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EFFECT OF PHOSPHORUS LEVELS AND SOME BIO-FERTILIZERS ON DRY MATTER , YIELD AND YIELD ATTRIBUTES OF GROUNDNUT

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By

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ABSTRACT

Two field trials were carried out in South Tahrir provence , El Beheira Governorate during the two successive summer seasons 2002 and 2003 to study the effect of phosphorus levels (15 and 30 kg P_2O_5 / faddan) and inoculation with Microbean and Phosphorein bio-fertilizers alone or in combinations on dry matter , yield and yield attributes of groundnuts in a sandy soil. Increasing phosphorus levels increased each of leaf, stem and pod dry weight / plant , number of pods /plant , weight of pods /plant , number of seeds / plant , weight of seeds / plant , 100-pod weight , 100-seed weight , pod yield , seed yield , straw yield , oil percentage , oil yield , seed protein content and NPK contents. However, the number of seeds / pod and shelling percentage decreased by increasing phosphorus levels. Seed inoculation with Microbean and Phosphorus in sole treatments showed the lowest values of the aforementioned traits, except the number of seeds/ pod and shelling percentage compared with the other treatments. Most of the aforementioned characters increased significantly when the two phosphorus levels were added in

combination with two inoculants, compared to phosphorus levels alone. However , pod weight / plant in the second vegetative sample, the number of seeds/ pod, shelling percentage, oil percentage, and potassium percentage did not show significant changes between the sole treatments of phosphorus or in combination with inoculation treatments.

***Key words**: dry matter, groundnuts, microbean, phosphorein, phosphorus, y ield and yield attributes.*

1. INTRODUCTION

Groundnuts (*Arachis hypogaea* L.) is considered one of the most important oilseed crops in the world. However, more than half of the global seed production is consumed directly without oil extraction, due to its high price in the international commodity market.

Phosphorus is one of the most important nutrients for crop growth, yield and quality. In this context, dry matter accumulation showed a positive response to P fertilizes (Singh and Ahuja , 1985 ; Tomar *et al.*, 1990 and Tiwari *et al.*, 1997). On the other hand , Nour El–Din *et al.*, (1990) found no significant effects for P application on dry weight of leaves and stems per plant at Ismalia Governorate, Egypt .

Concerning yield and its components, several workers (Jana *et al.*, 1990; Dwivedi and Gatutam, 1992; Singh *et al.*, 1994; Gomaa *et al.*, 1995 and Tiwari and Dhakar, 1997) reported that pod and seed yield, pod weight per plant, seed index, shelling percentage and seed oil content were increased due to phosphorus fertilizer applications. On the other hand , Detroja *et al.*, (1997a) found no significant effect for P levels on pod weight per plant , shelling percentage and pod yield per ha.

Some investigators reported that seed inoculation with phosphate dissolving bacteria could improve the growth and yield of groundnut . Mehta *et al.*, (1995) reported that seed inoculation with phosphorus bio-fertilizer cultures significantly improved the number of pods per plant, pod weight per plant and pod yield per ha. In addition, Mehta *et al.*, (1996), reported that seed inoculation with *Pseudomona striata* significantly increased seed protein content compared to un-treated control. Also, Detroja *et al.*, (1997b) found a

significant increase in pod yield due to seed inoculation with *Pseudomonas striata*

In Egypt , El Dsouky and Attia (1999) reported that seed inoculation with *Bacillus megatherium* significantly increased shoot and pod yields as well as NPK content in plant shoots.

Growing groundnut in the sandy soils usually produce high yield with good quality; however, such soils may have some nutrient problems such as less fertility in general and less availability of some elements such as phosphorus in the case of high pH value. This problem is present in sandy soils of South Tharir province in Egypt. Therefore, this study aimed to increase the availability of native or applied phosphorus by some phosphate dissolving bacteria. Thus, the effect of phosphorus fertilizer, bacteria inoculants and their combinations on growth, yield and yield attributes of groundnut were investigated.

2. MATERIAL AND METHODS

Two field experiments were carried out in South Tahrir province , El Beheira Governorate, during the two successive summer seasons 2002 and 2003 . Soil samples were taken at depths of 30 and 60 cm for mechanical and chemical analysis as described by Richard (1954).The randomized complete block design with three replicates was used . The experimental unit was 10.5 m^2 consisting of five rows (3.5 m long and 60 cm between rows). Seeds were sown on May 7 th and 11th in the first and second seasons , respectively. The seeds (Giza 6 c.v.) were coated just before sowing with the bacteria inoculants, using Arabic gum (40 %) as an adhesive agent and were sown in hills 10 cm apart. Phosphorus fertilizer, as calcium superphosphate, 15.5 % P_2O_5 was added during the seed bed preparation in two levels, *i.e.* 15 and 30 kg P_2O_5 /faddan. Potassium fertilizer as potassium sulfate, 48 % K_2O was added as a general application during the seed bed preparation, while the nitrogen fertilizer has been added at a level of 40 kg N / faddan as ammonium sulfate, 20.6 % in two equal doses at 15 and 45 days after sowing .Sprinkler irrigation was applied as plants needed. The preceeding winter crop was faba bean and wheat in the first and second seasons, respectively. Groundnut was manually harvested on September 10th and 14th in the first and second seasons, respectively.

2.1. The experimental treatments were.

1- Microbean only
2- Phosphorien only
3- 15 kg P_2O_5 /faddan
4- 30 kg P_2O_5 /faddan (control)
5- Microbean + 15 kg P_2O_5 /faddan
6- Microbean+ 30 kg P_2O_5 /faddan
7- Phosphorien + 15 kg P_2O_5 /faddan
8- Phosphorien + 30 kg P_2O_5 /faddan

The Microbean bio-fertilizer contains *Azotobacter spp.,Azospirillum spp. Pseudomonas spp. , Bacillus megatherium. Rhizobium spp.* The Phosphorien bio-fertilizer contains *Bacillus megatherium*

2.2. Data recorded.

2.2.1. Plant organ dry weight : Five guarded plants were taken at random from the second row of each plot at 45,75 and 105 days after sowing .Leaves and stems were oven dried at 70 C^o until constant weight to estimate leaves and stem dry weight / plant in the 1st sample in addition to pods dry weight / plant in the 2nd and 3rd samples. In the second sample , the root nodules were separated from the plant roots and the number and dry weight of nodules / plant were recorded.

2.2.2. Yield and yield attributes : At harvest , a random sample of 10 plants was taken from each plot to determine the number of pods / plant , weight of pods / plant, the number of seeds / plant , weight of seeds / plant, the number of seeds / pod , 100-seed weight, 100-pod weight. The plants on the middle two rows in each plot (4.2 m^2) were harvested and their pods were air dried to calculate pod, straw and seed yield/ faddan. Oil yield was calculated by multiplying seed yield by seed oil percentage. Shelling percentage was estimated from a random pod sample (100g per plot), the seeds were hand separated, then shelling percentage was calculated as follows :

$$\text{Shelling \%} = \frac{\text{Seed weight}}{\text{Pod weight}} \times 100$$

Table (1) : Mechanical and chemical analyses of the experimental soil (2002 & 2003 seasons).

	2002		2003	
	30cm	60cm	30cm	60cm
Mechanical analysis				
Sand (%)	94.72	94.72	94.72	94.72
Silt (%)	2.00	2.00	1.00	2.00
Clay (%)	3.28	3.28	3.28	3.28
Soil texture	Sandy	Sandy	Sandy	Sandy
Chemical analysis				
pH	8.60	8.60	9.00	9.00
E.c. m mohs/cm	0.13	0.13	0.09	0.09
$CaCO_3$ (%)	2.40	2.30	1.80	2.40
Available N ppm	18.00	27.00	9.00	13.00
Available P ppm	18.00	17.00	13.00	12.00
Available K ppm	120.00	104.00	88.00	104.00
Soluble Ca meq./l	1.20	0.80	0.90	0.80
Soluble K meq./l	0.26	0.14	0.14	0.14
Soluble Mg meq./l	-	0.40	0.10	-
Soluble Na meq./l	0.42	0.35	0.49	0.42
Soluble CO_3 meq./l	-	-	-	-
Soluble Cl meq./l	0.50	0.50	0.25	0.50
Soluble SO_4 meq./l	0.78	0.59	0.78	0.26
Soluble HCO_3 meq./l	0.60	0.60	0.60	0.60

At harvest, soil samples were collected from the rhizosphere in different plots and were analyzed for available nitrogen ,phosphorus and potassium .

2.2.3. Chemical analysis : Seed content of NPK was determined as follows: N (%) was determined by the improved Kjeldahl method of A.O.A.C. (1955), P (%) was determined according to A.O.A.C. (1980) and K (%) was determined by using Flame Photometer. Seed protein content was calculated by multiplying N (%) by 6.25. Seed oil

content was analyzed according to A.O.A.C. (1980) with Soxhelt. Nitrogen, phosphorus and potassium uptake were calculated by multiplying the NPK (%) by seed and straw yields / faddan. The data were subjected to statistical analysis of variance as described by Snedecor and Cochran (1969). Mean values of the recorded data were compared by using the least significant difference (L.S.D.) test.

3. RESULTS AND DISCUSSION

3.1. Dry matter accumulation

Data presented in Table (2), show that leaves dry weight / plant, stems dry weight / plant and pods dry weight / plant at 45,75 and 105 days after sowing increased significantly with increasing phosphorus levels from 15 to 30 kg P_2O_5 / faddan in both seasons with the exception of pods dry weight / plant at 75 days after sowing in both seasons. Increases in the dry weight of the previous characters with the increase in P levels may be due to that phosphorus is known to help developing a more extensive root system and thus enabling plants to extract water and nutrients from deeper depth. This, in turn, could enhance the plants to produce more assimilates which was reflected in high biomass. Similar results were obtained by Tomar *et al.*, (1990) and Tiwari *et al.*, (1997) .

Plots without P fertilization, but seeds were inoculated with Microbean and Phosphorein inoculants showed the lowest values of leaves dry weight / plant , stems dry weight / plant and pods dry weight / plant as compared to either 30 or 15 kg P_2O_5/faddan in both seasons.

Addition of phosphorus fertilizers at the rates of 15 and 30 kg P_2O_5 /faddan to inoculated treatment with Microbean and Phosphorein resulted in significant increases in dry weight of leaves, stems and pods / plant in both seasons , with the exception of pods dry weight/ plant at 75 days after sowing in both seasons. Maximum dry weight of leaves , stems and pods / plant were obtained by Phosphorein + 30 kg P_2O_5 / faddan followed by Microbean + 30 kg P_2O_5 / faddan in all samples in both seasons.

days after sowing of groundnut (2002&2003 seasons).

Characters / Treatment	First Sample		Second Sample			Thrid Sample		
	Leaf wt./plant (g)	Stem wt./plant (g)	Leaf wt./plant (g)	Stem wt./plant (g)	Pod wt./plant (g)	Leaf wt./plant (g)	Stem wt./plant (g)	Pod wt./plant (g)
	First season							
15 kg P_2O_5 / fed.,	7.75	7.16	24.84	23.95	13.01	46.85	41.53	31.25
30 kg P_2O_5 / fed.,	9.52	8.35	31.18	27.87	14.49	55.25	48.78	37.97
Microbean	7.48	6.99	22.87	22.53	12.7	41.63	39.83	30.95
Micro.+ 15 kg P_2O_5 / fed.,	8.18	7.45	29.22	24.65	13.08	50.94	45.57	31.95
Micro.+ 30 kg P_2O_5 /fed.,	9.43	8.28	34.01	28.11	15.17	56.49	51.74	40.17
Phosphorien	7.28	6.85	20.86	21.78	12.21	41.2	35.82	27.66
Phosph.+ 15 kg P_2O_5/fed.,	8.91	7.94	29.37	25.25	14.44	51.72	46.67	32.27
Phosph.+ 30 kg P_2O_5/fed.	10.39	8.93	35.34	29.79	16.58	58.32	55.5	43.11
LSD at 5 %	**1.11**	**0.746**	**3.87**	**2.97**	**N.S.**	**5.14**	**4.69**	**5.12**
	Second season							
15 kg P_2O_5 / fed.,	7.30	5.97	28.63	26.09	15.98	46.70	43.24	31.37
30 kg P_2O_5 / fed.,	9.09	7.43	35.09	28.65	16.77	53.63	50.59	40.75
Microbean	7.29	5.97	26.47	25.04	14.90	44.09	42.88	30.85
Micro.+ 15 kg P_2O_5 / fed.,	8.54	6.98	33.47	27.51	16.07	51.60	48.34	33.35
Micro.+ 30 kg P_2O_5 /fed.,	9.00	7.36	36.38	29.36	17.66	54.39	52.55	43.26
Phosphorien	7.26	5.94	24.87	24.87	14.83	43.86	41.67	29.79
Phosph.+ 15 kg P_2O_5/fed.,	8.78	7.18	34.20	27.89	16.45	51.95	48.53	35.65
Phosph.+ 30 kg P_2O_5/fed.	9.16	7.50	36.79	32.62	18.67	56.19	55.88	44.75
LSD at 5 %	**0.88**	**0.73**	**3.91**	**2.94**	**N.S.**	**3.62**	**2.72**	**5.73**

3.2. Number of nodules and its dry weight

Data presented in Table (3), show nodule dry weight / plant and number of nodules / plant. Increasing phosphorus levels from 15 to 30 kg P_2O_5/faddan insignificantly increased nodule dry weight /plant, while the number of nodules/plant increased significantly by increasing the phosphorus level.

Treatments of P fertilization and seed inoculation with Microbean and Phsphorein showed significant difference between the two inoculants in the number of nodules / plant as a result of the composition of Microbean which contained many different species of nitrogen fixers and those which produce growth regulators in addition to phosphate dissolving bacteria. This may have encouraged nodule formation. Thus, the number and dry weight of nodules / plant were higher with respect to Microbean compared to Phosphorein .

Table (3) : Effect of phosphorus levels and bio-fertilizers on the number and dry weight of nodules / plant after 75 days from sowing of groundnut (second season).

Treatments	P level		M	M+15	M+30	Ph	Ph+15	Ph+30	LSD
trait	15 kg	30 kg		kg	kg		kg	kg	
Nodules dry wt./plant	0.1508	0.2095	0.1911	0.2719	0.3007	0.1503	0.1974	0.2433	NS
No. of nodules/plant	55.92	69.14	94.15	105.15	112.61	86.68	88.84	101.91	6.15

M = Microbean Ph= Phosphorien

Addition of phosphorus fertilizer at the rates of 15 and 30 kg P_2O_5/ faddan to seed inoculated with Microbean and Phosphorein resulted in insignificant increases in nodule dry weight/ plant. However, the maximum number of nodules / plant was obtained by Microbean + 30 kg P_2O_5 / faddan followed by treatments of Microbean + 15 kg P_2O_5 / faddan and Phosphorein + 30 kg P_2O_5 / faddan.

These results could be explained as increasing P level from 15 to 30 kg P_2O_5 /faddan may enhanced the *Rhizobium* bacteria to form more nodules.This was more obvious when P fertilizer was added to plots inoculated with Microbean which contains Rhizobium bacteria . These results agreed with those obtained by Singleton *et al.*, (1985). They reported that nodule number was enhanced by increasing phosphorus level, and there was, almost, a two fold increase in nodule number with the addition of phosphorus.

3.3. Yield and yield attributes

Yield and yield attributes (i.e., number of pods/ plant, weight of pods /plant , number of seeds / plant , weight of seeds / plant, number of seed / pod, 100 – pod weight, 100- seed weight , pod yield, seed yield , straw yield and shelling percentage) as affected by the experimental treatments are presented in Table (4).

Increasing phosphorus levels from 15 to 30 kg P_2O_5/faddan significantly increased the number of pods/ plant, weight of pods /plant , number of seeds / plant , weight of seeds / plant , number of seed / pod , 100 – pod weight , 100 -seed weight, pod yield , seed yield and straw yield in both seasons. This means that P application improved the productivity of groundnut, through its effects on growth and yield attributes. Similar results were reported by Abdel Wahab *et al.*, (1986); Anton and Bassiem (1998) and Ali and Mowafy (2003) who reported that phosphorus fertilizers caused significant increase in yield and some yield components.

Inoculation of seeds with Microbean and Phosphorein inoculants showed the lowest values of yield and yield attributes and without significant differences between the two inoculants with the exception of pods weight / plant , number of seeds / plant and seed yield in the first season.

Addition of phosphorus fertilizer at the rates 15 and 30 kg P_2O_5 / faddan to inoculated plots with Microbean and Phsphorein resulted in significant increases in yield and its attributes. The highest values of pods yield (2.332 and 2.154 ton / faddan), seed yield (1.408 and 1.504 ton /faddan) and straw yield (4.284 and 4.276 ton / faddan) for the first and the second season, respectively, were obtained by the application of Phosphorein + 30 kg P_2O_5 /faddan. This increase may be due to the promoting effects of the microorganisms of the inoculants on the native and / or applied nutrients .This in addition to the inhibition effect on the pathogenic microorganisms, was reported by Gomaa *et al.*, (1995).Also ,these results are in harmony with those obtained by Mehta *et al.*, (1995) , Detroja *et al.*, (1997 a & b) , El Dosouky and Attia (1999) and Ali and Mowafy (2003).

3.4. Chemical analysis

The data in Table (5), show that seed oil content was not significantly affected by the treatments in both seasons. However, oil

Table (4) :Effect of phosphorous levels and bio- fertilizers on yield and yield components of groundnut (2002&2003 seasons).

Treaments	No. Pods/ plant	Wt. Pods/ plant	No. of seeds/ plant	Wt.of seeds/ plant (g)	No.of seeds/ pod	100-pod wt. (g)	100-seed wt. (g)	Pods Yield/ (ton/fed)	Seed yield/ (ton/fed)	Straw yield/ (ton/fed)	Shelling %
	First season										
15 kg P_2O_5 / fed.,	24.07	33.77	41.76	27.82	1.73	172.51	75.07	1.566	1.035	3.126	60.00
30 kg P_2O_5 / fed.,	32.83	41.98	54.88	35.52	1.67	178.68	83.98	2.045	1.224	4.106	59.00
Microbean	22.76	33.03	40.33	26.10	1.77	162.72	71.88	1.366	0.888	2.904	65.00
Micro.+ 15 kg P_2O_5 / fed.,	27.34	35.38	45.69	28.62	1.67	169.56	83.85	1.675	1.008	4.070	60.00
Micro.+ 30 kg P_2O_5 /fed.,	33.13	45.28	55.95	39.00	1.68	183.42	86.31	2.120	1.253	4.182	59.00
Phosphorien	22.87	29.51	37.45	24.15	1.64	159.47	74.83	1.266	0.844	2.888	66.00
Phosph.+ 15 kg P_2O_5/fed.,	28.31	34.03	49.67	29.76	1.75	175.95	81.08	1.737	1.015	4.126	58.00
Phosph.+ 30 kg P_2 O_5/fed.	37.39	46.53	59.25	39.54	1.58	186.86	87.04	2.332	1.408	4.284	60.00
LSD at 5 %	**2.45**	**2.36**	**2.67**	**2.2**	**N.S**	**4.21**	**3.37**	**0.157**	**0.140**	**0.127**	**N.S.**
	Second season										
15 kg P_2O_5 / fed.,	25.46	33.07	43.34	29.07	1.72	170.14	74.88	1.536	1.050	3.002	68.00
30 kg P_2O_5 / fed.,	32.34	42.08	54.50	36.43	1.68	178.65	83.49	1.845	1.158	4.122	62.00
Microbean	24.30	32.13	42.45	26.30	1.74	164.40	71.69	1.347	0.950	2.722	70.00
Micro.+ 15 kg P_2O_5 / fed.,	26.96	35.31	49.91	30.25	2.00	173.72	80.55	1.575	1.112	4.102	67.00
Micro.+ 30 kg P_2O_5 /fed.,	34.16	46.37	58.62	38.68	1.72	181.95	83.78	1.948	1.423	4.208	72.00
Phosphorien	24.36	31.29	40.17	25.26	1.64	166.76	73.84	1.311	0.930	2.802	70.00
Phosph.+ 15 kg P_2O_5/fed.,	29.73	37.96	53.93	31.52	1.67	176.80	82.07	1.743	1.155	4.115	65.00
Phosph.+ 30 kg P_2O_5/fed.	38.76	48.27	63.33	41.88	1.63	184.76	85.05	2.154	1.504	4.276	69.00
LSD at 5%	**1.68**	**2.62**	**4.02**	**1.90**	**0.16**	**3.64**	**2.20**	**0.074**	**0.080**	**0.101**	**N.S**

yield was significantly increased. This is due to the significant increase in seed yield/ faddan when P application was increased from 15 to 30 kg P_2O_5/faddan(Table4). The highest oil yield per faddan was obtained when 30 kg P_2O_5/faddan was applied to inoculated plots with Phosphorein inoculant followed by the addition of 30 kg P_2O_5 /faddan with Microbean inoculant in both seasons. Both treatments produced the highest seed yield / faddan (Table 4). The data in Table (5) indicate that the addition of 30 kg P_2O_5/faddan to inoculated plots with Phosphorein or Microbean inoculants also showed the highest values of seed protein content, NPK contents in the seed as well as in the straw. This means that the combination of P fertilizer and bio-fertilizers may enhance plant utilization of nutrients and water which was reflected in growth and high biological yield.

Table (5): Effect of phosphorous levels and bio-fertilizers on some chemical traits of groundnut (second season only).

Treatment	Oil (%)	Oil yield.	Seed rotein content	NPK in Seed			NPK in Straw		
				N (%)	P (%)	K (%)	N (%)	P (%)	K (%)
15 kg P_2O_5 / fed.,	47.30	497.16	24.255	3.881	0.865	0.724	1.949	0.256	1.160
30 kg P_2O_5 / fed.,	47.67	552.23	25.268	4.043	0.913	0.787	2.107	0.270	1.198
Microbean	47.35	450.06	24.055	3.849	0.856	0.735	1.891	0.250	1.151
Micro.+ 15 kg P_2O_5 / fed.,	47.81	531.56	24.693	3.951	0.885	0.783	1.961	0.261	1.172
Micro.+ 30 kg P_2O_5 /fed.,	48.22	686.13	26.337	4.214	0.949	0.836	2.114	0.275	1.223
Phosphorien	47.75	443.76	23.449	3.752	0.837	0.712	1.928	0.254	1.159
Phosph.+ 15 kg P_2O_5/fed.,	47.81	552.13	24.399	3.904	0.879	0.774	2.068	0.266	1.178
Phosph.+ 30 kg P_2O_5/fed.	47.85	719.16	26.116	4.179	0.942	0.821	2.111	0.277	1.248
LSD at 5 %	NS	37.61	1.44	0.23	0.055	NS	0.019	0.002	0.011

3.5. Phosphorus, potassium and nitrogen uptake

The results of this study indicated that, although native phosphorus level in the soil was high in the first season and medium to high in the second one (Table 1), addition of 30 kg P_2O_5 /faddan improved the growth and yield as well as NPK content in groundnut plants. Such improvement was more pronounced when this level of fertilizer was added to plots inoculated with bio-fertilizers (Tables 3,4&6).

This could be explained as the microorganisms of both bio-fertilizers may have improved the rhizosphere conditions which enhanced the availability of soil nutrients and increased the NPK

Table (6): Effect of phosphorous levels and bio-fertilizers on phosphorus and nitrogen uptake by goundnut (second season only)

		Soil ppm	Applied fertilizer kg/fed.	Total fertilizer mg/kg	Uptake			Residual
					Seed	Straw	Total	
Microbean	N	9	40	49	36.53	51.48	88.02	12.00
Phosphorien					34.89	54.05	88.95	10.00
15 kg P_2O_5 / fed.,					40.71	58.50	99.22	6.00
Micro.+ 15 kg P_2O_5 / fed.,					43.94	80.45	124.39	10.00
Phosph.+ 15 kg P_2O_5/fed.,					45.10	85.11	130.22	19.00
30 kg P_2O_5 / fed.,					46.81	83.83	130.65	20.00
Micro.+ 30 kg P_2O_5 /fed.,					59.95	88.96	148.91	16.00
Phosph.+ 30 kg P_2O_5/fed.					62.88	90.28	153.16	11.00
LSD at 5 %					**4.34**	**3.50**	**3.97**	
Microbean	P	13	–	13	8.11	6.82	14.93	42.00
Phosphorien					7.77	7.12	14.90	45.00
15 kg P_2O_5 / fed.,					9.07	7.69	16.76	42.00
Micro.+ 15 kg P_2O_5 / fed.,			15	28	9.83	10.73	20.56	43.00
Phosph.+ 15 kg P_2O_5/fed.,					10.15	10.95	21.11	43.00
30 kg P_2O_5 / fed.,					10.58	11.15	21.73	48.00
Micro.+ 30 kg P_2O_5 /fed.,			30	43	13.50	11.58	25.08	48.00
Phosph.+ 30 kg P_2O_5/fed.					14.13	11.84	25.97	53.00
LSD at 5 %					**0.70**	**0.30**	**0.69**	
Microbean	K	88	24	112	6.98	31.34	38.32	108.00
Phosphorien					6.62	32.49	39.11	124.00
15 kg P_2O_5 / fed.,					7.60	34.83	42.43	152.00
Micro.+ 15 kg P_2O_5 / fed.,					8.70	48.08	56.78	128.00
Phosph.+ 15 kg P_2O_5/fed.,					8.93	48.47	57.40	132.00
30 kg P_2O_5 / fed.,					9.10	49.39	58.49	128.00
Micro.+ 30 kg P_2O_5 /fed.,					11.89	51.48	63.37	144.00
Phosph.+ 30 kg P_2O_5/fed.					12.35	53.38	65.74	136.00
LSD at 5 %					**0.79**	**1.47**	**1.19**	

uptake by groundnut plants .

Data in Table (6) show the NPK supply and uptake. This data indicate that the N and K contents in plant material and P content in most cases were greater than the applied NPK in addition to a great amount as a residual in the soil for the subsequent crops.

From the results of the present study, bio-fertilizers could improve the growth and economic yield of groundnut under the condition of this experiment and similar conditions through their indirect effects which improve soil condition, soil nutrient status, as

well as, nutrients of the applied fertilizers.

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تأثير مستويات الفوسفور وبعض الأسمدة الحيوية على المادة الجافة، المحصول ومكوناته للفول السوداني

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ملخص

أقيمت تجربتان حقليتان في منطقة جنوب مديرية التحرير بمحافظة البحيرة، خلال الموسمين الزراعيين الصيفيي٢٠٠٢، ٢٠٠٣– وذلك بهدف دراسة التأثير المشترك لكل من مستويات التسميد الفوسفاتي (١٥ ،٣٠ كجم فوسفور / فدان) وبعض اللقاحات البكتيرية (الميكروبين و الفوسفورين) على تراكم المادة الجافة والمحصول ومكوناته في الفول السوداني ،باستخدام تصميم القطاعات الكاملة العشوائية في ثلاث مكررات. يمكن تلخيص أهم النتائج المتحصل عليها فيما يلي:

أدت زيادة مستويات التسميد الفوسفاتي من ١٥ إلي ٣٠ كجم فوسفور / فدان إلي زيادة معنوية في الوزن الجاف للأوراق والسيقان والقرون / نبات وذلك عند أعمار ٤٥ ،٧٥، ١٠٥ يوم من الزراعة ، كذلك زاد عدد القرون / نبات ، وزن القرون / نبات ، عدد البذور / نبات ، وزن البذور / نبات ، وزن ١٠٠ قرن ، وزن ١٠٠ بذرة، محصول القرون / فدان ، محصول البذور/ فدان ،

محصول القش / فدان ، محصول الزيت ، محتوى البذور من النتروجين و الفوسفور زيادة معنوية بزيادة مستوى التسميد الفوسفاتي في حين لم تكن الزيادة معنوية في نسبة الزيت و محتوى البذور من البوتاسيوم.

أدى تلقيح التقاوي بالأسمدة الحيوية فقط (الميكروبين و الفوسفورين) إلي الحصول على أقل قيمة بالنسبة للصفات سابقة الذكر ماعدا صفتي عدد البذور/ قرن و نسبة التصافي مقارنة بالمعاملات الأخرى.

أدى الاستخدام المشترك لكلا من الميكروبين والفوسفورين بالإضافة إلي التسميد الفوسفاتي(١٥ أو ٣٠ كجم فوسفور / فدان) إلي زيادة معنوية في كل الصفات سابقة الذكر ماعدا صفات وزن القرون / نبات في العينة الخضرية الثانية ، عدد البذور / قرن ، نسبة التصافي ، نسبة الزيت ، محتوى البذور من البوتاسيوم. ولقد تحقق أعلا محصول من البذور و الزيت من الإضافة المشتركة للأسمدة المعدنية (الفوسفور بمعدل ٣٠ كجم فوسفور / فدان) مع لقاح الفوسفورين تلاه في ذلك نفس المعدل من السماد الفوسفاتي مع لقاح الميكروبين . كما أدى إلى زيادة محتوى النبات من النتروجين والفوسفور والبوتاسيوم، وكذلك زيادة محتوى التربة منها بعد الحصاد مما قد يفيد المحصول اللاحق في الأرض.

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