynthesis, respiration and other metabolic processes of organic compounds in plant and hence increasing plant growth Ahmed *et al*., (2002) and Awad and Tahir, (2011).

2. Effect of bio fertilizers:

Data given in Table (2) showed that the inoculation of broad bean with microbein (M) or phosphorein (P) and or the mixture of M + P at rate 1 : 1 led to significant increase in vigor plant growth expressed as, the highest plants which carried the heaviest leaves and shoots compared with control treatment. These results were similar in both seasons.

It could be concluded that, using bio fertilizers are benefit when used as a mixture with broad bean seeds, the application of mixture of microbein in phosphorein resulted in more plant growth. The superiority effect of bio fertilizer could be explained based on their role in supplying the growing plant with available phosphorus, some micronutrients and the role of microbein which contains the photosynthetic bacteria as well as due to the phosphorein. Other investigators such as Abdalla 2002 , Abo El – Soud *et al* ., 2003 , El-Tantawy and Mohamed 2004, El- Gizawy and Mahasen 2009, El-, Abo El-Yazied and Abo Aly 2011 and Mokhta *et al.,* 2011 obtained data supported the obtained results.

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3. Effect of the interaction:

Data presented in Table (2) reveal that the interaction between two forms phosphorus and 4 treatments of bio fertilizers had no significant effects on height of plant, average leaves and shoots numbers and fresh or dry weight in both two experiments. But the present data of Table (2) reveal that, the plants which received Ca super phosphate and its seeds treated by the mixture of phosphorein and microbein were the best for highest plant vigor. It could be constructed that the non significant effect of two factors of interaction treatments on plant growth properties, means that each factor of the interaction act independtly in two seasons 2011 and 2012.

B) Nitrogen and phosphorus uptake:

1. Effect of phosphorus forms:

The presented data in Table (3) show the effect of two sources of P fertilizer on the uptake N and P by broad bean plant in two seasons of 2011 and 2012. The result show using Ca superphosphate as phosphate fertilizer caused an enhancement in the uptake of both nitrogen and phosphorus in leaves and branches tissues compared to plants which supplied with rock phosphorus. These results were similar in both experiments of 2011 and 2012. It could be concluded that, the higher nitrogen and phosphorus uptake which recorded with chemical phosphorus might be own to the more solubility and availability of Ca super phosphate compared to the natural phosphate, hence root system can absorb more nutrient, consequently increasing their content in plant tissues. These results are in good accordance with that obtained by Dubey, (2000).

Table 3: Effect of different sources of phosphorus and bio fertilizer on N and Puptake of broad bean plant during 2011 and 2012 seasons.

Treatments		N – uptake (mg / plant)				P– uptake (mg / plant)			
		Leaves		Shoots		Leaves		Shoots	
P phosphorus	Bio fertilizers	2011	2012	2011	2012	2011	2012	2011	2012

Natural	**Cont.**	323.51	305.35	131.78	121.61	46.83	32.15	18.83	14.12
	M	340.25	310.78	142.81	136.41	52.21	41.33	24.12	21.21
	P	359.67	339.51	156.51	141.15	60.49	48.53	25.92	22.28
	M+P	369.84	335.31	163.91	142.73	65.33	56.13	26.33	23.19
Chemical	**Cont.**	328.41	321.26	153.19	147.56	48.11	36.19	20.98	16.80
	M	358.51	345.30	165.58	158.22	63.11	53.86	24.81	21.51
	P	385.11	356.32	175.71	164.15	75.22	63.41	29.11	22.53
	M+P	397.21	368.11	178.52	167.31	78.13	66.71	30.15	24.18
LSD at 5 % Level	**S.**	12.32	18.75	5.63	19.35	2.35	3.01	0.35	1.31
	B.	13.81	8.68	12.02	8.46	5.63	3.36	1.61	1.78
	S+B	NS	NS	NS	NS	NS	NS	NS	NS

Where: M: 750g / 100 kg seeds microbein. P = 750 g seeds phosphorein.
S: Sources. B: Bio fertilizer.

2. Effect of bio fertilizers:

Table (3) showed that N and P were significantly increased by using bio- fertilizers as compared with control in both seasons. Whereas the mixture of microbein and phosphorein caused an increase in N and P uptake in tissues of shoots and leaves of broad bean plants. The statistical treatments were significant at 5 % level. The superiority of plants which treated with bio fertilizer may be attributed to its roles in N fixation bacteria or increasing the beneficial microorganism in soil as whole, or its roles in increasing the solubility and availability of minerals for absorption. The findings which obtained by El- Kamony *et al*., 2000 , Abdalla 2002 , Abo El-Soud *et al.,* 2003 and Khlaj *et al.,* 2009 are in accordance with the results reported herein.

3. Effect of the interaction:

The effect of interaction between P rates and bio fertilizers is presented in Table (3). The interaction had no significant effect on the uptake of N and P in tissues of leaves and shoots in both seasons. These results mean that, each factor of the interaction treatments act independently.

C) Total pods yield and its some physical properties:

1. Effect of phosphorus forms:

Effect of phosphorus forms on yield is presented in Table (4). The obtained results revealed that, the heaviest pods yield as tons / fed. (1.012and 0.958 in 1st and 2nd seasons respectively) were higher as compared with that bean plants which received phosphorus fertilizer in the chemical forms. Whereas, that superiority is amounted by 4.8 and 2.5 % respectively for 2011 and 2012 seasons. The response of average weight of 100 dry seed, number of pods / plant and or seeds / pod as well as the average length, width and or weight of pod (g / pod), followed the same Pattern of change like that previous mentioned in both two experimental seasons. Moreover, the statistical analysis of the resulted data reveals that, the differences within the two forms phosphorus were great enough to be significant at 5 % level. These were true for average pod weight (g / pod), number / plant, weight of 100 dry seeds (g) and total pods yield (ton / fed.) in

both two seasons. It could be concluded that, The Ca superphosphate (15.5 % P_2O_5) as a chemical phosphorus forms led to produce heaviest and best pods yield. This might be attributed to the better plant growth and the higher N and P uptake of the chemical phosphorus compared to the natural (rock phosphorus) form and the limited solubility of rock phosphate. These results are in accordance with those of Kumar *et al.*, 2001, Akintokum *et al*., 2003 , Mohammed 2004 , Al- Fageh and Mahasen, 2006 , Yillmaz 2008 and Rughein and Abdelegn 2012.

2. Effect of bio fertilizer:

Table (4) indicate that mixture of microbein with phosphorein 1: 1 gave heaviest pods yield of broad bean. However the average tonnage per fed., amounted by 1.060 and 0.984 in 1st and 2nd seasons respectively, followed in descending order by that plants received phosphorein then that received microbein as individual for each. Generally, the bio fertilizers had the highest values of in total pods yield as compared with control. These findings were similar in both seasons of 2011 and 2012.The obtained results are expected owing to the vigor plants of broad bean plants which were supplied with the mixture of microbein and phosphorein as shown in Table (2). Consequently, the superiority in plant growth parameters is reflected on the pods yield of plant. The physical properties of broad bean pods, i.e., length, width, weight of pod, average number per plant and or average number of seeds per pod as well as average weight of 100seeds, all of these measurements responded to the bio fertilizer completely similar to that which mentioned above for total pods yield. These results were true in both experiments of 2011 and 2012. It could be concluded that, using bio fertilizer with broad bean plant gained a superiority in total pods yield and improved the physical yield quantity. Similar results were reported by Viveganandan and Jauhri 2002, Abo El-Soud *et al.,*2003, Hamed 2003, Mohammed 2004, Mekail *et al.,* 2005, El- Habbasha *et al.,* 2007 and Mubassara *et al*., 2008.

3. Effect of interaction:

Data of Table (4) show that interaction treatments between the two forms of phosphorus with the 4 bio fertilizers treatments had no significant effect on the total pods yield of broad bean and its some physical properties. These findings are true in the two experimental seasons.

C) Nutrition value:

1. Effect of phosphorus forms:

An increase in value of N, P and Fe in tissues of dry broad bean seeds had been obtained in both seasons. But values of protein and K measured only in 1stseason were found with the application of phosphorus fertilizer in the chemical form. However Mn, Zn and Cu did not change in two seasons as shown in Table(5). It could be concluded that, the phosphorus forms (chemical and or nature) caused no great effect on the nutritional values of broad bean seeds. This result is in harmony with findings which obtained by Akintotkum *et al.,* 2003 and Ahmed and El- Abagy 2007.

2. Effect of bio fertilizer:

An improvement in the nutritional values of dry broad bean seeds with the inoculation of bio fertilizers such as phosphorein, microbein and or a

mixture of were shown in Table (5). The plants received mixture of phosphorein and microbein gained the best nutritional values. The highest content of N, protein, P, K, Fe, Mn, Zn and Cu were obtained during the experimental seasons of 2011 and 2012. However, the response of N, protein, P, K and Fe concentrations to the inoculation bio fertilizer treatment recorded a significant value at 5 % level in both 2011 and 2012 seasons. These results were in accordance with those of Abo El-Soud *et al.,* 2003, Mohammed 2004 and Ahmed and El-Abagy 2007.

3. Effect of the interaction:

The effect of interaction between phosphorus forms and different inoculation with bio fertilizer had no effect in nutrional values, i.e. the content of protein, N, P, K, Fe, Mn, Zn and Cu on dry seeds of broad bean. These were true in the two seasons, these findings means that, each factor the interaction act independently. Such result is in harmony with many workers such as Abdalla 2002 and Abo El-Soud *et al*., 2003.

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تأثير التسميد الفوسفاتى الطبيعى أو الكيماوى مع استعمال مصادر مختلفة من السماد الحيوى على النمو والمحصول لنبات الفول الرومى.

محمد خفاجى عبد الرحيم رخا و السعيد محمود السعيد.

قسم بحوث الخضر ذاتية التلقيح – معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة - مصر.

أجريت تجربتان حقليتان بمزرعة خاصة بكفر الوكالة – شربين – محافظة الدقهليةخلال الموسم الشتوى لعامى ٢٠١١ و ٢٠١٢ لدراسة تأثير مصدرين من السماد الفوسفاتى (سوبر فوسفات الكالسيوم وصخر الفوسفات) بجانب معاملة البذور بالمخصب الحيوىالميكروبين والفوسفورين أو خلط كلا منهما بنسبة ١ : ١ والتفاعل بينهما على النمو والمحصول لنبات الفول الرومى صنف قبرصى وتم الحصول على النتائج التالية:

- أدى استخدام السماد الكيماوى (سماد سوبر فوسفات الكالسيوم) بمعدل ٣٠ كجم فو٢ أ٥ للفدان الى زيادة نمو النباتات وزيادة الانتاجية للفدان وتحسين بعض الصفات الطبيعية والكيماوية للمحصول الناتج بالمقارنة باستخدام نفس المعدل من السماد الطبيعى (صخر الفوسفات) .
- أدى خلط بذور الفول الرومى قبل الزراعة بمخلوط من البكتريا المثبتة للنيتروجين (الميكروبين) مع البكتريا المثبتة للفوسفور (الفوسفورين) الى زيادة امتصاص نباتات الفول الرومى لعنصرى النيتروجين والفوسفور معاً وادى ذلك لتحسين نمو النباتات وزيادة المحصول البذرى بنسبة ١٠ % مع تحسين الصفات الطبيعية والكيماوية للمحصول الناتج وذلك بالمقارنة مع عدم اضافة السماد الحيوى
- لا يوجد تأثير معنوى على أى من الصفات تحت الدراسة للتفاعل بين عاملى الدراسة.
- ولذلك يمكن التوصية باضافة الميكروبين مع الفوسفورين بنسبة ١ : ١ وذلك لزيادة القدرة الانتاجية لمحصول الفول الرومى وخاصة المنزرع تحت الظروف المماثلة.

قام بتحكيم البحث

أ.د / سميرطه محمود العفيفى	**كلية الزراعة – جامعة المنصورة**
أ.د / أيهاب عوض اللة أبراهيم	**مركز البحوث الزراعية**

Table 2: Effect of different sources of phosphorus and bio fertilizer on growth characters of broad bean plant during 2011 and 2012 seasons.

Treatments		Plant height (cm)		No./plant				Plant fresh weight g / plant				plant dry weight (g)/ plant			
				Leaves		Shoots		Leaves		Shoots		Leaves		Shoots	
P phosphorus	Bio fertilizers	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Natural	Cont.	90.11	78.50	41.51	52.81	1.75	2.12	335.5	309.7	364.6	351.7	94.15	91.96	129.93	121.3
	M	98.13	80.23	50.41	54.87	2.02	2.32	355.6	326.0	375.5	373.6	103.14	91.52	145.86	120.23
	P	102.03	89.11	56.58	56.63	2.35	2.50	374.4	329.8	392.6	380.1	106.60	98.18	156.41	126.1
	M+P	119.51	95.13	58.48	58.96	2.45	2.54	387.3	335.2	401.8	387.5	108.59	102.46	159.81	130.43
Chemical	Cont.	96.91	80.21	48.49	59.06	1.88	2.15	336.8	316.3	375.1	362.3	109.17	95.73	137.08	121.55
	M	105.33	82.13	51.76	63.13	2.20	2.35	356.8	333.5	385.5	380.6	109.83	101.81	142.31	129.40
	P	112.38	85.31	54.03	66.35	2.41	2.62	382.9	337.9	403.8	389.1	109.23	105.21	152.22	130.28
	M+P	120.09	96.17	57.81	67.78	2.53	2.70	394.8	340.5	410.2	392.3	114.80	106.31	165.61	130.41
LSD at 5 % Level	S.	NS	NS	0.98	3.46	NS	NS	NS	NS	NS	NS	7.39	7.31	NS	NS
	B.	4.22	3.71	3.42	2.05	0.11	0.12	11.2	8.7	12.1	6.91	5.84	5.28	9.15	4.3
	S+B	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Where: M: 750g / 100 kg seeds microbein. P = 750 g seeds phosphorein. S: Sources. B: Bio fertilizer.

Table 4: Effect of different sources of phosphorus and bio fertilizer on yield characters of broad bean plant during 2011 and 2012 seasons.

Treatments		Pod characters						Number of				Weight of 100 seeds (g)		Total yield (ton / fed.)	
		Length (cm)		Width (cm)		Weight (g)		Pods / plant		Seeds / pod					
P phosphorus	Bio fertilizers	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Natural	Cont.	12.70	11.80	1.330	1.280	14.20	13.36	18.70	17.37	3.77	4.11	108.47	104.17	0.791	0.802
	M	13.00	11.80	1.370	1.267	14.27	14.93	20.57	19.23	4.20	4.12	110.50	109.67	0.971	0.841
	P	13.60	12.56	1.370	1.286	14.70	15.07	21.63	20.23	4.22	4.12	110.90	111.66	0.875	0.865
	M+P	13.47	12.73	1.373	1.283	15.43	15.32	22.30	20.63	4.22	4.14	113.13	112.32	0.861	0.896
Chemical	Cont.	12.77	12.20	1.343	1.267	16.47	15.00	21.00	18.61	4.21	4.10	112.84	109.11	0.914	0.891
	M	12.90	12.67	1.357	1.260	16.70	15.60	22.43	20.36	4.26	4.12	114.77	110.70	0.965	0.885
	P	13.70	12.77	1.367	1.286	17.40	15.90	24.97	21.03	4.31	4.13	116.93	113.77	1.012	0.958
	M+P	13.97	13.10	1.360	1.273	8.13	16.37	25.53	22.50	3.34	4.13	118.00	114.60	1.060	0.984
LSD at 5 % Level	S.	NS	NS	NS	NS	1.15	0.23	2.58	0.71	NS	NS	2.67	0.94	0.006	0.056
	B.	0.38	0.39	NS	NS	0.72	0.38	2.46	0.62	NS	NS	3.38	2.75	0.051	0.025
	S+B	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Where: M: 750g / 100 kg seeds microbein. P = 750 g seeds phosphorein. S: Sources. B: Bio fertilizer.

Table 5: Effect of different sources of phosphorus and bio fertilizer on chemical content of dry seeds of broad bean plant during 2011 and 2012 seasons.

Treatments		%								Meg / g dry weight							
		N		Protein		P		K		Fe		Mn		Zn		Cu	
P phosphorus	Bio fertilizers	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012	2011	2012
Natural	Cont.	4.290	4.181	26.851	26.145	0.551	0.421	2.309	2.256	7.151	5.951	0.231	0.288	0.218	0.208	0.211	0.204
	M	4.46	4.361	27.791	27.26	0.653	0.551	2.381	2.281	7.552	6.668	0.230	0.221	0.219	0.209	0.211	0.201
	P	4.661	4.541	29.125	28.371	0.752	0.652	2.438	2.397	7.856	6.931	0.232	0.222	0.215	0.205	0.214	0.204
	M+P	4.751	4.611	29.648	28.832	0.791	0.671	2.435	2.426	7.955	6.952	0.235	0.225	0.218	0.208	0.215	0.205
Chemical	Cont.	4.456	4.360	27.851	27.251	0.602	0.502	2.441	2.396	8.381	6.981	0.226	0.217	0.227	0.211	0.214	0.203
	M	4.581	4.471	28.645	27.978	0.713	0.661	2.448	2.411	8.781	7.053	0.237	0.228	0.209	0.205	0.214	0.204
	P	4.692	4.553	29.315	28.451	0.814	0.693	2.491	2.486	8.571	7.821	0.241	0.231	0.213	0.207	0.216	0.204
	M+P	4.852	4.652	30.311	29.081	0.853	0.825	2.508	2.511	8.779	7.965	0.235	0.223	0.215	0.210	0.213	0.206
LSD at 5 % Level	S.	0.102	0.076	0.646	NS	0.015	0.060	0.081	NS	0.425	0.782	NS	NS	NS	NS	NS	NS
	B.	0.131	0.072	0.822	0.461	0.072	0.071	0.058	0.056	0.551	0.435	NS	NS	NS	NS	NS	NS
	S+B	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Where: M: 750g / 100 kg seeds microbein. P = 750 g seeds phosphorein. S: Sources. B: Bio fertilizer.

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