Response of *Faba* Bean (*Vicia Faba, L.*) Incoulated with *Bradyrizobium Japonicum* Grown on Sandy Soil to Compost and Elemental Sulphur Application.

El-Kouny.H.M. , Fayed, R.I.
Soil Salinity Research Department , Soil , Water and Environment Research Institute , ARC , Alex , Egypt

ABSTRACT

A field experiment was carried out on sandy soil during the growth season 2007-2008 at El-Bostan region , Tawfek El-Hakeem Village , El-Behira governorate , to study the effect of compost "C" (0,6,12 and18m^3/fed.) and elemental sulphur "S^o"(0,50and100Kg/fed.) on soil and with seeds treatments with inoculated or not with Bradyrhiobium japonicum (*R. japonicum*) on nodulation , growth , yield components and chemical composition of *faba* bean (*Vicia faba* , *L.*) plants . The treatments were arranged in split – split plots with compost assigned to main plots, inoculation of seeds to subplots, and S^o application to sub-subplots.

The obtained results showed that faba bean plants showed high response to inoculation with *R.japonicum* under increasing compost and S rates addition. The treatments for 12 m^3 compost and 100kg S/fed.(C_3S_3) produced the highest mean values of number and dry weight (g) of nodules/10 plants which were 132.92 and 9.95, respectively, and 74.0 and 4.84 for noninoculated seeds. The highest mean values of plant height (cm), branches number/plant, leaves number/plant, straw yield (ton/fed.),seed yield(ton/fed.),pods number/plant and seed number/pod for inoculated seeds were 92.15,6.95,36.47,5.10,1.64,21.70 and 5.98, respectively while for noninoculated seeds were 67.10,5.80,29.00,3.45,0.95,14.70 and 2.90, respectively , and were obtained from C_3S_2,C_3S_3 and C_4S_2 treatments .

The highest average values of macronutrients N,Pand K contents (%) in plant parts seeds and straw at C_3S_3 treatment were 2.63% ,0.22% and 1.82% for seeds , respectively, and 1.63% , 0.22%and 0.88% for straw , respectively for inoculated seeds. In the case of noninoculated seeds , C_3S_3 treatment values were 1.63%, 0.163% and 1.35% in seeds , respectively and 1.3% ,0.195% and 0.95% , respectively in straw . The C_4S_2 treatment with respect to macronutrients (N,P,and K) uptake by faba bean plants in case of inoculated seeds gave 3.45,0.215 and 1.45 mg/plant in seeds, respectively and 2.47 , 0.150 , 0.95 mg/plant respectively in case of noninoculated .With respect to micronutrients (Fe , Mn and Zn) contents in case of inoculated seeds , the highest values of (Fe , Zn , and Mn) obtained with 18 m^3 compost and 100 KgS / fed .

Key words : compost , sulphur - Bradyrhiobium japonicum , inoculation , nodulation , macronutrients and micronutrients .

INTRODUCTION

Faba bean (*Vicia faba ,L.*) is the most important seed legume crop in Egypt and it is a cheap source of protein. The average seeds yield is 10.50 ardabs/fed. During the past seasons about 90% of the total area was

located in North Delta and newly reclaimed lands at Noubaria region(Mohamed et.al.,2001) .Regarding to the misuse of mineral fertilizers by farmers with high amounts since term ago, the pollution of the environment become one of the most important problem specially , NO_3–N pollution in foods and drinking water (Abd Allah,2001).Rhizobial strains vary in their ability to form infection threads to initiate early nodules and in the rate at which they form nodules (Abdel-Ghaffar, 1980).In Egyptian soils which are voide of *R. japonicum* , faba bean plants grown from seeds inoculated with strain of *R.japonicum* showed 80-90% nodulation of the plants upon inoculation(Hamdi ,1976) . Soils of Noubaria are mainly characterized with low organic matter contents and unstable aggregates . Elemental sulphur (S) and organic residues are the most important amendments used for soils reclamation and improvement, especially sandy and calcareous soils(Koreish et.al.,2001).Some studies showed that sulphur application with organic manure led to decrease pH and increase in the availability of K, P, Fe, Mn and Zn in Nubaria region (El-Fayoumy et.al., 1996) (Radwan et.al., 2005) and (Mohamed et.al. , 2001) . The application of organic manure caused a remarkable increase in dry matter and seed weight of grain yield when applied with sulphur (Saddik and Laila , 2004 and Abbas et.al., 2006).

The objective of this study was to investigate the effects of organic manure (compost),elemental sulphur (s^5) application to soil and inoculation of seeds on nodulation , growth , yield and chemical composition of faba been (*Vicia faba*, L.) plants grown in sandy soil at Noubaria area , Behera Governorate.

MATERIALS AND METHODS

A field experiment was carried out during the growth season 2007 – 2008 at El-Noubaria region (El-Bostan area - Tawfik El-Hakeem village). Surface composite soil (0-25cm) samples were collected from the experimental site before cultivation and at the end of the field experimental work, air –dried ground to pass 2mm sieve and analyzed for soil chemical and physical properties according to the methods outlined in Black (1965) . The main chemical and physical properties of the soil are given in Table 1 .

Table 1- the main chemical and physical properties of the field experimental soil

Soil character	Value
pH (1:2.5)Soil :water	7.93
EC (1:2.5) dSm^{-1}	0.89
Water soluble ions , meg/L	
Na^+	3.50
K^+	0.35
Ca^+	3.75
Mg^{2+}	1.30
CO_3^{2-}	4.45
Cl^-	3.25
SO_4^{2-}	1.20
T-N, %	0.05
Av.N mg/kg soil	32.82
Av.P mg/kg soil	5.88
Av-K mg/kg soil	59.25
O.M, %	1.104
Total $CaCO_3$%	1.45
Particle size distribution	
F. sand%	14.45
C. sand,%	60.55%
Silt,%	16.75
Clay,%	8.25
Texture class	Sandy Loam

The source of organic compost was a mixture of farm animal wastes and plants residues subjected to composting using composter machine (El-Kouny, 1999 , Bertran Kehres and Andreas ,1994and Muthur et.al.,1993) The main characteristics of compost is given in Table-2.

Table (2) : The main characteristics of the used compost.

Parameter	(Bd)kg m^{-3}	EC, dS/m (1:10) compost:H2O	T.N,%	OM,%	T-p,%	T-K,%	C/N, ratio	D,M,%	CEC, Cmol/kg
Value	590	7.24	2.75	69.39	1.75	1.90	14.64	81.25	190.0

Experimental layout :

Treatments : the compost (C) was applied at four rates (C_1=zero, C_2=6, C_3=12 and C_4=18 m^3 fed^{-1}). and the elemental sulphur (S°) at three rates (S_1=0, S_2=50 and S_3=100 kgfed^{-1}). The sulphur (S°) was well-mixed before application with the compost and was added within depth of approximately 25cm , two weeks before cultivation. The experimental design was a randomized complete block with three replicates. The treatments were arranged in split – spilt plots with compost assigned to main plots , inoculation and noninculation with *R. japonicum* (CIAT899) [produced by Agriculture Ministry , Cairo, Egypt] to subplots and elemintal sulphur (S) to sub-subplots . The net area for each plot was 20m^2 (4m*5m).The *faba* bean (*Vicia faba,L.*)seeds for inoculated treatments were coated before seedling with *Rhizobium japonicum*. The seeds were sown in hills at space of 20cm between hills and 30cm between ridges and thinned to 2 plants/hill after 15 days . All plots were fertilized uniformly and the agricultural practices were done according to the prevailing methods in the area . For evaluating nodulation , 10plants/plot were carefully uprooted 7 weeks after planting , washed with water and nodules were separated and dried in an oven at 65C° for 24 hrs.

At harvest , the dried plants materials were measured and the number was counted as nodules 10plant^{-1}. The seed yield (ton Fed^{-1}) ,number of pods plant^{-1}, number of seeds pod^{-1} and straw yield Fed^{-1} (ton) were determined by hand harvest of one m^2 quadrate from each plot. The plant height was measured and the number of branches and leaves per plant were recorded at fruiting stage. The uprooted plant was taken and cleaned by means of water and piece of fine cloth. The samples were dried at 65 C° in an oven for 24 hrs, and kept tightly in small paper bags for analysis . The contents of N, P and K% in plant samples were determined according to Chapman and Pratt (1961). The amount of available Fe, Mn and Zn were determined after DTPA extraction using atomic absorption spectrophotometer according to Page et.al., (1982) .

The obtained data were statistically analyzed according to Steel and Torrie (1982).

RESULTS AND DISCUSSION

Table (3) showed that inoculated faba bean treated with application rates of compost (0, 6, 12 and 18 m^3 fed^{-1}) together with different rates of elemental sulphur (0, 50 and 100 kg Fed^{-1}) formed nodules . This may support the use *R. japonicum* (CIAT 899) for successful nodulation and increasing numbers and weights of nodules in faba bean plants. The

response of faba bean to nodulation under compost and S° rates application were increased by increasing compost and S° rates addition. The increase was highly significant for treatments C_3 (12) and C_4 (18) . The treatment with 12 m^3 compost and 100 kg S° per Fed^{-1} produced higher number and dry weight of nodules per 10 plants compared with other treatments (132.32 nodules and 9.95 g /10 $plants^{-1}$). Generally, it remains worthy to note that , under the conditions of the experiment, the application of higher rates of compost ($18m^3Fed^{-1}$) did not increase nodulation compared to $12m^3$ fed^{-1}. Complicating data on the influence of organic fertilization and S° addition on nodulation of many leguminous plants had been reported (Abo Shakra and Bassiri, 1972, Williamson and Diatollf, 1975, Mohamed et.al., 2001 ,Abdel Ghaffar et.al. , 1981 and Abbas et.al., 2006).

Table (3) : Effect of compost (C) , elemental sluphur (S^0) application and inoculation and noinoculation of seeds on the number and dry weight of nodules (g) per 10 plants (after 90 days) of faba bean plants under field condition (2007/2008)

The treatments		No. of nodules per 10 plants	Dry weight of per 10 plants	No. of nodules per 10 plants	Dry weight. g/10 plants
Compost (m^3 fed^{-1})	Elemental sulphur, kg fed^{-1}	Inoculation (I)		Noninoculation (Non)	
	S1 = 5	40.45	5.63	25.00	3.10
C1= 0	S2= 5 0	45.42	6.75	30.00	3.25
	S3 = 100	49.32	6.95	33.00	3.90
	S1 = 0	65.22	7.25	45.00	4.25
C2= 6	S2 = 50	74.15	7.35	56.00	4.55
	S3 = 100	79.10	7.90	59.00	4.75
	S1 = 0	95.15	8.75	64.00	4.75
C3= 12	S2 = 50	132.35	9.25	69.00	4.80
	S3 = 100	132.92	9.95	74.00	4.85
	S1 = 0	97.00	8.76	63.00	4.78
C4= 18	S2 = 50	131.55	9.29	72.00	4.84
	S3 = 100	132.11	9.50	74.00	4.88
L . S . D	(0.05)	1.43	1.40	1.10	N . S.

Table (4) showed that there were significant differences for all studied treatments , between inoculation and noninocualtion for plants height, number of branches and leaves per plant , straw yield (ton fed^{-1}.), seeds yield (ton fed^{-1}.), number of pods and seeds per plant . These gave similar trend under the effect of compost (C) and elemental sulphur (S°) application at the different rates , on faba bean plants in sandy soil. It is clear that the highest values of plant height were found with C_4S_3, C_3S_3,C_4S_2 and C_3s_2 which were 92.15, 91.90, 90.15 and 88.75 cm, respectively for inoculated seeds and C_3S_3, C_4S_3, C_4S_2 and C_3S_2 which were 67.10,66.95,66.50 and 66.25 cm respectively , for noinoculated seeds . However the highest values were found with C_4S_3 and C_3S_3 which had the same value approximately (92.00cm) for inoculated seeds, also it was with C_3S_2 and C_4S_3 (67.00cm) for noninoculated seeds.

Table (4) : Effect of compost and elemental sluphur (S°) application of different rates and inoculation and noninoculation seeds by *R. Japonicum* on yield, and yield components of faba bean plants grown under field condition (2007/2008)

The treatments		Plant height, (cm)	No.of branches per plant	No .of leaves per plant	Straw , yield (ton/fed)	Plant height, (cm)	No.of branches per plant	No .of leaves per plant	Straw yield ton fed $^{-1}$
Compost m^3 /fed	S° kg /fed	Inoculation (I)				Noninoculation (Non)			
	S1 = 5	62.75	2.35	21.32	2.01	40.10	2.10	19.65	2.00
C1= 0	S2= 5 0	65.25	3.55	22.23	2.02	41.15	2.75	19.96	2.01
	S3 = 100	64.50	3.70	22.25	2.07	42.00	2.90	19 23	2.01
	S1 = 0	71.35	3.70	28.22	2.10	46.25	3.15	20.25	2.01
C2= 6	S2 = 50	75.70	3.85	29.25	2.12	50.75	3.25	21.85	2.02
	S3 = 100	77.75	4.25	30.45	2.13	55.15	4 10	22 95	2.05
	S1 = 0	86.15	5.75	30.93	3.43	65 10	4.55	25 61	2.20
C3= 12	S2 = 50	88.75	6.95	43.57	3.78	66.25	5.78	37.78	2 75
	S3 = 100	91.90	6.96	36.43	3.92	69.10	4.59	28.92	2.95
	S1 = 0	86.10	6.15	31.21	4.22	66.25	4.65	26.15	2.75
C4= 18	S2 = 50	90.13	6.85	35.52	4.61	66 50	6.75	28.12	3.20
	S3 = 100	92.15	6.95	36.51	5.10	66.95	5.92	29.08	3.45
L . S D (0.05)		0.71	0.07	0.15	0.24	0.36	0.02	0.12	0.21

Table (4) : continued

The treatments		Seeds yield, ton fed^{-1}	No.of pods / plant	No of seeds / pods	Seeds yield, ton / fed	No.of pods / plant	No of seeds pods
Compost m^3 /fed	S° kg /fed	Inoculation (I)			Noninoculation (Non)		
	S1 = 5	0.475	12.15	2.03	0.402	8.22	1 62
C1= 0	S2= 5 0	0.485	13.22	3.12	0.415	8 62	1.65
	S3 = 100	0.530	13.67	3.25	0.420	8.78	1.93
	S1 = 0	0.530	13.82	3.75	0.413	9.92	1.98
C2= 6	S2 = 50	0.744	14.42	4.15	0.535	10.88	1.99
	S3 = 100	0.788	15.22	4.25	0.572	10.93	2 01
	S1 = 0	1.500	19.85	5.02	0.822	12.21	2.70
C3= 12	S2 = 50	1.580	20.70	2.82	0.925	13.42	2.85
	S3 = 100	1.640	21.70	5 98	0.952	14 70	2 90
	S1 = 0	1.520	20.12	5.05	0.820	14.15	2.72
C4= 18	S2 = 50	1.600	20.75	5.82	0.930	14.15	2.88
	S3 = 100	1.630	21.50	5.93	0.950	14.72	2.95
L . S D (0.05)		0.044	0.36	0.06	0.025	0.24	0.04

Table (4) revealed that compost and S° caused significant increases in the values of branches/plant for inoculated seeds. The highest values were with C_3S_2 and C_4S_3 which have the same value (6.95),also for noninoculated seeds, and with C_4S_3,C_3S_2 and C_4S_2 which had the same value (5.8) approximately. For leaves number plant^{-1} the values showed a parallel trend as branches number/plant values. The highest mean values were found with C_4S_2 and C_3S_2 which had the same value (63.47) for inoculated seeds , whereas for noninoculated seeds , the highest value was 29.00 leaves plant^{-1} approximately. The highest values of straw yield were recorded for C_4S_3 and C_4S_2 and were 5.15 and 4.61 ton fed^{-1} . , respectively , for inoculated seeds and 3.45 and 3.20 ton fed^{-1}. for noninoculated seeds .

Results showed that increasing compost and S° application caused significant increase in the mean values of seed yield (Table 4) . The highest values were recorded for C_3S_3 and C_4S_3 which were 1.64 and 1.63 ton fed^{-1}., respectively , for inoculated seeds and 0.952and0.950 ton fed^{-1}. for noninoculated seeds .Also ,the results showed that the highest mean values of pods number plant^{-1} and seeds number/pods were found for C_3S_3 and C_4S_3 which were 21.70 and 21.50 pods plant^{-1} for inoculated seeds and 14.70 and 14.72 pods/plant for noninoculated seeds .On the other hand ,seeds number/pods increased by increasing C and S application rates without significant differences between the two treatments C_3 and C_4 with S_3 .The highest values were 5.98and5.93 seeds /pod and 2.90and2.95 seeds/pod for inoculated and noninoculated seeds, respectively. Similar results and close were obtained by Selim and El-Seessy(1991), Radwan et.al., (1997), Rehab(1999) and Radwan et.al.,(2005) on faba bean and Hassouna and Abou El-Naser(1992)on soybean . Table (4)showed that addition of 12 or 18m^3 compost/fed. with 100KgS/fed.was significantly superior to 6 or0 m3 compost(control) in increasing seed yield/fed., pods number/plant ,seed number/pod and straw yield/fed. These results may be attributed to nitrogen fixation by Bacterial nodules which was translocated from roots to the other plants parts giving increased the straw and seeds yield of faba bean [Stewart (1967) , Mabrouk (2002) and Salib(2002)].

The macronutrients (N , P and K) contents of plant parts showed that compost applied at 12 or 18m^3/fed.and S at 100Kg/fed. produced higher contents of N,PandK in seeds and straw than the other treatments without significant differences in both inoculated and noninoculated seeds treatments (Table 5) . In the case of N content of faba bean straw ,12 and 18m^3 compost/fed. were of significant effect over compost which was significantly higher than significantly the control (untreated).

The S application also had significant effect on increasing the content N,PandK in seeds and straw over the control by using rate of 100Kg S/fed. Thus , Table (5)showed that the differences between treatments are significant in N , P and K percentage is both inoculated or noninoculated seeds.

Table (5) : Effect of compost (c) and elemental sulphur (s0) application of diggerent rates and inoculation and Inoculation and noninoculation seeds *R . Japonicu*,on NPK contents (%) of seeds and straw of faba bean plants under field condition (2007/2008)

The treatments		N,%		P, %		K, %		N,%		P,%		K, %	
		seeds	straw	seeds	straw	seeds	straw	seeds	straw	seeds	straw	seeds	straw
		Inoculation (I)						Noninoculation (Non)					
Compost m^3 fed^{-1}	Elemental sulphur (S^5) kg fed												
C1= 0	S1 = 5	1.42	1.02	0.096	0.099	1.220	0.40	1.09	0.69	0.090	0.096	1.19	0.35
	S2= 50	1.45	1.10	0.096	0.099	1.280	0.40	1.11	0.95	0.090	0.097	1.22	0.35
	S3=100	1.46	1.15	0.115	0.112	1.34	0.41	1.20	0.96	0.112	0.110	1.22	0.36
C2= 6	S1 = 0	1.49	1.16	0.126	0.122	1.28	0.40	1.32	1.02	0.112	0.110	1.22	0.36
	S2 =50	1.51	1.20	0.142	0.152	1.30	0.55	1.39	1.11	0.115	0.123	1.28	0.50
	S3=100	1.57	1.29	0.152	0.155	1.32	0.62	1.42	1.15	0.122	0.125	1.28	0.55
C3= 12	S1 = 0	2.00	1.45	0.170	0.220	1.50	0.81	1.39	1.12	0.122	0.155	1.28	0.72
	S2 =50	2.38	1.53	0.217	0.200	1.75	0.86	1.53	1.19	0.135	0.83	1.30	0.92
	S3=100	2.63	1.63	0.221	0.220	1.82	0.88	1.63	1.29	0.163	0.193	1.35	0.95
C4= 18	S1 = 0	2.03	1.46	0.215	0.215	1.52	0.79	1.40	1.11	0.122	0.152	1.30	0.70
	S2 =50	2.39	1.53	0.217	0.217	1.82	0.87	1.50	1.20	0.143	0.180	1.32	0.91
	S3=100	2.60	1.62	0.220	0.200	1.80	0.86	1.61	1.30	0.162	0.195	1.34	0.95
L . S . D	(0.05)	0.038	0.033	0.018	0.019	0.025	0.01	0.025	0.022	0.013	0.015	0.020	0.010

Inoculated seeds of C_3S_3 treatment gave the highest values, calculated as an average of N%, P% and K% which were 2.63%, 0.22% and 1.82% in seed, respectively. The highest , values in straw for N%, P and K% were 1.63%, 0.22%, and 0.88% respectively.The highest values of N%, P% and K% increase of nonioculated seeds were recorded C_3S_3, which were 1.63%, 0.163% and 1.35% in seeds, respectively , and for C_4S_3 which were 1.3%, 0.195% and 0.95% in straw , respectively . The highest values in N%, P% and K% were obtained for $12m^3$ compost and 100kgS/fed (C_3S_3) for seeds and straw .Similar and close results were observed by Tiflen(1972), Mohamed et. al., (2001) and Salib (2002).

Table (6) : Effect of compost and elemental sluphur (S^0) application of different rates and inoculation and noninoculation seeds by *R. Japonicum* on NPK uptake (mg/plant) of faba bean plants grown under field condition (2007/2008)

The treatments		N	P	K	N	P	K
Compost, m^3 /fed	S^0 kg /fed	Inoculation (I)			Noninoculation (Non)		
C1= 0	S1 = 5	1.46	0.112	1.100	1.150	0.106	0.880
	S2= 5 0	1.56	0.115	1.170	1.220	0.111	0.870
	S3 = 100	1.47	0.134	1.200	1.250	0.118	0.880
C2= 6	S1 = 0	1.81	0.130	1.200	1.930	0.124	0.860
	S2 = 50	1.90	1.143	1.250	1.930	0.125	0.880
	S3 = 100	1.99	1.149	1.270	1.970	0.125	0.880
C3= 12	S1 = 0	2.50	0.155	1.390	2.180	0.142	0.920
	S2 = 50	2.78	0.183	1.390	2.310	0.149	0.950
	S3 = 100	3.35	0.210	1.450	2.400	0.150	0.950
C4= 18	S1 = 0	2.43	0.150	1.400	2.170	0.150	0.930
	S2 = 50	2.76	0.185	1.380	2.200	0.150	0.963
	S3 = 100	3.30	0.215	1.445	2.470	0.155	0.970
L . S D (0.05)		0.06	0.004	0.060	0.050	0.003	0.040

Table (6) showed that the differences between treatments were significant in N, P and K uptake by faba bean plants, in both inoculated and noninoculated seeds. For N uptake C_3S_3 treatment gave the highest values , calculated as an average of uptake of mg $plant^{-1}$ (3.35), while for P uptake was achieved from C_4S_3 treatment (0.215mg/plant), and the treatment C_3S_3 give the highest value for K uptake (1.450mg/plant). This may be attributed to bacterial fixation of nitrogen which play the main role of plant growth between all nutrients. In the case of noninoculated seeds, the highest values of N, P and K uptake were found for C_4S_3 treatment which were 2.47, 0.155 and 0.970 mg/plant , respectively, (Maharam et.al.,1999, Abd Allah, 2001 and Mohamed et.al.,2001).

Table (7) : Effect of compost (c) and elemental sulphur (S^5) application of different rates and inoculation and noninoculation seeds *R. Japonicum* on micro- nutrients contents (mg/ plant) of seeds and straw of faba bean plants under field condition (2007/2008).

Compost m^3 fed^{-1}	Elemental sulphur (S^5) kg fed^{-1}	Iron		Manganese		Zinc		Iron		Manganese		Zinc	
	Treatments	Inoculation (I)						Noninoculation (Non)					
		seeds	straw	seeds	straw	seeds	straw	seeds	straw	seeds	straw	seeds	straw
C1= 0	S1 = 5	44.96	195.85	3.41	6.52	7.35	8.57	55.41	145.21	3.32	6.55	6.87	6.61
	S2= 5 0	49.82	185.31	3.82	7.70	7.56	8.32	58.72	155.32	3.30	7.11	7.45	6.21
	S3 = 100	57.77	195.36	4.35	6.95	7.57	7.69	65.82	161.42	3.30	6.93	8.75	6.99
C2= 6	S1 = 0	50.48	197.42	4.22	6.15	9.12	7.02	60.35	170.35	3.50	6.12	7.50	7.01
	S2 = 50	54.28	198.19	4.75	7.56	9.49	7.12	63.42	183.45	3.45	6.55	7.42	7.21
	S3 = 100	59.33	189.20	4.69	6.22	9.75	7.08	69.75	185.22	3.25	6.22	8.95	7.05
C3= 12	S1 = 0	57.65	173.75	4.81	6.59	11.40	6.45	67.56	165.92	3.22	5.62	8.72	5.43
	S2 = 50	63.15	173.25	5.22	6.35	12.15	7.10	70.15	176.21	3.25	6.01	9.01	5.11
	S3 = 100	69.78	189.53	5.45	6.75	12.69	7.22	71.82	176.13	3.22	5.89	9.11	6.02
C4= 18	S1 = 0	58.11	175.25	4.85	5.15	11.50	6.55	68.23	158.15	3.50	6.21	8.75	5.45
	S2 = 50	63.52	163.11	5.35	5.27	12.22	6.13	71.25	176.34	3.51	6.31	8.85	5.15
	S3 = 100	68.91	170.25	5.49	5.88	12.49	6.35	71.95	176.22	3.45	6.41	8.15	6.05
L. S. D	(0.05)	5.06	16.36	0.35	0.50	0.22	0.16	N.S	N.S	N.S	NS	N.S	N.S

With respect to micronutrients uptake, Table (7) presents the faba been Fe, Mn and Zn contents of seeds and straw . In case of inoculated seeds, the added 18 m^3 compost/fed. increased Zn content of seed significantly over control and 6m^3 compost application treatment, but insignificantly compared to 12 m^3 compost whereas straw content of Fe and Zn decreased significantly compared to the control. The same trend was found in the case of Mn in straw. This may be due to better translocation of the elements from vegetative parts to fruits in treated (healthy) plants compared to the control (Tiflon,1972 and Salib,2002). Regarding S° application, the rates of 50 kg S° did not improve significantly Fe and Mn contents of faba seeds as compared to the control. The rate of 100 kg S° caused significant increase over control both (O) and 50 kg S°/fed. application treatments at 50 or 100 kg S° increased Fe content of straw. While Mn content increased insignificantly in straw.

The previous results clarifies that the studied sandy soil was poor in its organic matter and nutreint supply contents. The treatment of $12m^3$ compost and 100kg S / fed . (C_3S_3) with seeds treated with *R. Japonicum* inoculants significant effect on increasing faba bean yield , yield components and mineral composition due to considerable improvement in soil condition . It may be useful to mention that commercial recommendation for faba bean production may be sometimes of less sufficiency to plant requirement .

REFERENCES

Abbas, H.H.,E.H. A. Noufal, I.M. Farid and I.M.F. Ali (2006) Organic manuring and bio fertilization approaches as potential economic and safe substitutes for mineral nitrogenous fertilization .Egypt .J. Soil Sci.46,:219-235.

Abd Allah,G.A (2001) Effect of Heavy Nitrogen application on yield and chemical composition of some vegetable crops . Ph.D.Thesis. Fac.Agric. Mansoura Univ.,Egypt.

Abdel-Ghaffar,S.A.(1980) Soil moisture and its effect on biological nitrogen fixation. Ph .D . Thesis Fac . of Agric. Tanta Univ. Egypt.

Abdel-Ghaffar ,S.A.,M.N. Alaa El.Din, F.M.Hammouda and M.Fawaz Kreaman (1981) Symbiotic nitrogen fixation by desert legumes indigenous to Egypt.8-th North Americon Rhizobium Conferance,Winnipeg,Canada ,August 2-7.

Abo-Shakra,S. and A.Bassiri.(1972) Effect of inoculation and fertilization on nodulation, seed yield and quality of some legumes (soybeans).J.Agric. Sci.,28 (2)179- 190 .

Black,C.A.(1965) Methods of Soil Analysis.Part2,Am .Soc.of Agron.INC. Publ. Madision , Wisconsin,USA.

Bertran and Andreas ,M.(1994). " Methods Book for the Analysis of Compost" Publisher Federal Compost Quality Assuron Organization(FCQAO).

Chapman,H.D.and Pratt.P.F. (1961)"Methods of Analysis for Soil, plant and water" Division of Agricultural Sci., California Univ., Berkely. USA.

El-Kouny,H.M.(1999) Evaluation of compost production and its properties with special references to compost extract. Ph.D. Thesis Fac. Agric . , Alex . , Alex .Univ .,Egypt.

EL-Fayoumy,M.F.,H.M. Ramadan and E.A. Koreish(1996) Soybean biomass,N2-Fixation and water use efficiency as affected by

frequency of irrigation ,soil. Salinity and inoculation with Bradyrhizobuim. Alex .J. Agric . Res.41(1):313-326.

Hamdi ,Y.A.(1976) Field and green house experiments on the response of legumes in Egypt to inoculation and fertilizers in symbiotic nitrogen fixation in plants ".P.S Nutman(ed.).University press, pp.289-298.

Hassouna , M .G .and Abou EL-Nasr ,A. (1992) Application of growth promoting Rhizobacteria and vesicular mycorrhiza on soybean (Glycine max) on the poor land of N.W. Egypt. Comin . In Sci and develop. Res .39:47-61.

Koresish, E . A., Ramadan , H . M. ,EL - Fayoumy ,M .F. and Gaber , H . M . (2001) Response of *faba* bean and wheat to bio – and mineral fertilization in newly – reclaimed soils. J. Adv . Agric . Res . 6: 903-924.

Mabrouk ,S.S.(2002) Response of some peanut cultivars to bio- and organic-chemical fertilization. Zagazig J. Agric.Res.29:2071-2083.

Moharam ,T .,M .A .Mohande and M.B .Badwi(1999) Effect of inoculation and organic manure application on symbiotic N-fixation ,microbial biomass and nutrients availability in sandy soil cultivated with soybean , peanut and faba bean. Annals of Agric. Sci., Ain Shams Univ., Cairo44:27-40.

Mohamed,M.R.A.,H.Z.Abd El-Salam and M.A.EL-Saei (2001) Effect of Biofertilizer and micronutrients on growth ,yield and chemical composition of some broad bean varieties (*Vicia faba*)in salt affected soil .J .Agric . Sci .Mansoura Univ. , 26: 1169 - 1176.

Muthur , S . P., G. Dinel , M. Schnitzer and I.Duugan (1993).Determination of Compost bio-maturity . Qptical density of water extracts of compost as a reflection of their maturity . Biological Agric. and Horti. 10:87-108.

Page, A . L., Miller , R .H .and Keeny , D,R. (1982)"Methods of Soil Analysis" part 2 ed . Am . Soc. Agron . Madison ,WI,USA.

Radwan ,F.L.(1997) Effect of VA-mycorrhizal inoculation and weed control methods on growth ,yield and its components of faba bean cultivars .Zagazing , J .Agric. Res.(24): 375-391.

Radwan , F . I .and M . A. , Wafaa ,H . Mohamed(2005) Influence of planting density , Biofertilizers inoculation and super phosphate application to soil on growth and yield components of faba bean plants .J.Adv.agric .Res 10.164 –175.

Rehab,I.F. (1999) Effect of sowing dates and VA – mycorrhizae inculation on growth attributes , yeild and its components of three varieties of *faba* bean (*Vicia* faba,L.).Adv . Agric . Res. V (4) N (3): 963-981

Saddik,Wafaa,M.A. and Laila,K.M.(2004) Effect of some natural soil amendments on some soil physical properties, peanut and carrot yield in a sandy soil .Egypt J.Agric.Res.82: 95-105.

Salib , M . M (2002) The integrated effect of humic acid and micronutrients in combination with effective micro-organisms on wheat and peanut grown on sandy soils . Zagazig . J . Agric . Res . 29 : 2033 – 2050 .

Selim,M.M.and EL-Seesy ,M.A.A(1991) Productitivity of *faba* bean as affected by plant population ,phosphorus fertilization and sowing methods . Egypt J .Agron ..(16):239-251.

Stewart,W.D.P(1967).Nitrogen- fixing plants . Science 158,1426-1432 .

Steel,R.G.D.and Torrie,T.H.(1982)"Principles and Procedures of Statistics, McGraw-Hill International Book company,3rd ed,London .

Tiflen,L.O(1970) translocation of micronutrients in plants .pp.199-299 in Micronutonutrients in Agricultural. Soil Sci.Soc.Amer. IC .Madison.USA.

Williamson ,A.J.P.and A. Dialioilf (1975) Effect supplementary nitrogen fertilizer on nodulation ,yield and seed characteristics of soyabean (Glycine max) on the darling Down .Australain .J.Expt. Agric and Animal Husbandry ,15,76.

الملخص العربي

استجابة محصول الفول البلدي النامي في الارض الرملية للتلقيح ببكتريا *R.Japonicum* والسماد العضوي والكبريت المعدني

حامد مبروك القوني رجب إسماعيل فايد

قسم بحوث الأراضي الملحية والقلوية بالإسكندرية ــ معهد بحوث الأراضي والمياه والبيئة – مركز البحوث الزراعية – ج.م.ع .

تم دراسة تأثير إضافة الكمبوست (٠-٦-١٢-١٨م٣/للفدان) والكبريت المعدني (S°) (٠-٥٠-١٠٠ كجم/فدان) مع أو عدم تلقيح البذور بسلالة من بكتريا *R-Japonicum* علي تكوين العقد الجذرية ومكونات المحصول والتركيب الكيماوي لنباتات الفول البلدي في الأراضي الرملية في منطقة البستان – قرية توفيق الحكيم – محافظة البحيرة . وكان التصميم الإحصائي لهذه التجربة هو القطع المنشقة مرتين

حيث كانت الكمبوست هي القطع الرئيسية والتلقيح أو عدمه هو القطع المنشقة الأولي والكبريت المعدني هو القطعة المنشقة الثانية عام ٢٠٠٧/٢٠٠٨ .

أوضحت النتائج إلى استجابة نباتات الفول البلدي لتكوين العقد الجذرية مع تلقيح الجذور ببكتريا *R-japonicum* مع زيادة إضافة الكمبوست والكبريت المعدني .

و كانت المعاملة C_3S_3 (١٢م٣كمبوست مع ١٠٠كجم S° /فدان) قد أعطت أعلي قيمة لكل من العدد والوزن الجاف للعقد الجذرية لكل ١٠ نباتات في المتوسط ، حيث كانت ١٣٢,٩٥ جم و ٩,٩٢ جم علي التوالي أما في حالة عدم تلقيح البذور للبكتريا السابقة فكانت هذه القيم ٧٤ جم و ٤,٤٨ جم علي التوالي أيضا.

كما أوضحت النتائج أيضا أن القيم المتوسطة لكل من طول النباتات (سم) ، عدد الأفرع لكل نبات ، عدد الأوراق لكل نبات ، محصول القش (طن/فدان) ومحصول البذور (طن/فدان) وعدد القرون لكل نبات وعدد البذور لكل قرن كانت كالتالي ٩٢,١٥ ،٦,٩٥ ، ٣٦,٤٧ ، ٥,١ ، ١,٦٤ ، ٢١,٧٥ ، ٥,٩٨ على التوالي هذا في حالة تلقيح البذور أما في حالة عدم تلقيح البذور فكانت هذه القيم علي التوالي هي ٦٩,١ ، ٥,٨ ، ٢٩ ، ٣,٤٥ ، ٠,٩٥ ، ١٤,٧ ، ٢,٩ علي التوالي وكانت مع معاملات C_3S_3 ، C_3S_2 ، C_4S_2 .

كما أوضحت النتائج أن متوسط القيم الأعلى لمحتوي أجزاء النبات – بذور وقش – من العناصر الأساسية وهي N, P, K كنسبة مئوية (%) عند إضافة كمبوست بمعدل ١٢م٣ وكبريت بمعدل ١٠٠ كجم للفدان حيث كانت ٢,٦٣ ، ٠,٢٢ ، ١,٨٢ علي التوالي بالنسبة للبذور وكانت ١,٦٣ ، ٠,٢٢ ،٠,٨٨ علي التوالي بالنسبة للقش هذا في حالة تلقيح البذور بالبكتريا السابقة الذكر ، أما في حال عدم تلقيح البذور كانت أكبر القيم كالتالي ١,٦٣ ، ٠,١٦٣ ، ١,٣٥ في حالة البذور وكانت ١,٣ ، ٠,١٩٥ ، ٠,٩٥ في حالة القش لكل من النيتروجين والفسفور والبوتاسيوم على التوالي حيث هذه القيم كانت مع معاملات C_4S_3, C_3S_3 علي التوالي .

بخصوص امتصاص العناصر الكبرى النيتروجين والفسفور والبوتاسيوم (مجم/ نبات) بواسطة نباتات الفول كانت القيمة الأعلى هي ٣,٢٥ ، ٠,٢١٥ ، ١,٤٥ علي التوالي هذا في حالة تلقيح البذور، أما في حالة عدم تلقيح البذور فكانت ٢,٤٧ ، ٠,١٥ ، ٠,٩٥ لكل من النيتروجين والفسفور والبوتاسيوم علي التوالي .

أخيرا في حالة العناصر النادرة حديد ــ منجنيز– زنك ، ففي حالة تلقيح البذور فكانت القيم الأعلى للعناصر الثلاثة عند إضافة كمبوست بمعدل ١٨ م٣ مع ١٠٠ كجم كبريت/فدان.

دراسة مورفولوجية لبعض طرز الزعرور البري *Crataegus monogyna* المنتشرة في محافظة اللاذقية من سورية

د. سرحان لايقة [1] د. جرجس مخول[2] م. لينا ريا [3]

1- أستاذ في قسم العلوم الطبيعية- كلية العلوم- جامعة تشرين- اللاذقية- سورية.

2-أستاذ في قسم البساتين- كلية الزراعة- جامعة تشرين- اللاذقية-سورية.

3- طالبة دكتوراه- كلية الزراعة - جامعة تشرين- اللاذقية-سورية.

الملخص

أجريت هذه الدراسة خلال عام 2007 - 2008 على نبات الزعرور *C. monogyna*. استخدمت فيها القياسات الحيوية على (20 صفة لأجزاء النبات من الورقة حتى البذرة) للتمييز بين العينات التي أخذت من عدة مجموعات موزعة على بعض المواقع الطبيعية الموجودة في الساحل السوري (القساطل، السفكون، الحفة، كسب، الحراجية) التابعة لمحافظة اللاذقية. بهدف دراسة أهم الصفات المورفولوجية والفينولوجية لهذا النوع المنتشر في هذه المواقع طبيعياً.

تبين نتيجة تحليل التباين عند المستوى (0.05) أن الفروق بين الصفات الكمية والنوعية المدروسة للأشجار (B10-B11-B12) التابعة لموقع كسب والشجرة (B14) التابعة لموقع الحراجية قد تميزت وتفوقت على باقي الأشجار المدروسة وكان هنالك فروق معنوية واضحة بين هذه الأشجار وكافة الأشجار الأخرى المدروسة في مختلف المواقع.

كلمات مفتاحية: العائلة الوردية - زعرور- زعرور وحيد المدقة - طرز- أفراد - مواقع- القياسات الحيوية.