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EFFECT OF NITROGEN SOURCES ON MACRO AND MICRONUTRIENTS UPTAKE OF FABA BEAN IN SALT AFFECTED SOILS

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ABSTRACT Two field experiments were carried out at Agriculture Research Station of Tag EL-Ezz, Dakahlia Governorate, during 1997-1998 and 2001-2002 seasons to study the effect of four nitrogen sources, two salinity levels and inoculation with Rhizobia for faba bean on macro and micronutrients uptake in salt affected soils. The experiment involved 20 treatments; each treatment replicated three times.

The obtained results revealed that, the differences among either the treatments or the most parameters were highly significant as compared with cont

The inoculation increased the uptake of N, P. K, Mn, Zn, Cu and Fe, however, there is a positive relationship among salinity levels and P, Zn and Fe uptake, while a negative relationship among salinity levels and N, K, Mn and Cu uptake. However, the best fertilization was $CO(NH_2)_2$ fertilizer for macronutrients while the NH_4NO_3 was the best for micronutrients.

INTRODUCTION

Faba bean is one of the most important crops in Egypt as well as in many countries. It is cultivated mainly as a source of protein for most people. Salinity is one of the major environmental stresses that drastically affect crop productivity especially in arid and semi-arid region (Abd EL-Hameed et al., 2003).

The growth of plants under saline conditions could be improved by the use of inorganic fertilizer. Nitrogen plays a vital nutritional and physiological role in plant and is also unique among the mineral nutrients in that, it can be absorbed by plants in two distinct forms, either as the anion No^-_3 or the cation NH_3, (Irshad et al., 2002).

The nutrient concentration of shoot under different saline conditions indicated a trend almost opposite to that observed for biomasses yield, the average concentration of all nutrients except P decreased with increasing the salinity (Irshad et al., 2002).

The inoculation induced enhancement of mineral uptake in plants (Amara and Dahdoh, 1997).

This work aimed to study the effect of nitrogen sources, salinity and inoculation on Macro- and micro nutrients uptake of faba bean plants in salt affected soils.

MATERIALS AND METHODS

The present study was carried out through 1997-1998 and 2001-2002 seasons as the following:

Location: Agriculture Research Station of Tag EL-Ezz, Dakahlia Governorate, A.R.C.

Surface soil sample was taken and air dried, ground a 2 mm sieve. Particle size distribution was determined according to the international method (Piper, 1950).

The chemical analysis of the experimental soil in Table (1):

Table 1: Chemical analysis of soil samples (0-30 cm).

Ec/dsm^{-1}	PH	Anion meq/100g soil				Cations meq/100g soil				Available nutrients (ppm)							ESP	Texture
		CO_3^-	HCO_3^-	Cl^-	SO_4^-	Ca++	Mg++	K^+	Na^+	N	P	K	Mn	Zn	Cu	Fe		
S_1 4.7	7.9	-	0.4	3.6	0.8	0.7	0.4	0.1	3.6	26	19	301	1.7	1.5	1.9	6.4	10.1	Clayey
S_2 4.2	8.1	-	0.3	2.4	1.8	1.3	0.8	0.1	2.3	31	15.2	194	1.8	1.6	1.3	8.4	8.6	

All chemical analysis was carried out according to Black, (1965) and Page, (1983).

Studied crop: Faba bean (Vicia faba, Var, Sakha 461).

Experimental plot: 3 x 4m.

Date of sowing: The seeds were sown on 11th November, 1997 and 2001.

Experimental treatments: The experiments were carried out in split-split plot design involving 20 treatments. Each treatment was replicated three times.

The detailed experimental treatments were as following:

a- Main plot; two salinity levels (S1 = 4.7 dsm-1 and S2 = 4.2 dsm-1).

b- Sub-plot; N-sources i.e. control treatment without any addition, (nitrate-N + Ammonium-N) as NH_4NO_3, (Ammonium-N) as $(NH_4)_2SO_4$, (Urea-N) as $CO(NH_2)_2$ and (nitrate-N) as $Ca(NO_3)_2$. N-source was added (16 kg N/fed).

c- Sub-sub plot; Rhizobium inoculated and free inoculated.

A basal dose of phosphorus and potassium were applied at the rate of (15 kg P_2O_5/fed.) as $Ca(H_2PO_4)_2.H_2O$ and K_2SO_4 at the rate of (48 kg/fed.) as stimulative dose.

The seeds were inoculated with (Rhizobium Leguminosarum) before cultivation (300gr/40kg seeds/fed).

Seed samples: Seeds oven dried (65°C) for 48 hours, weighed and milled into powder. The milled samples were digested using sulfuric and perchloric acid solutions, for determination of N, by using Microkeldahel, phosphorus determined by spectrophotometer and potassium by using flame photometer. The microelements determined by using atomic absorption.

Statistical analysis: A combined analysis of collected data for both seasons was done using the analysis of variance technique according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effect of inoculation and N-sources on macro and micronutrients uptake:

There are a changes in N, P, K, Mn, Zn, Cu and Fe in balance induced in seed and straw of faba bean by inoculation with Rhizobium. Data in Tables 2 and 3 show that, significant differences between inoculation and free inoculation. The increasing percentages over the control were 69.0, 61.1 and 59.5 for seed, while they were 62.0, 65.2 and 60.0 for straw, at S1 level for N, P and K, respectively with $CO(NH_2)_2$ fertilizer.

However, at S_2 level, the increasing percentages were 70.1, 60.5 and 61.9 for seed, while, they were 63.2, 63.0 and 64.4 for straw, respectively for the studied parameters, with $CO(NH_2)_2$ fertilizer.

For the micronutrients, data revealed that the inoculation increased the concentration of Mn, Zn, Cu and Fe in seed and straw of faba bean plants. The increasing percentages over the control were 66.1, 63.9, 59.2 and 68.8

for seed while, they were 61.4, 58.1, 63.8 and 59.8 for the straw, respectively with the (NH_4NO_3) fertilizer at S_1 level. Whatever the increasing percentages over control were 67.5, 58.0, 63.9 and 67.9 for the seed, while they were 62.5, 55.6, 64.7 and 57.4 for the straw, respectively at S_2 level, with (NH_4NO_3) fertilizer, Amara and Dahdoh (1997) found that, the inoculation increased, both concentration and uptake of N, P and K in wheat, indicating the beneficial effect of biofertilization, also, the uptake of micronutrients increased significantly with the inoculation.

Effect of salinity and N-sources on macro and micronutrients uptake:

A negetive relationship was observed between N and K concentrations (of seed and straw) and different salinity levels, while the relationship was positive in the case of P concentration.

Whereas the increasing percentages between two salinity levels, were 1.1 and 2.4 for seed, while they were 1.2 and 4.4 for straw to N and K respectively. P concentration increased with S_1 than S_2 (0.6% for seed and 2.2% for straw).

There was a positive relationship between Mn and Cu and salinity levels with N sources treatments, the increasing percentages were 1.4 and 4.7 for seed, while they were 1.1 and 0.9 for straw, respectively. However, a negative relationship among Zn and Fe and salinity levels, the increasing percentage were 4.9 and 0.9 for seed while they were 2.5 and 2.4 for the straw, respectively. Irshad et al. (2002) found that, the average concentration of N and K opposite to salinity except P concentration, also, the increasing levels of salinity decreased the concentration of Mn, while the concentration of Zn and Fe was increased at a higher level of salinity.

The effect of different N-sources on macro and micronutrients :

Data revealed that, among the N-sources the uptake of macronutrients were greater in $CO(NH_2)_2$ fertilizer than other N-treatments. However, the uptakes of micronutrients were also greater in NH_4NO_3 fertilizer than other N-treatments across two salinity levels. Irshad et al. (2002) found that the NH_4NO_3 fertilizer with combination of NH_4^+-N and NO_3^--N, whereas the NO_3-N was a better N-sources than NH_4^+ for wheat grown in salt-affected areas, also, the NO_3^--N tookup substantially more total N than other N-source treated plants. As a result of higher mobility of the nitrate form of N within the root zone.

Table (2) : N-Sources, salinity and inoculation effects on N, P and K-uptake (kg/fed) of faba bean plants.

Treatments	N-uptake								P-uptake								K-uptake							
	Grain				Straw				Grain				Straw				Grain				Straw			
	S_1		S_2		S_1		S_2		S_1		S_2		S_1		S_2		S_1		S_2		S_1		S_2	
	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc
Control	9.9	6.9	11.8	8.2	3.2	2.4	4.1	3.0	3.7	2.8	3.4	2.6	2.4	1.7	2.2	1.6	4.8	3.6	5.5	4.0	3.9	2.9	4.4	3.3
NH_4NO_3	21.8	13.6	124.4	15.3	7.6	4.7	9.1	5.7	6.2	3.9	6.1	4.0	2.5	2.5	3.8	2.4	10.0	6.3	13.1	8.1	5.8	3.7	7.3	2.06
$(NH_4)_2SO_4$	18.4	11.7	29.2	18.6	9.2	5.8	10.1	6.3	8.1	5.2	7.3	4.8	2.7	2.7	4.1	2.6	13.2	8.4	15.7	9.9	7.2	2.7	9.4	6.0
$CO(NH_2)_2$	18.6	11.0	23.3	13.7	81	5.0	12.4	7.6	5.8	3.6	6.1	3.8	2.3	2.3	4.4	2.7	12.6	7.9	15.7	9.7	6.4	2.0	7.7	4.8
$Ca(NO_3)_2$	20.1	13.3	25.4	16.0	8.4	5.4	12.8	8.1	6.7	4.4	6.2	4.1	2.3	4.3	4.5	2.9	11.1	7.2	13.8	8.9	6.8	4.4	7.9	5.1
F-test	**		**		**		**		**		**		**		**		**		**		**		**	
L.S.D.	0.96		0.70		0.41		0.38		0.42		0.40		0.33		0.30		0.29		0.29		0.28		0.25	
L.S.D.	1.84		0.96		0.57		0.51		0.60		0.57		N.S.		N.S.		0.41		0.40		0.40		0.38	

Table (3) : N-Sources, salinity and inoculation effects on Mn, Zn, Cu and Fe-uptake (gm/fed) of faba bean plants.

Treatments	Mn-uptake								Zn-uptake							
	Grain				Straw				Grain				Straw			
	S_1		S_2		S_1		S_2		S_1		S_2		S_1		S_2	
	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc
Control	4.5	3.6	6.1	4.6	3.3	2.3	3.8	2.6	27.1	18.9	23.8	17.1	7.5	5.5	6.8	5.4
NH_4NO_3	20.6	12.4	25.3	15.1	7.1	4.4	9.1	5.6	111.6	68.1	101.1	63.5	31.3	19.8	29.4	16.9
$(NH_4)_2SO4$	27.1	16.8	29.4	18.0	7.8	4.9	10.2	6.3	161.1	101.3	137.3	86.5	25.1	16.3	22.6	14.8
$CO(NH_2)_2$	32.6	21.0	40.1	25.7	9.8	6.3	13.1	8.3	141.9	98.3	133.1	84.6	33.3	21.6	27.3	18.1
$Ca(NO_3)_2$	37.5	23.8	44.3	28.0	11.2	7.4	14.0	8.8	151.4	96.7	146.3	93.2	35.3	24.1	29.1	19.7
F-test of salinity	**		**		**		**		**		**		**		**	
LSD5% of source	0.67		0.65		0.35		0.32		0.78		0.74		0.59		0.58	
LSD5% of interaction	0.95		0.91		0.50		0.48		1.10		1.08		0.84		0.83	

Treatments	Cu-uptake								Fe-uptake							
	Grain				Straw				Grain				Straw			
	S_1		S_2		S_1		S_2		S_1		S_2		S_1		S_2	
	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc	Inc	F.inc
Control	9.1	6.3	13.6	9.3	4.8	3.6	6.3	4.6	36.1	29.1	34.3	27.7	4.9	3.6	4.6	3.5
NH_4NO_3	27.7	17.4	34.2	21.4	7.7	4.7	11.2	6.6	139.4	82.6	127.6	76.0	17.1	10.7	14.8	9.4
$(NH_4)_2SO_4$	65.2	41.1	81.4	50.3	9.6	6.1	13.8	8.6	383.8	249.0	368.2	243.0	24.2	15.4	23.1	14.8
$CO(NH_2)_2$	85.5	57.2	91.2	60.9	19.3	12.0	24.7	15.1	285.0	178.1	295.0	194.3	23.5	1.2	21.2	13.9
$Ca(NO_3)_2$	69.1	46.6	75.6	49.8	14.8	9.8	26.2	17.2	414.6	271.7	404.7	265.7	30.4	19.4	32.1	20.5
F-test of salinity	**		**		**		**		**		**		**		**	
LSD5% of source	0.59		0.58		0.29		0.27		0.58		0.55		0.17		0.16	
LSD5% of interaction	0.84		0.84		0.40		0.38		0.83		0.79		0.24		0.22	

It was concluded that, the inoculation increased the uptake of N, P, K, Mn, Zn, Cu and Fe. The relationship among salinity levels and P, Zn and Fe uptake was positive, while it was negative with N, K, Mn and Cu uptake. Also, the best fertilization was $CO(NH_2)_2$ fertilizer for macronutrients while NH_4NO_3 was the best for micronutrients.

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مجلة الأزهر للبحوث الزراعية
العدد (٣٧) يونيو ٢٠٠٣

تأثير مصادر النيتروجين على امتصاص العناصر الكبرى والصغرى لنبات الفول البلدي في الأراضي المتأثرة بالأملاح

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*** قسم بحوث تغذية النبات – معهد بحوث الأراضي والمياه والبيئة – مركز البحوث الزراعية – الجيزة – مصر.**

**** معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية – الجيزة – مصر.**

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بتاج العز – محافظة الدقهلية خلال موسمى ١٩٩٧ -١٩٩٨ و ٢٠٠١-٢٠٠٢ لدراسة تأثير أربعة مصادر نيتروجينية ومستويان من الملوحة مع التلقيح بالريزوبيا لنبات الفول البلدي على امتصاص العناصر الكبرى والصغرى في الأراضي المتأثرة بالأملاح، شملت التجربة ٢٠ معاملة فى تصميم قطع منشقة مرتين وكررت كل معاملة ثلاث مرات.

أظهرت النتائج المتحصل عليها أنه يوجد فروق معنوية بين المعاملات ومعظم الصفات المدروسة مقارنة بالكنترول. وأدى التلقيح إلى زيادة الممتص من النتروجين – الفوسفور – البوتاسيوم – المنجنيز – الزنك – الحديد. ووجدت علاقة موجبة بين مستويات الملوحة والممتص من الفسفور – الزنك – الحديد، كما وجدت علاقة سالبة بين مستويات الملوحة والممتص من النتروجين – البوتاسيوم – المنجنيز – النحاس.

كان التسميد باليوريا أفضل مع العناصر الكبرى بينما كان التسميد بنترات الأمونيوم أفضل مع العناصر الصغرى.