J. Agric. Sci. Mansoura Univ., 32 (11): 9731 - 9739, 2007

EFFECT OF ORGANIC AND INORGANIC FERTILIZERS WITH SOME DIFFERENT COMPOUNDS FOLIAR APPLICATIONS ON BROAD BEAN (*Vicia faba L.*) YIELD AND PHYTIC ACID CONCENTRATION

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ABSTRACT

A pot experiment was carried out under greenhouse conditions at El-Mansoura Lab. of Plant Nutrition Research Department to study the efficiency of different soil fertilizer types with different compounds foliar applications on yield, nutrients uptake and phytic acid concentration of broad bean yield (seeds).

Obtained results showed that, the FYM fertilizer gave the highest values of yield and uptake of N, P, K, Fe, Mn, B and Co for the foliar treatments of (B, Mo and Co).While, the foliar treatments of sucrose and yeast caused the highest values of Zn and Mo uptake respectively.

The soil addition of mineral fertilizers gave the highest values of yield and the uptake of N,P,K and Fe for the foliar treatments (N,P and K), The highest values of Zn and B uptake obtained in the T_m foliar treatment, while Mo and Co uptake with the sucrose foliar treatment , and Mn uptake with the foliar treatment of T_o.

Also, the combined organic and inorganic fertilizer resulted in the highest values of yield and the uptake of N,P,K,Zn,Mn ,B and Co for N,P and K foliar treatments ,but the highest values of Fe and Mo uptake with B,Mo and Co foliar treatments.

All fertilizers (mineral, FYM fertilizer and its combination) gave the lowest values of phytic acid concentration for the yeast foliar treatment.

From these results, it could be concluded that the organic and inorganic soil fertilization with the studied compounds foliar additions are the important role for obtaining ahigh and good quality at broad bean yield and its components.

INTRODUCTION

Broad bean yield represents the third most important leguminous crop in the world, right after soybean and groundnut. Broad bean (Vicia *faba* L.) is one of the most important crops in many countries as well as in Egypt. It is cultivated mainly as a source of protein for most people (Abd EL-Hameed *et al.* , 2003).

Bean yield and its quality similarly to other crops depend on fertilization. It's well known that the foliar nutrient applications will often correct deficiency symptoms and more efficient than any other application of nutrient to the soil. Therefore the extensive research has addressed foliar fertilization of bean for increasing and improving its productivity and quality.

Foliar fertilization of soybean with NPK during early vegetative stages could result in increased growth and higher yield, Haq and Mallarino, (1998).Mourad *et al.* , (2004) indicated that foliar application of Fe, Zn and Mn on faba bean individually or in double or triple combination increased yield and its component. Janeczek *et al* .,(2004) reported that foliar application of

B,Mo and Co on common bean increased number of pods/ plant and number of seed / pod compared with control.

Foliar spray of N.A.A as a growth regulator increase pod length, yield and fruit number per plant yield of yard long bean, Resmi and Gopolokrishnan, (2004). Fathy and Farid, (1996) reported that the number of pods, fruit setting and total yield of common bean plants were increased by application of backer's yeast.

Phytic acid (myo inositol 1,2,3,4,5,6 hexa kis- phosphate or Ins P6) is the most abundant phosphorus- containing compound in mature seeds which typically representing from 65% to 80% of the mature seed's total phosphorus Raboy *et al.* ,(2000).

Phytate levels are correlated with the supply of phosphorous to the plant and the content of inorganic phosphorous in leaves, which ultimately leads to increased translocation phosphorous to the grain. Thus the aim of this work is an attempt to reduce the phytic acid content of bean after treating with different foliar nutrients application.

MATERIALS AND METHODS

A pot experiment was carried out in the greenhouse, at EL-Mansoura Lab. of Plant Nutrition Research Department, Soil, Water and Environment Res-Institute of Agricultural Research Center to evaluate the effect of different fertilizer types with different compounds foliar applications on yield and phytic acid concentration.

Patter pots of 25 cm diameter and 30 cm depth were filled with 10 Kg as dry weight basis sandy loam soil from Qalabshu area, Dakahlia Governorate.

Broad bean (*Vicia faba* L., var.Giza3) seeds were sown on the 5th of November, 2006

The experiment study involved 30 treatments, where, the main plots were NPK (100% of recommended dose),FYM fertilizer (100% of recommended dose),and 50% NPK +50% FYM fertilizer of recommended dose , each treatment replicated 3 times so the total experimental pots were 90 pots.

Each pot received 1 gm N from the urea fertilizer (46.5%), 0.6 P as Calcium super phosphate fertilizer (15.5 % P_2O_5) before sowing represent a 100% from recommendation dose (150 Kg / fed), and 0.2 gm K as potassium sulfate (48% K_2O) where The recommended dose was 50kg/fed .

The following types of foliar applications were used as sub main treatments:

1- N, P and K (250ppmN+150ppmP and 100ppmK), respectively
2- Fe, Zn and Mn (50ppmFe+100ppmZn and 50ppmMn), respectively
3-B, Mo and Co (20ppmB+10ppmMo and 2.5ppmCo), respectively
4- Mixed with treatments of 1, 2 and 3. (T_m)
5-N.A.A (0.4gm/L) (Naphthalene Acetic Acid)
6-Sucrose (2 gm/L)
7-Yeast (4 gm/L)
8- Mixed with treatments of 5, 6 and 7. (T_o)

9- Mixed with treatments of 4and8. (T_{m+o})

10 -control (distilled water)

Soil: The sample was analyzed to determine some physical and chemical properities as shown in table (1).

Table 1: Some chemical, physical properities of the experimental soil and farmyard manure:

Soil physical proprieties%			Soil chemical proprieties (mg/100g soil)								Available nutrient (ppm)	
			Cations				Anions					
Sand	59.98		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	SO_4^{--}	Cl^{-}	N	22
Silt	32.94		0.8	0.6	1.15	0.1	0.0	0.2	1.45	1.0	P	6.4
Clay	7.08	EC 0.53 dsm^{-1}									K	264
O.M	1.47										Fe	3.51
$CaCO_3$	1.85										Zn	0.8
Texture	Sandy Loam	pH 8.06									Mn	1.3
											B	0.63
											Mo	0.09

Physical and chemical properities of the soil sample were determined using the methods described by Piper (1950), Cottenie *et al.* (1982) and Black (1982) and presented in Table 1.

Dry pods were picked up; seeds were weight and recorded in gm / pot. Samples from the dried seeds were ground and wet digested by sulphoric-percloric acid mixture according to Petter Burgski (1968) to determine the total N, P, K, Fe, Zn, Mn, B, Mo and Co in the acidic extract. Phytic acid was determined calorimetrically at wave length of 480 nm using spectrophotometer as described by Wheeler and Ferrel (1971).

All recorded data were statistically analyzed according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect of inorganic and organic fertilizers with foliar applications on

1- Yield:

Data tabulated in Table 2 illustrat the interaction effect of inorganic and organic fertilizers with foliar applications on yield of bean plant (gm/pot) The statistical analysis are significant .Which the mineral fertilization with the foliar treatment (N, P and K) gave the highest ,while, the lowest value obtained by the foliar treatment (T_{m+o}). For the FYM fertilizer the highest value obtained by the treatment (B, Mo and Co) foliary, but the foliar treatment (T_o) give the lowest value. The combination fertilizer with foliar treatment (N, P and K) gave the highest value, but the lowest value obtained by the yeast treatment foliary with combined fertilizer.

Generally, the result referred to that, using treatment (N,P and K) foliary with mineral fertilization increased yield by (53%) over the control, this data confirmed by Said, (1996).The foliar addition of (B,Mo and Co) with FYM fertilizer increased yield by (74%) over the control and this data confirmed by Aly, (2003). Also, foliar of the (N, P and K) with combined fertilizers increase yield by (67%) over the control, the work of Tolba *et al.* , (2003), confirmed these results. The data pointed out that to the best treatment was FYM with foliar of (B, Mo, Co) which resulted in the highest yield in this trail. This result confirmed by the works of Said, (1996), Aly, (2003) and Tolba *et al.* , (2003).

Table 2: The effect of inorganic and organic fertilizers with foliar applications on yield of broad bean (gm/pot)

Treatments	Mineral	FYM	Mix
Control	15.97	10.46	10.90
NPK	34.55	26.46	33.63
Fe, Zn, Mn	19.13	22.29	19.77
B, Mo, Co	26.41	40.41	27.17
T_m	28.04	18.20	23.07
N.A.A	13.90	18.24	17.78
Sucrose	29.09	31.70	24.16
Yeast	21.18	18.30	15.91
T_o	32.36	11.98	17.36
T_{m+o}	12.56	16.46	26.65
L.S.D 5%	0.9259	0.4416	1.6038

NAA (naphthalene acetic acid) ,T_m (NPK + Fe,Zn, Mn + B,Mo ,Co) , T_o (NAA + sucrose + yeast) , T_{m+o} (T_m + T_o)

2-Macronutrients uptake:

The interaction effect of (mineral, FYM fertilizer and its Combination) with foliar applications on NPK uptake illustrates in Table 3, where the statistical analyses are significant at all parameters under investigation. The data show that, the maximum increase was obtained by foliar treatment of (N, P and K) with the mineral fertilization, while the lowest values obtained by treatments of (T_{m+o} and N.A.A) foliary. For the FYM fertilizer the highest values for N, P and K uptake were obtained with the treatment of (B, Mo and Co) foliary, but the foliar treatment (T_o) caused the lowest value for N, P and K uptake.

Table: 3 The effect of inorganic, organic fertilizers and foliar applications on N, P, K uptake gm/pot by broad bean yield:

Treatments	N			P			K		
	Mineral	FYM	Mix	Mineral	FYM	Mix	Mineral	FYM	Mix
Control	0.570	0.270	0.340	0.044	0.026	0.026	0.230	0.113	0.147
N, P, K	2.040	1.547	1.810	0.237	0.150	0.134	0.710	0.533	0.630
Fe,Zn,Mn	1.097	1.263	1.097	0.065	0.074	0.067	0.390	0.450	0.470
B,Mo,Co	1.310	1.670	0.983	0.101	0.144	0.086	0.600	0.780	0.520
Tm	1.580	0.783	0.900	0.073	0.068	0.067	0.600	0.357	0.477
N.A.A	0.573	0.630	0.513	0.045	0.069	0.062	0.270	0.343	0.283
Sucrose	10603	1.637	1.003	0.112	0.092	0.086	0.540	0.600	0.480
Yeast	0.770	0.627	0.657	0.076	0.051	0.036	0.400	0.333	0.287
To	1.220	0.410	0.563	0.076	0.033	0.040	0.610	0.203	0.273
Tm+o	0.277	0.333	0.737	0.030	0.043	0.067	0.313	0.370	0.580
L.S.D 5%	0.0261	0.0529	0.0917	0.0059	0.0082	0.0142	0.0174	0.0269	0.0466

The combination fertilizer with foliar treatment of (N, P and K) gave the highest values of N, P and K uptake, but the lowest values were obtained by yeast treatment foliary for N, P and K uptake respectively.

Generally, the results referred to that the treatment of (N, P and K) foliary with mineral fertilization increased N, P and K uptake over the control with (72, 81 and 67% respectively). Using treatment of (B,Mo and Co) foliary with FYM fertilizer increased N,P and K uptake over the control with (83,81 and 85%) respectively .On the other hand , using foliar of (N,P and K) treatment with combined with fertilizers increased N,P and K uptake over the control with (81,80 and 76% respectively) and these results confirmed by those of Brohi and Karaman,(1997) , Haq and Mallarino, (1998) and Janeczek *et al.* ,(2004).

3- Micronutrient uptake:

*** Fe, Zn and Mn:**

Data tabulated in Table 4 illustrate the interaction effect of (mineral, FYM fertilizer and its combination) with foliar applications on Fe,Zn and Mn uptake by bean plant (mg/pot) where the statistical analyses are significant at all parameters under investigation.

Table 4: The effect of inorganic, organic fertilizers and foliar applications on Fe, Zn, Mn uptake mg/pot by broad bean yield:

Treatments	Fe			Zn			Mn		
	Mineral	FYM	Mix	Mineral	FYM	Mix	Mineral	FYM	Mix
Control	2.260	1.140	1.283	0.200	0.181	0.160	0.348	0.208	0.229
N, P, K	12.063	3.427	4.990	0.628	0.401	0.574	0.674	0.522	1.144
Fe,Zn,Mn	3.237	3.973	3.760	0.383	0.535	0.377	0.714	0.890	0.640
B,Mo,Co	4.073	6.953	5.427	0.456	0.698	0.538	0.526	1.402	0.797
Tm	8.847	2.383	3.067	0.807	0.402	0.571	0.975	0.633	0.681
N.A.A	1.427	1.893	2.170	0.277	0.275	0.302	0.310	0.318	0.620
Sucrose	4.560	4.277	3.467	0.434	0.856	0.419	0.824	1.301	0.713
Yeast	2.277	3.067	2.757	0.371	0.325	0.281	0.470	0.569	0.420
To	4.717	1.860	3.463	0.551	0.180	0.266	0.022	0.328	0.511
Tm+o	3.393	2.050	4.103	0.290	0.327	0.533	0.342	0.651	0.997
L.S.D 5%	0.1129	0.1663	0.2881	0.0053	0.0213	0.0370	0.0186	0.0412	0.0713

The mineral fertilization with the foliar treatment (N, P and K) gave the highest value of Fe uptake, also (T_m and T_o) gave the highest values of Zn and Mn uptake, but the lowest values obtained by the treatment of (N.A.A). While the FYM fertilizer gave the highest values of Fe and Mn uptake by the foliary treatment of (B,Mo and Co), also the foliar (sucrose) treatment gave the highest value of Zn uptake ,but the (T_o) treatment gave the lowest value of Fe and Zn uptake ,and the lowest value of Mn uptake obtained by the (N.A.A) foliary treatment. The combination fertilizers with foliar treatment (B,Mo and Co) gave the highest Fe uptake , on the other hand the foliar treatment of (N,P and K)with combined fertilizer gave the highest Zn and Mn uptake , but the foliary N.A.A,T_o and yeast treatments caused the lowest Fe,Zn and Mn uptake respectively. These results agreed with those of Brohi *and Karaman, (1997),* EL Tawil *et al.* , (2003), Vreugderihil *et al.*; (1998), Abd EL-Rahim *et al.* , (2003) and Thalooth *et al.* , (2006)

*** B, Mo and Co:**

Data tabulated in Table 5 illustrate the interaction effect of (mineral, FYM fertilizer and its combination) and foliar applications on B, Mo and Co uptake by bean plant (mg/pot) where the statistical analyses are significant at all parameters under investigation. The mineral fertilization with the foliar treatment (T_m) gave the highest value of B uptake ,and the foliar treatment (sucrose) gave the highest value of Mo and Co uptake , but the lowest B uptake was obtained by the treatment (T_{m+o}) foliary , treatment of (T_o) foliary gave the lowest value for Mo and Co . On the other hand the FYM fertilizer gave the highest values for B and Co uptakes were obtained by the treatment of (B, Mo and Co) foliary. As well as, the (yeast) foliar treatment gave the highest Mo uptake, but the lowest values were obtained in case of treatment (N.A.A) foliary for B and Mo uptake, and the foliar treatment (T_{m+o}) gave the lowest Co uptake. The combination fertilizer with foliar treatment (N, P and K) gave the highest value for B and Co uptake. On the other hand, the treatment of (B,Mo and Co) gave the highest Mo uptake .The lowest B and Mo uptake were obtained by(yeast) foliary treatment, and the lowest Co uptake was obtained by foliary treatment of (T_{m+o}) with combined fertilizer.These results agreed with those of Thalooth *et al.*,(2006), Vreugdenhil *et al.* ,(1998), EL-Banna *et al.* ,(2005) , Reddy *et al.* , (2003), Fathy and Farid ,(1996) and Haq *et al.* ,(1998)

Table: 5 The effect of inorganic, organic fertilizers and foliar applications on B,Mo,Co uptake mg/pot by broad bean yield :

Treatments	B			Mo			Co		
	Mineral	FYM	Mix	Mineral	FYM	Mix	Mineral	FYM	Mix
Control	0.098	0.143	0.135	0.167	0.075	0.040	0.004	0.002	0.002
N, P, K	0.127	0.138	0.500	0.349	0.039	0.134	0.000	0.000	0.008
Fe,Zn,Mn	0.229	0.193	0.315	0.019	0.215	0.314	0.004	0.005	0.004
B,Mo,Co	0.352	0.499	0.227	0.130	0.519	0.502	0.006	0.009	0.006
Tm	0.435	0.304	0.198	0.110	0.116	0.062	0.006	0.004	0.005
N.A.A	0.195	0.024	0.154	0.037	0.036	0.053	0.003	0.004	0.000
Sucrose	0.308	0.430	0.295	0.833	0.062	0.210	0.007	0.007	0.000
Yeast	0.328	0.141	0.118	0.203	0.706	0.011	0.005	0.004	0.004
To	0.247	0.103	0.132	0.063	0.047	0.046	0.000	0.003	0.000
Tm+o	0.119	0.110	0.218	0.084	0.183	0.072	0.003	0.000	0.000
L.S.D 5%	0.0101	0.0154	0.0267	0.0084	0.0200	0.0346	0.0003	0.0004	0.0007

4- Phytic acid concentration:

Data tabulated in Table 6 illustrate the interaction effect of (mineral, FYM fertilizer and its combination) with foliar applications on phytic acid concentration in bean seeds where the statistical analyses are significant .The foliar treatment (T_o) with (mineral, FYM fertilizer and its combination) gave the highest values of phytic acid concentration, but the lowest values obtained by foliar treatment of (yeast) with (mineral. FYM fertilizer and its combination), the work of Raboy *et al.* , (2000) and Sandberg, (2002), confirmed these results.

From these results, it could be concluded that, using of (mineral. FYM fertilizer and its combination) with foliar applications to bean seeds helping to increase yield, increase uptake of both macronutrient and micronutrient, but reduce phytic acid concentration of bean seeds .

Table 6: The effect of inorganic and organic fertilizers with foliar applications on phytic acid concentration of broad bean seeds:

Treatments	Mineral	FYM	Mix
Control	0.404	0.404	0.404
NPK	0.532	0.415	0.428
Fe, Zn, Mn	0.463	0.436	0.451
B, Mo, Co	0.252	0.173	0.207
T_m	0.261	0.211	0.243
N.A.A	0.441	0.423	0.434
Sucrose	0.193	0.120	0.174
Yeast	0.044	0.026	0.047
T_o	0.592	0.522	0.538
T_{m+O}	0.433	0.413	0.426
L.S.D 5%	0.0017	0.0010	0.0029

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J. Agric. Sci. Mansoura Univ., 32 (11), November, 2007

تأثير التسميد العضوى والمعدنى والرش ببعض المركبات، على المحصول وتركيز حمض الفايتك لنبات الفول البلدى.

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أقيمت تجربة اصص فى معمل بحوث تغذية النبات بالمنصوره - دقهليه لدراسة تأثير التسميد العضوى والمعدنى والخلط بينهما مع الاضافات رشا على كل من المحصول وتركيز حمض الفايتك لنبات الفول .

ولقد أوضحت النتائج أن:

- التسميد العضوى اعطى اعلى قيم لكل من المحصول , النيتروجين, الفوسفور, البوتاسيوم, الحديد , المنجنيز, البورون والكوبلت الممتص مع المعامله (B ,Mo ,Co) بينما اعطى اعلى قيم لكل من الزنك مع المعامله(sucrose) والموليبدينم مع المعامله (yeast).
- التسميد المعدنى اعطى اعلى قيم لكل من المحصول,النيتروجين , الفوسفور , البوتاسيوم والحديد الممتص مع المعامله (N,P,K). بينما اعطى اعلى قيم للزنك والبورون لممتص مع المعامله (T_m) واعطى اعلى قيم للموليبدينم والكوبلت مع المعامله (sucrose) واعطى اعلى قيمه للمنجنيز مع المعامله (T_o)
- معاملة الخلط (٥٠% معدنى + ٥٠% عضوى) اعطت اعلى قيم لكل من المحصول , النيتروجين , الفوسفور , البوتاسيوم , الزنك , المنجنيز, البورون والكوبلت الممتص مع المعامله (N,P,K. بينما اعطى اعلى قيم للحديد والموليبدينم مع المعامله (B,Mo ,Co)
- اظهرت اقل قيمه لتركيز حمض الفايتك لبذور نبات الفول بالمعامله (yeast) رشا مع كل من التسميد (العضوى والمعدنى والخلط بينهما) .

وتشير النتائج المتحصل عليها الى زيادة فى المحصول والمحتوى المعدنى للعناصر فى بذور الفول , بينما يقل المحتوى فى بذور الفول لحمض الفايتك باستخدام التسميد المعدنى والعضوى والخلط بينهما مع الاضافات رشا .