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INFLUENCE OF FARMYARD MANURE, BIOLOGICAL INOCULATION AND ORGANIC EXTRACT ON PEANUT PRODUCTIVITY UNDER OROANIC CROPPING SYSTEM IN SANDY SOIL.

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ABSTRACT

A field experiment was carried out for two successive summer seasons (2007and 2008) in sandy soil at EL- Ismailia Agriculture Research station El-Ismailia Governorate to study the effect of farmyard manure(FYM) applied with different rates 0,10,20,30 and 40 m^3 fed^{-1} with either inoculation with a mixture of biofertilizer P (*Bacillus megatherium*), K (*Bacillus Circulans*) dissolving bacteria and N_2 –fixer *(Bradyrhizobium*) or non –inoculation. All plots of experiments were foliar treated with different rates (100,200 and 400 L fed^{-1}) of organic extract (rabbit manure).

Results indicated that mean values of peanut yield components increased significantly due to the application of high rate of FYM ; these increases were 81.2%,and 79.7% for seeds and straw, respectively. High rates of organic extract were more effective as compared to lower rate . Moreover, using mixed inoculation treatment, also, affected significantly the peanut yield (seeds and straw) as compared to non -inoculation ones.

In addition, data indicated that FYM applied at a rate of 40m^3 fed^{-1} increased N,P & K uptake by peanut seed and straw as compared to control treatment. Similar trend was obtained when soil inoculated with (a mixture of P, K dissolving bacteria and N_2-fixer)as compared to non-inoculation. Results also revealed that high rate of organic extract was more effective for N,P&K uptake as compared to the other applied rates.

The interaction between tested treatments showed that the highest peanut seed yield and N , P&K uptake were accompanied with 40 m^3 fed^{-1} FYM application, inoculation with (mixing of P, K dissolving bacteria and N_2-fixer) combined with foliar application with high rates of organic extract(400 L fed^{-1}).

On the other hand, mean values of some chemical properties of the tested soil (pH, EC, OM% and available macronutrients (N, P&K) revealed that values of pH decreased due to the applied treatments. The recorded values showed that the use of 40 m^3 fed^{-1} FYM, inoculation and foliar application with organic extract (400 L fed^{-1}) caused decreases in pH values as compared to the other treated treatments.

An opposite trend was encountered with mean values of EC, percentages of OM and available N, P& K in soil, which had increased due to applied treatments.

These parameters had more affected as a result of the application of high rate of both FYM and organic extract; bacterial inoculation also being more favorable as compared to non- inoculation.

Keywords: Farmyard manure (cattle), organic extract (rabbit), biofertilizer, peanut yield, NPK uptake, chemical properties of soil.

INTRODUCTION

In Egypt, the total area cultivated with peanut is about 135569 Fadden's, the most suitable area for peanut production are located at Eastern Delta (Ismailia and Sharkia Governorates) *Omar (1988)*. Most of these areas could be classified as newly reclaimed sandy soil. These areas are poor in nutrient elements and organic matter (often less than 1%). So, the organic

manure requisite to improve the physical, chemical and biological properties of the soil. Also, it is important to reduce soil pH and increase availability of nutrient elements requested to plant growth entails plentiful yield (Goyal and Singh, 1989 and NFDC, 1999).

On the other hand, organic agriculture aims to protect balance, reduce out farm inputs and to produce high quality, quantities and healthy food. Also, the application of organic fertilizer such as cattle manure, chicken manure and compost in sandy soils improve the soil structure, this support root development leading to higher yield and better quality. Moreover, organic matter plays an important role in the chemical behaviors of several metals in soil throughout its active groups (fluvic and humic acids), which have the ability to retain the metals in complex and chelate forms (Gregorich *et al.*, 1993).

Many reports have also revealed various aspects of biology of soils amended with organic matters, including the number of general microorganisms (Nishio and Kusano, 1980), biomass of bacteria and fungi *(Sakamoto* and Oba, 1992; Lundquist *et al.*, 1999). A further explanation is that the FYM stimulates the synthesis of soil microbial biomass and labile microbial metabolites.

In addition, Abou Bakr and Omar (1996) found that the effect of applying fertilizer organic form as cattle manure fertilizer individually or in combination with inorganic ones resulted in increasing soil organic carbon, total nitrogen and organic matter content. Except, soil pH which was slightly decreased.

Also, inoculation the seeds of different crops, before sowing, with one or two from different bacteria strains, which can fix - N or dissolve soil- P or soil- K (Bio-fertilization), in combination with organic manure leads to reducing the amounts of chemical fertilizers required for crops. Thus, many risks raised from the luxury uses of chemical fertilizers can be avoided. Moreover, safety, healthy, good quality and greatly yield can be achieved (Khalil, 2005).

Concerning the effect of inoculation with phosphate and potassium solubilizing bacteria on plant growth (Heggo and Barakah, 1993 and Seddik, 2006) found that maize and peanut inoculated with phosphate and potassium dissolving bacteria increased plant growth, N,P and K contents .

El-Ghandour *et al.* (1997) showed that number and weight of nodules were increased over the control as a result of inoculation with *Rhizobium.* Ghosh and Poi (1998) studied the response of *Rhizobium*, phosphate solubilizing bacteria on some legume crops. They found that, nodulation, plant growth, P uptake and population of microorganisms in the rhizosphere were highest in combined inoculation treatments with all microorganisms.

The effect of inoculation with *Bacillus megatherium var. phosphaticum* and root nodules bacteria on rhizosphere microflora as will as yield of soybean and peanut grown in either sterile or non- sterile soils was tested by (Abd El-allah *et al.*, 1984). They found that the tested microorganisms resulted in the highest increase of phosphorus uptake, seed yield and nitrogen content of both plants.

Single or mixing inoculation with N_2-fixers, potassium and phosphate dissolving bacteria increased NPK-uptake by peanut and wheat plants in sandy soil, while dependent of peanut and wheat plants on mineral fertilizers decreased N_2-fixation, potassium and phosphate dissolving bacteria compared with the inoculated treatments (Khalil, 2005).

On the other hand, many reports have also revealed that certain liquid extraction of manures or composts can supply plant with at least four major benefits: a source of inorganic nutrients and beneficial organic compounds (Hadas and Rosenberg, 1992); an ability to suppress certain plant disease (Brinton *et al.*, 1996 and Zhang *et al.*, 1998); as a way to build soil structure when applied a drench and optimizes the soil pH (Ingham, 2000).

The present work aims to study the effect of different rates of organic manure (cattle manure), inoculation with different sources of microorganisms and different rates of organic extract (rabbit manure) on yield components of peanut crop as well as the reflection of these applications on nutrients status in the tested plants and some chemical properties of the studied soil.

MATERIALS AND METHODS

A field experiment was carried out in a sandy soil at Ismailia Agric. Res. Station (ARC) El-Ismailia Governorate for two consecutive summer seasons (2007&2008) to study the effect of using different rates of farmyard manure (FYM) with or without inoculation with a mixture of P&K dissolving bacteria and N fixer on improving soil N, P&K availability and peanut (Giza, 5) productivity under drip irrigation system.

Farmyard manure (cattle manure) was applied in five rates (0,10,20,30 and 40 m^3 fed^{-1}) .Table (1) indicates the soil analysis of the experimental soil, while farmyard manure constituents analysis is described in Table (2,a).

The experiments were laid out in spilt –split plot design with three replications for each experiment unit .The main treatments were inoculation with a mixture of P and K dissolving bacteria along with N_2-fixing bacteria as compared to non inoculation .These inoculation treatments were achieved by mixing of *B. megatherium* , *B. circulans* and *Bradyrhizobium* .

Table (1): Some physical and chemical properties of the experimental soil

Soil characteristics			
Particle size distribution		**Cations and anions in sat. extract (meq/L)**	
Sand	89.9		
Silt	5.30	Ca^{++}	0.80
Clay	4.80	Mg^{++}	0.80
Texture class	Sandy	Na^{+}	1.60
$CaCO_3$	1.12	K^{+}	0.25
OM%	0.27	CO_3^{--}	-
CEC meq 100^{-1}g	3.67	HCO_3^{-}	1.50
pH(1:2.5 soil suspension)	7.86	CL^{-}	1.35
EC dS/m (1:5 extract)	0.35	SO_4^{--}	0.60
Available macronutrients (ppm)			
N	**P**	**K**	
14.28	3.38	62.8	

Table (2,a): Main characteristics of the farmyard manure (FYM) used in the experiment

OM %	OC %	pH (1:10)	EC dS m^{-1}	Available macronutrients (%)		
				N	P	K
29.6	17.2	7.87	3.25	1.10	0.12	0.481

Table (2,b): Chemical analysis of the organic extract (rabbit manure) used in the experiment

OM %	pH (1:10)	EC dS m^{-1}	Available macronutrients (%)		
			N	P	K
32.34	8.01	4.50	2.70	0.134	0.90

The sub-main treatments were FYM applied at five rates (0 10, 20,30 and 40 m^3 fed^{-1}) ,each treatment was spread over plots and thoroughly incorporated into the surface soil layer,2 weeks before planting. In each plot, diluted organic extract rabbit manure (1:10) was sprayed at three levels (100,200 and 400L fed^{-1}), which were added every week (Table 2, b) .The recommended practices of cultivation were applied till crop maturity.

After peanut maturity, peanut were harvested and yield components (seeds and straw) of each plot were recorded.

Plant samples of peanut were collected from bulk plot, weighed, oven dried at 70 ^oC, ground and prepared for digestion using H_2SO_4 and H_2O_2 as described by page *et al.* (1982). The digests were then subjected to measurement for macronutrients (N, P and K) using the procedure described by Ryan *et al.* (1996).

Surface soil samples (0-30 cm) layer were collected from each plot after harvesting, and subjected to determine some chemical properties such as pH, EC and O.M. % as well as available macronutrients N, P and K according to Page *et al.* (1982).

All data were subjected to statistical analysis of variance and treatment mean were compared according to the Least Significant Differences (L. S. D.) test method as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Peanut seed and straw yields.

Data presented in Table (3) reveal that mean values of peanut seed and straw yields increased significantly due to tested FYM, inoculation and foliar spray to with organic extract.

With respect to FYM application, data also reveal that yield of peanut (seeds& straw) increased significantly by the use of FYM. High rate of FYM (40 m^3 fed^{-1}) was superior as compared to other rates and/or control treatment. These results may be attributed the increase of organic matter decomposition by time, which leads to the release of many nutrients, as well as it plays an important role in the behaviors of several metals in soil throughout its active groups (fulvic and humic acids).These active groups have the ability to retain the metals in complex and cheated forms (Gregorich *et al.,*1993 and Abou Bakr and Omer, 1996).

Table (3): Effect of FYM (m^3 fed^{-1}) addition , inoculation and organic extract (L fed^{-1}) on peanut seed and straw yields (Kg fed^{-1}) grown in sandy soil (data are a mean of two seasons)

Rate of FYM m^3 fed^{-1}	Seeds yield (kg fed^{-1})			Mean	Straw yield (kg fed^{-1})			Mean
	Organic extract				Organic extract			
	C1	C2	C3		C1	C2	C3	
	Inoculated							
0	150	175	211	179	515	625	657	599
10	340	565	855	586	1744	1866	2189	1933
20	728	834	951	837	2578	2678	2744	2666
30	864	890	1120	958	2889	2944	3033	2955
40	1120	1298	1387	1268	3389	3489	3561	3296
Mean	640	812	905		2223	2320	2436	
	Non- inoculated							
0	112	125	155	131	420	436	500	452
10	262	489	719	490	1533	2011	1978	1840
20	492	685	759	645	2011	2133	2307	2150
30	667	718	982	789	2274	2388	2478	2380
40	893	977	1154	1008	3122	2889	3244	3085
Mean	485	599	754		1872	1971	2101	

L.S.D. at 5% for seeds				L.S.D. at 5% for straw			
A (Inoculation)=	4.11	(AB)=	8.81	A(Inoculation)=	202	(AB)=	172
B (FYM rate)=	6.23	(AC)=	7.94	B (FYM rate)=	121	(AC)=	138
C (organic extract)=	5.61	(BC)=	11.2	C(organic extract)=	98.0	(BC)=	196
(ABC)=	15.8			(ABC)=	277		

Also, high increment of peanut yield was observed due to inoculation with biofertilizer (P& K dissolving bacteria and N_2-fixer) rather than without inoculation, (Table,4).Inoculation with biofertilizer caused increases in peanut yield components as compared to non- inoculated treatments.

Moreover, mean values show that high rate of organic extract (400 L fed^{-1}, C3) affected positively peanut yields (seeds& straw) as compared to those recorded by low rate(100 L fed^{-1}, C1). This effect of organic extract application was also, clear under inoculation treatments as compared to non-inoculation ones.

From the above mentioned data it can be noted that high significant values of peanut yield (seeds and straw) was obtained when FYM at rate of (40 m^3 fed^{-1}), inoculation with biofertilizer and foliar spray with organic extract (400 L fed^{-1}, C3) were applied. These results are in agreement with those of Heggo and Barakah (1993) and Pondey *et al. (*1998) who found that theaddition of FYM to the soil encourages the growth of microorganisms .So , these microorganisms depend on a supply of decomposable organic matter for their activity (Eletr *et al.,*2005). In addition, Khalil (2005) reported that single or mixing inoculation with N_2-fixers, potassium and phosphate dissolving bacteria increased the response of yield by peanut and wheat crops in sandy soil.

Macronutrients uptake by peanut yield:

Data in Tables (4&5) indicate that N, P& K uptake by peanut yield (seeds and straw) responded positively to the tested treatments (FYM application, inoculation with biofertilizer and foliar spray with organic extract.

Table (4): Effect of FYM rates, inoculation and organic extract on N, P and K uptake by seed yield of peanut plant grown in sandy soil (data are a mean of two seasons)

Rate of FYM m^3 fed^{-1}	N-uptake in seeds (Kg fed^{-1})			Mean	P-uptake in seeds (Kg fed^{-1})			Mean	K-uptake in seeds (Kg fed^{-1})			Mean
	Organic extract				Organic extract				Organic extract			
	C1	C2	C3		C1	C2	C3		C1	C2	C3	
	Inoculated											
0	5.12	8.35	10.33	7.93	1.22	2.33	3.15	2.23	0.58	0.89	1.12	0.86
10	10.89	24.47	27.55	20.97	2.75	3.95	4.19	3.63	1.66	3.22	3.31	2.73
20	22.57	31.35	37.09	30.34	4.15	4.75	4.94	4.61	3.56	4.34	4.75	4.22
30	39.91	42.62	45.18	42.57	5.01	5.80	6.72	5.84	4.92	5.11	5.26	5.10
40	40.00	48.24	53.38	47.21	7.05	8.08	8.49	7.87	6.38	6.49	6.93	6.60
Mean	23.70	31.01	34.71		4.04	4.98	5.50		3.42	4.01	4.27	
	No inoculated											
0	3.12	4.15	7.22	4.83	0.79	1.11	1.35	1.08	0.34	0.55	0.89	0.59
10	7.70	11.59	15.24	11.51	1.41	2.98	3.88	2.76	1.28	2.45	3.60	2.44
20	17.58	21.93	28.39	22.63	3.05	6.65	4.25	4.65	2.31	3.63	3.79	3.24
30	21.49	25.25	31.61	26.12	4.20	6.94	6.08	5.74	3.80	4.09	4.60	4.16
40	28.57	32.56	47.40	36.18	4.91	5.47	8.19	6.19	4.27	4.78	5.23	4.76
Mean	15.69	19.10	25.97		2.87	4.63	4.75		2.40	3.10	3.62	

L.S.D. at 5% for N				L.S.D. at 5% for P				L.S.D. at 5% for K			
A*	=0.246	AB	=0.26	A	=0.045	AB	=0.079	A	=0.032	AB	=0.045
B*	=0.186	AC	=0.27	B	=0.056	AC	=0.069	B	=0.032	AC	=0.045
C*	=0.197	BC	=0.39	C	=0.049	BC	=0.098	C	=0.032	BC	=0.064
ABC	=0.55			ABC	=0.13			ABC	=0.09		

A*=inoculation B*=FYM treatments C*=organic extract

Table (5): Effect of FYM rates ,inoculation and organic extract on N, P and K uptake by straw yield of peanut plant grown in sandy soil (data are a mean of two seasons)

Rate of FYM m^3 fed^{-1}	N-uptake in straw (Kg fed^{-1})			Mean	P-uptake in straw (Kg fed^{-1})			Mean	K-uptake in straw (Kg fed^{-1})			Mean
	Organic extract				Organic extract				Organic extract			
	C1	C2	C3		C1	C2	C3		C1	C2	C3	
	Inoculated											
0	8.23	9.25	15.23	10.90	3.11	4.12	4.55	3.93	8.33	9.56	10.25	9.38
10	14.36	24.30	42.23	26.96	4.86	5.96	7.53	6.12	12.77	15.03	29.98	19.26
20	25.00	45.00	54.50	41.50	7.10	8.83	10.4	8.78	21.65	25.88	34.30	27.28
30	31.96	53.00	57.96	47.64	8.80	10.3	12.4	10.5	27.33	31.22	38.55	32.37
40	59.63	63.96	66.60	63.40	12.2	12.9	14.7	13.7	33.55	41.28	51.47	42.1
Mean	27.84	39.10	47.30		7.21	8.42	9.92		20.73	24.59	32.91	
	Non - inoculated											
0	6.11	7.12	10.25	7.83	2.33	2.39	3.12	2.61	5.22	6.35	7.33	6.30
10	11.76	18.56	31.53	20.62	3.80	4.23	5.30	4.44	10.86	13.14	18.78	14.26
20	20.83	26.03	35.76	27.54	5.86	5.40	7.36	6.20	18.12	21.89	23.76	21.26
30	29.56	38.26	43.00	36.94	6.90	8.50	9.70	8.37	21.28	24.36	26.81	24.15
40	38.56	43.00	57.53	46.36	9.30	10.4	12.6	10.7	24.54	27.69	31.49	27.91
Mean	21.36	26.59	35.61		5.64	6.18	7.62		16.00	18.69	21.63	

L.S.D at 5% for N				L.S.D at 5% for P				L.S.D at 5% for K			
A*	=0.136	AB	=0.205	A	=0.032	AB	=0.032	A	=0.644	AB	=0.489
B*	=0.145	AC	=0.126	B	=0.022	AC	=0.037	B	=0.382	AC	=0.409
C*	=0.089	BC	=0.178	C	=0.026	BC	=0.052	C	=0.289	BC	=0.579
ABC				ABC	=0.07			ABC	=0.81		

A*=inoculation B*=FYM treatments C*=organic extract

With respect to FYM application , data reveal that high rate of FYM (40 m^3 fed^{-1}) led to significantly higher N,P&K uptake as compared to either other rates or control treatment. Also, N, P and K uptake were more pronounced was combined when FYM with biofertilizer (N, K dissolving bacteria and N_2 fixer). Similar trend was observed by Sikander (2001) and El-Komy (2005) who reported that, the use of FYM enhances the metabolic activity within plants and promotes the migration of the metabolites through roots and steams toward leaves that may increase the percentage of nutrients in plant.

On the other hand, inoculation with a mixture of P and K dissolving bacteria and N_2-fixer caused higher N, P and K uptake by peanut yield as compared to non- inoculation. Mean values of inoculation treatments had increased by 31.9, 15.7&21.1% (seeds) and 26.77, 23.9 and 28.0% (straw) for N,P and K uptake, respectively. Obtained results may be due to the inoculation with P&K dissolving bacteria that provided more balanced nutrition for the plant and improvement in N,P and K uptake, which is the major mechanism of microorganisms such as P &K solubilizing bacteria (El-Komy, 2005) and Seddik ,2006). Also exploitation of biologically nitrogen fixation would sustain high yield and save large amounts of N- fertilizers (Tilak *et al.*, 2005).

Moreover, foliar application of organic extract was favored for nutrients uptake by peanut yields; high rate (400 L fed^{-1}) was more beneficial as compared to low rate 100 L fed^{-1}). Hadas and Rosenberg (1992) and Abdel-wahab *et al.*(2007) reported that extraction of manure can supply plants with inorganic nutrients and beneficial organic compounds along with rich in nutrients and microorganisms, which can stimulate plant growth.

Comparing the interaction effect between tested treatments, data reveal that the highest yield of peanut (seeds and straw) was due to the application of FYM at a rate of 40 m^3fed^{-1}, inoculation and foliar spray with organic extract at rate of 400L fed^{-1}.

Response of some soil properties to applied tested treatments.

Data presented in Table (6) show mean values of the studied chemical soil characteristics in response to the tested treatments.

Concerning pH values, results show that application of FYM, generally, decreased pH values as compared to control treatment. The gradual decreases of pH values were related to the increase of FYM rates .This finding is expected due to the organic acids released during FYM decomposition (Gagnon *et al.,* 1998).

Also, mean values of pH reveal that inoculation with biofertilizer and foliar spray of organic extract treatments decreased pH in the tested soil as compared to non-inoculation .High rate organic extract was the favorite in reducing pH values in soil.

The interaction between the tested treatments show that the application of FYM at high rate (40m^3 fed^{-1}) combined with inoculation with a mixture of bacteria and foliar spray with 400 L fed^{-1} reduced significantly the soil pH.

Table (6): Effect of FYM (m^3 fed^{-1}), inoculation and organic extract (L fed^{-1}) on pH, EC (dS m^{-1}) and organic matte r(%) in sandy soil after peanut harvesting peanut(data are a mean of two seasons)

Rate of FYM m^3 fed^{-1}	pH (1:2.5)			Mean	EC (dS/m)1:5			Mean	O.M %			Mean
	Organic extract				Organic extract				Organic extract			
	C1	C2	C3		C1	C2	C3		C1	C2	C3	
Inoculated												
0	8.10	7.98	7.79	7.96	0.35	0.41	0.48	0.41	0.31	0.35	0.37	0.34
10	7.76	7.68	7.59	7.68	0.37	0.43	0.51	0.44	0.42	0.48	0.49	0.46
20	7.65	7.55	7.48	7.56	0.39	0.47	0.53	0.46	0.53	0.56	0.58	0.56
30	7.56	7.48	7.45	7.50	0.42	0.49	0.54	0.48	0.59	0.61	0.68	0.63
40	7.54	7.41	7.25	7.40	0.46	0.51	0.56	0.51	0.62	0.65	0.71	0.66
Mean	7.72	7.62	7.51		0.40	0.46	0.52		0.49	0.53	0.57	
Non- inoculated												
0	8.24	8.10	8.00	8.11	0.37	0.44	0.51	0.44	0.28	0.31	0.34	0.31
10	7.81	7.75	7.64	7.73	0.41	0.46	0.53	0.47	0.41	0.45	0.47	0.44
20	7.76	7.66	7.51	7.64	0.43	0.49	0.55	0.49	0.51	0.53	0.55	0.53
30	7.67	7.59	7.49	7.58	0.45	0.51	0.56	0.51	0.55	0.59	0.62	0.59
40	7.59	7.49	7.39	7.49	0.47	0.55	0.59	0.54	0.58	0.62	0.65	0.61
Mean	7.81	7.72	7.61		0.43	0.49	0.55		0.47	0.50	0.53	

Regarding the EC values and soil organic matter (OM%) in soil after peanut harvesting, data reveal that the application of FYM caused increases of both EC and OM (%); these increases were obvious due to the application of FYM at high rate of ($40m^3$ fed^{-1}). The maximum value of EC and percentage of OM were obtained when FYM added at rate of $40m^3$ fed^{-1} as compared to control treatment. Similar results, also, were recorded at high rate of organic extract (C3, 400L fed^{-1}), which caused significant increases in both EC value and OM percentage. These results may be due to farmyard manure that contains a high salinity levels of 4.5 dSm-1, and its application to soil probably caused the increase of soil salinity values, similar results was obtained by Lithourgidis *et al.* (2007). On the contrary, the use of biofertilizer (inoculation) treatments had slightly decreased EC value and OM percentage as compared to non-inoculation ones.

Finally, the combined effect of the FYM , inoculation and organic extract, Table (6) noted that high rates of both FYM and foliar spray with organic extract caused an increased of EC and organic matter content in sandy soil .These data is also true under non inoculation treatments.

Available N, P and K in the study soil .

The status and availability of the studied nutritional elements (N, P and K) in the tested soil under different treatments are shown in Table (7).

Results indicate that after peanut harvesting, available (N, P and K) in soil were increased in response of different treatments as compared to control treatment.

As far as FYM treatments, results indicated that the application of $40m^3$ fed^{-1} FYM was superior in available (N, P and K) as compared to other treatments and /or control treatment. Similar results are reported by Saber (1997) who found that the major objective of soil conservation is prevention of

(N, P and K) losses, which usually take place during the decomposition of FYM.

Also, inoculation with biofertilizer (P and K dissolving bacteria and N_2 fixer), also caused increases in the availability of N, P and K in soil as compared to non-inoculation. These results may be due to the inoculation with bacteria, which dissolve the insoluble phosphate and potassium minerals in soil by direct enzymatic attack and via formation of organic acids and chelating substances (Bowen and Rovira, 1999, Seddik, 2001 and Laxminarayana and Patiram, 2005).

Table (7): Effect of FYM (m^3 fed^{-1}), inoculation and organic extract (L fed^{-1}) on available nitrogen, phosphorus and potassium (ppm) in sandy soil after harvesting peanut (data are a mean of two seasons)

Rate of FYM m^3 fed^{-1}	Available N (ppm)			Mean	Available P (ppm)			Mean	Available K (ppm)			Mean
	Organic extract				Organic extract				Organic extract			
	C1	C2	C3		C1	C2	C3		C1	C2	C3	
Inoculated												
0	18.22	20.22	22.03	20.16	4.55	5.12	5.55	5.07	76.12	77.15	79.15	77.47
10	29.01	30.11	32.03	30.38	9.12	9.45	11.53	10.03	81.90	113.1	120.9	105.3
20	30.10	32.02	34.41	32.18	11.42	11.99	14.05	12.49	93.60	120.9	123.5	112.67
30	32.42	34.55	36.24	34.40	15.45	17.35	18.36	17.05	101.4	122.3	132.6	118.77
40	35.59	39.01	40.22	38.27	18.32	19.95	22.15	20.14	113.1	135.45	141.9	130.15
Mean	29.07	31.18	32.99		11.77	12.77	14.33		93.22	113.78	119.61	
Non- inoculated												
0	17.22	18.12	20.33	18.56	4.14	4.48	5.01	4.54	67.55	69.55	72.15	69.75
10	26.01	27.21	30.03	27.75	8.12	8.45	10.53	9.03	77.90	80.10	100.9	86.30
20	28.22	31.11	32.31	30.55	10.42	10.99	13.05	11.49	83.60	88.95	113.5	95.35
30	30.32	32.41	33.14	31.96	13.45	14.35	15.36	14.39	99.40	112.3	122.6	111.43
40	32.48	35.41	38.21	35.37	16.32	17.95	19.15	17.81	101.1	125.45	131.9	119.48
Mean	26.85	28.85	30.80		10.49	11.24	12.62		85.91	95.27	108.21	

In addition ,mean values indicated that foliar spray with organic extract was positively affected N, P and K availability in soil ;high rate of organic extract (C3,400 L fed^{-1}) being more efficient as compared to low rate C1,100 L fed^{-1}).

The interaction between different treatments indicated that the application of high rate of FYM (40m^3 fed^{-1}) combined with inoculation with different P and K dissolving bacteria and N_2 fixer along with foliar spray with 400 L fed^{-1} organic extract was superior for soil (N, P and K) availability as compared to other treatments. Similar results were in agreement with of those Mekail (1998) and Badran *et al.* (2000) who dominated that increasing soluble N in sandy soil may be due to the release of N from the supplied organic matter and biological fixation of atmospheric nitrogen and their reflection on soil fertility. Also, Abdel wahab *et al.* (2006) added that foliar application of organic extract has a promotive effect on biological activity in soil either for added or native microorganisms.

Conclusion

From this study it could be concluded that the use of farmyard manure at a high rate of 40 $m^3 fed^{-1}$ for peanut plants accompanied with biofertilizer (P and K dissolving bacteria and N_2-fixer) along with foliar spray with organic extract at a rate of 400L fed^{-1}, caused improving in soil fertility and supply the grown plant with nutrients required for their growth. Further studies should be accomplished to reach the level of recommendation.

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تأثير إضافة السماد البلدى والتلقيح البيولوجى والمستخلص العضوى على انتاجية محصول الفول السودانى تحت نظام الزراعة العضوية فى التربة الرملية

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تم إجراء تجربة حقلية في موسمين صيفيين زراعيين متتالين (٢٠٠٧ - ٢٠٠٨) تحت ظروف التربة الرملية بمحطة البحوث الزراعية بالإسماعيلية لدراسة تأثير اضافه معدلات مختلفة (٠،١٠،٢٠،٣٠،٤٠) م^{٣} / فدان من السماد البلدي ومع اضافة السماد الحيوى والذى يشمل البكتريا المذيبة للفوسفور (*Bacillus megatherium*) والبكتريا المذيبة للبوتاسيوم (*Bacillus circulans*) وكذلك مثبتة للنيتروجين (*Brayrhizobium*) بالمقارنة بعدم التلقيح وكذلك تم رش التجربة بمعدلات مختلفة (١٠٠،٢٠٠،٤٠٠) لترفدان$^{-١}$ من مستخلص عضوي (سماد الأرانب).

أكدت النتائج أن القيم المتوسطة لمكونات المحصول زادت معنويا عند إضافة المعدل العالي من السماد البلدي. وهذه الزيادة تصل الى ٨١,٢ % و٧٩,٧% لكل من البذور والقش على التوالى.

وكذلك كانت هناك استجابة معنوية لإضافة المستخلص العضوي بمعدل ٤٠٠ لتر/فدان. علاوة على ذلك فان استخدام مخلوط اللقاح سبب زيادة معنوية لمحصول الفول السوداني (بذور وقش) بالمقارنة بعدم التلقيح.

بالإضافة إلى ذلك أظهرت النتائج أن إضافة السماد العضوي بمعدل ٤٠ م^{٣} / فدان أدى إلى زيادة امتصاص النيتروجين والفوسفور والبوتاسيوم لكل من البذور والقش بالمقارنة بمعاملة الكنترول ونفس الاتجاه تم الحصول علية عند إضافة مخلوط من اللقاح البكتيري بالمقارنة بعدم التلقيح.

ولقد اظهر التفاعل بين العوامل التجريبية إلى أن أعلى محصول من بذور الفول السوداني وكذلك امتصاص النيتروجين والفوسفور والبوتاسيوم قد تحقق عند إضافة ٤٠ م^{٣} فدان$^{-١}$ سماد بلدي – والتلقيح بمخلوط اللقاح بالإضافة إلى رش المستخلص العضوي بمعدل ٤٠٠ لترفدان$^{-١}$.

ومن جهة أخرى أظهرت القيم المتوسطة لبعض الصفات الكيميائية للأرض المختبرة pH –EC والنسبة المئوية للمادة العضوية بالإضافة إلى النيتروجين والفوسفور والبوتاسيوم الميسر . أن قيم pH تقل عند استخدام المعاملات المشار إليها سابقا . كما أظهرت النتائج أن إضافة المادة العضوية بمعدل ٤٠ م^{٣} فدان$^{-١}$ والتلقيح بالإضافة إلى رش المستخلص العضوي بمعدل ٤٠٠ لترفدان$^{-١}$ يسبب خفض في قيم pH بالمقارنة بالمعاملات الأخرى.

إما قيم EC ، والنسبة المئوية للمادة العضوية وقيم العناصر الميسرة من النيتروجين والفوسفور والبوتاسيوم فقد أدت هذه المعاملات إلى زيادتها . وهذه القيم كانت أكثر تأثراً عند إضافة المعدل العالي من المادة العضوية والمستخلص العضوي بالإضافة إلى التلقيح والذي كان ذو تأثير ايجابى واضح بالمقارنة بعدم التلقيح.