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IMPROVING PRODUCTIVITY OF SOME PEANUT CULTIVARS GROWN IN SANDY SALINE SOIL USING SOME NITROGEN TREATMENTS

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ABSTRACT: *Two field experiments were carried out on saline soil of El-Tina Plain region during summer seasons of 2008 and 2009 to study the response of two peanut cultivars (Arachis hypoea L.) namely Giza 6 and Gregory to mineral N alone or in combination with bio fertilizer and its effect on some vegetative growth parameters, photosynthetic pigments, chemical and mineral composition and yield of both straw and seeds. Also, the effect of the studied treatments on some soil properties and its content of available macro- and micro-nutrients was studied. Mineral N fertilizer was applied as urea (46% N) at rates of 20, 30 and 40 kg N / fed. The obtained results indicate that the application of mineral nitrogen alone or in combination with biofertilizer increased most growth characters represented as plant height, No. of branches / plant and dry weight of different plant organs. Also, these treatments overcome the inhibitor effect of salinity hazard on leaf water relations and improved water status in peanut leaves that enhanced relative water content and improved leaf water deficit, osmotic pressure and membrane integrity. Application of N fertilizer (mineral alone or with bio-) markedly increased photosynthetic pigments (chl. a + b and carotenoids), total sugars, total carbohydrates, total amino acids and proline concentration. Generally, the application of biofertilizer was more effective on these parameters than that of mineral N. Data also revealed that Gregory cultivar was superior in all traits than Giza 6 cultivar. Most interactions exerted highly significant influence on all traits under study except for No. of branches / plant. Generally, the best results was found with the treatment of biofertilizer with 40 kg N / fed. The data also revealed that, slight decrease of soil pH and also slight increase of EC (dSm^{-1}) were found with increasing the rate of mineral N individually or in combination with biofertilization. The yield of both shoots and seeds and also the weight of 100 seed were increased with the increase of added N. The high yields were obtained when mineral N and bio fertilization were added together. Gregory cultivar showed more response to nitrogen fertilization and also its was more tolerance to high salinity levels compared with Giza 6 cultivar.*

Key Words: *Peanut, Salinity, Cultivars, Nitrogen, Growth, Physiological and Chemical characters.*

INTRODUCTION

Peanut is one of the most important oil crops and food seed legume; it contains about 50% oil, 25 – 30% protein, 20% carbohydrate and 5% fiber and ash and makes a substantial contribution to human nutrition. Peanut is one of the most important crops which cultivated successfully in a newly reclaimed sandy soil of Egypt (Abdalla *et al.,* 2009). Mineral nitrogen is also most abundant element in atmosphere (approximately 78.08%) but plants are unable to use it as such. It can be made available through chemical or biological means but chemical nitrogen fertilizers are expensive. Ashmawy *et al.* (2008) reported that, the 100-seed weight and dry matter production of inoculated seed peanut with bio-fertilizer in combination with mineral N fertilizer rates compared to control (un inoculation). Nasef *et al.* (2006) found that, the inoculation with bio-fertilizer (Rhizobium strains) alone increased significantly the uptake of N, P, K, Fe, Mn, Zn and B by straw and seeds of peanut as compared with corresponding treatments without bio-fertilizer. Dakora (2003) found that, the inoculation seeds crop with rhizobia led to higher crop yields, because rhizobia also produce various metabolites such as auxins, cytokinins, riboflavin and vitamins their invasion of legume and non-legume plant roots should promote an increase in plant growth. Rashed (2006) reported that, the contribution of N_2 fixation to the total nitrogen, phosphorus and potassium per plant are increased by moderate levels of soil or mineral fertilization nitrogen, but declined at high levels, reflecting the depression of N_2 fixation by the high levels of either soil or fertilizer. Also, Biswas *et al.* (2000) found that, inoculation with *Rhizobium leguminosarum* cv. *trifolii* E11, *Rhizobium* sp. IRBG74, and *Bradyrhizobium* sp. IRBG271 increased rice grain and straw yields by 8 to 22 and 4 to 19%, respectively, at different N rates. Nitrogen, P and K uptake were increased by 10 to 28% due to rhizobia inoculation.

Salinity has a considerable effect on world agriculture, results in reducing productivity of agricultural plants. Soil salinity is an increasing threat for agriculture and is a major factor in decreasing plant production. Due to over irrigation, salinity, which hampers metabolic activities in plant cells, in increasing many areas around the world (Sanan-Mishra *et al.,* 2005).

Plant productivity on many semi-arid rangelands, including saline areas, is often limited by a lake of nitrogen (Alyemeni, 1997). The application of N fertilizer to plants growing in arid climate may increase the salt tolerance of these plants (Cordovilla *et al.,* 1994). However, the increasing costs of N fertilizers and the danger of increasing the soil salinity is likely to further limit the application of N to rangelands (Mohammad *et al.,* 1989). Hence, the importance of biological fixation of nitrogen has increased.

In legumes salt stress significantly limits productivity because of the adverse effects on growth of plants, root nodule bacteria and the nitrogen fixation capacity (Bekki *et al.*, 1987). Hedge *et al.* (1999) and El-Shouny *et al.* (2009) indicated that, bio-fertilizers play an important role in enhancing crop productivity through nitrogen fixation and plant hormones production. These hormones were found to be reversed the adverse effect of stress conditions.

Physiological criteria suggested for selection of salt tolerant are osmotic adjustment (Morant-Avice *et al.*, 1998) and proline content (Trotel *et al.*, 1996).

The aim of the current investigation is to study the response of two cultivars of peanut to individual treatments of mineral and its combination with bio fertilization under saline conditions. The effects of these treatments on vegetative growth and physiological parameters, yield, oil yield and chemical composition were studied.

MATERIALS AND METHODS

Two field experiments were carried out on saline and sandy loam soil of Gelbana Town of El-Tina Plain, Ismalia Governorate during summer season of 2008 and 2009. Surface soil samples (0 – 20 cm) were taken from the studied location. The collected samples were air-dried, ground, good mixed, served through a 2 mm sieve and analyzed for some physical and chemical properties and also for its content of available macro- and micronutrients according to the methods described by Black *et al.* (1965), Cottenie *et al.* (1982) and Page *et al.* (1982). The obtained results were recorded in Table (1-a, b and c).

Table (1): Some properties of the cultivated soil.

a- Physical properties:

Particle size distribution (%)				Texture grade	O.M (%)	$CaCO_3$ (%)	WHC (%)
C. sand	F. sand	Silt	Clay				
5.32	75.92	6.13	12.63	Sandy loam	0.56	9.30	30.2

b- Chemical prosperities:

pH 1 : 2.5 (soil : water) susp.	E.C dSm^{-1}	Soluble ions (meq / L)							
		Cations				Anions			
		Ca^{2+}	Mg^{2+}	Na^+	K^+	Cl^-	$CO_3^=$	HCO_3^-	SO_4^{2-}
8.12	12.45	9.34	13.00	99.00	3.13	88.00	0.00	8.90	27.66

c- Available nutrients (mg / kg):

Macronutrients			Micronutrients			
N	P	K	Fe	Mn	Zn	Cu
48.00	6.20	187.01	1.36	3.19	0.66	0.003

In both seasons, each experiment was carried out in split design with six replicates. The used two rates of bio-fertilization and the used three application rates of mineral N fertilization (fertilization treatments) were arranged randomly as main plots (A_1). Also, the used two cultivars of peanut plant were arranged randomly as sub plots (B). The area of each experimental unit (plot) was 5 × 10 m (50 m^2), where its divided into rows with 50 cm. The two tested cultivars of peanut (*Aracnis hypogaco* L.) were Giza 6 and Gregory which obtained from Crop Institute, Agriculture Research Center, Giza, Egypt.

All farming processes were carried out before planting. All experimental plats were fertilized by compost as organic fertilizer at rate of 5 ton / fed^{-1}. Also, ordinary super phosphate (15.5% P_2O_5) was applied at rate of 100 kg / fed^{-1} during tillage soil. The experimental plats (72 plot) were divided into two equal main groups which were planted by uninoculated and inoculated peanut seeds by bio-fertilizer (without or with), respectively. The plots of each main group were divided into two equal sub group (18 plot / sub group) which were planted by seeds of Giza 6 and Gregory cultivar, respectively. At the same day of sowing, the seeds of peanut plant were inoculated (treatments of bio-fertilizer) using inoculations of the symbiotic N-fixing bacteria (*Rhizbium leguninosamis* salt tolerant strain). The inoculation process was carried out by coating seeds with arabic gum media carrying the bacteria strain. Also, the plots planted by inoculated seeds were treated as soil application with liquid bacteria strain at another three times which were after 21, 42 and 63 days of planting as recognized concluded by Shaban and Omar (2006).

Sowing was carried out on 20 May 2008 and 25 May 2009. Three to four of uncoated or coated seeds were sown in hole with 5 cm depth. The distance between each two holes was 15 cm. After 15 days from planting, the plants of each hole were thinned to one plant. All experimental plots were irrigated with El-Salam Canal water which characterized by the mean chemical composition recorded in Table (2). Water analysis was carried out during the two growing seasons. The determined properties of irrigation water were carried out according to the methods described by Cottenie *et al.* (1982). Irrigation process was carried out at interval periods of 8 days.

Table (2): Mean chemical composition of El-Salam Canal water.

pH	E.C dSm^{-1}	Soluble cations (meq / L)				Soluble anions (meq / L)				SAR
		Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}	
8.20	1.93	3.57	5.30	10.10	0.16	0.00	2.83	8.40	8.10	5.22

Macronutirents (mg / L)			Micronutirents (mg / L)				
NO_3 - N	NH_4 –N	P	Fe	Mn	Zn	Ca	B
4.03	12.57	5.10	0.51	0.31	0.40	0.55	0.05

The plots of each sub group were divided into three groups (6 plots / group). These three sub sub groups were fertilized by urea (46% N) as mineral N fertilizer at rates of 20, 30 and 40 kg N / fed^{-1}. These rates equal 50, 75 and 100% of recommended dose of N requirements. Each rate of added N was carried out in three equal doses after 21, 42 and 63 days from planting. After 21 days from planting all plots were fertilized by potassium sulphate (48% K_2O) as K fertilizer at rate of 100 kg / fed^{-1}. The used rates of all mineral fertilization were recommended by Ministry of Agriculture.

At flowering stage (75 – 80 days from planting), plant samples were taken randomly from three replicates of each sub sub group to determine the following parameters.

1. Vegetative growth parameters: Plant height (cm), number of branches / plant, the plant organs were separated and dried in electric oven at 70°C for 72 hrs and dry weights were measured in gms.
2. Leaf water relations: Relative water content (RWC %), leaf water deficit (LWD %) were estimated according to Kalapos (1994). Osmotic pressure of cell sap (πs bar), using the methods described by Kreeb (1990).
3. Membrane integrity (MI): To indicate the extent of membrane damage in leaf tissues subjected to saline condition, measurements on the leakage of solutes were determined, following the method of Leopold *et al.* (1981).
4. Chemical constituents:
   a) Photosynthetic pigments: (chl. a, b and carotenoids) were estimated in fresh leaves as described by Witham *et al.* (1971).
   b) Total soluble sugars and total carbohydrates: in dry leaves were determined colorimeterically using the phenol sulfuric acid method of Dubois *et al.* (1956).
   c) Total amino acids and proline concentrations: were estimated according to the methods described by Rosen (1957) and Bates *et al.* (1973), respectively.
   d) Enzyme activity: Phenoloxidase activity was measured in fresh leaves using the method described by Broesh (1954).
   e) Total phenols: were determined in dried leaves following the method of Snell and Snell (1953).

At maturity stage (after about 120 and 150 days of planting for Giza 6 and Gregory cultivars, respectively), the plants of the latter three replicates were harvested above the soil surface. The seeds were separated from the harvested plants. Portions of the separated shoots and seeds were air-dried, oven-dried at 70°C for 72 hrs, weighted, ground and kept for chemical analysis. The dry matter yield of both shoots and seeds was calculated as kg / fed^{-1}. Also, the dry weight of 100 seeds (g) was estimated.

f) Minerals: A 0.5 g of each oven-dried and ground plant samples (shoots or seeds) was digested using mixture of concentrated of H_2SO_4 + $HClO_4$ according to the method of described by Chapman and Pratt (1961). The shoots and seeds content of N, P, K, Fe, Mn and Zn was determined in plant digestion using the methods described by Jackson (1973), Cottenie *et al.* (1982) and Page *et al.* (1982). Oil seed content (%) was determined in air-dried seeds using Soxhlet method (A.O.A.C, 1990).

All obtained data were statistically analyzed and (L.S.D) were estimated according to Snedecor and Cochran (1972).

RESULTS AND DISCUSSION

1. Vegetative growth:

Data presented in Table (3), show significant increments in most studied growth characters of peanut plants grown in saline soil due to N application. The increases in plant height, number of branches / plant and dry weights of plant organs were corresponding to increase N level (40 kg N/fed.) as alone or in combination with bio fertilization. The lowest values of these parameters were recorded in the plants treated with 20 kg N / fed. These results are in agreement with those obtained by El-Beheidi *et al.* (2005). Inoculation of peanut with nitrogen fixing bacteria (slat tolerance) significantly gave higher mean values for all growth parameters. Similar results were obtained by Hammad and El-Gamal (2004) on pepper. In this respect Hamida and El-Komy (1998) reported that, inoculation with *Azospirillium* spp. could improve plant growth by improving mineral and water uptake in colonized roots.

Table (3): Vegetative growth parameters of two cultivars of peanut plant grown in saline soil as affected by mineral and bio N fertilization treatments.

Cultivars	Treatments		Plant height (cm)		Number of branches / plant		Dry weight (g / plant)					
							Root		Stem		leaves	
	Mineral kg/fed.	Bio	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Giza 6	20	Without	12.5	13.5	7.0	8.0	0.78	0.72	1.35	1.78	4.86	5.15
	30		17.5	16.5	8.33	8.0	0.89	0.91	1.97	2.11	5.81	6.75
	40		23.0	21.0	9.0	9.33	0.93	0.99	2.27	2.48	6.76	8.85
	Mean		17.66	17.0	8.11	8.44	0.86	0.87	1.86	2.12	5.81	6.92
	20	With	15.5	16.0	9.0	8.33	0.88	0.97	2.03	2.25	6.77	6.97
	30		19.5	18.5	10.0	9.66	1.05	1.15	4.61	3.63	8.92	9.99
	40		24.0	25.0	11.0	11.33	1.42	1.37	5.39	5.22	9.18	11.42
	Mean		19.66	19.83	10.0	9.77	1.12	1.16	4.01	3.70	8.29	9.46
	Mean		18.66	18.41	9.55	9.11	0.99	1.02	2.93	2.91	7.50	8.19
Gregory	20	Without	13.5	14.0	8.33	8.66	0.91	1.02	2.52	2.71	5.01	5.61
	30		19.5	17.0	10.0	10.33	1.02	1.27	4.13	3.85	6.0	7.0
	40		24.0	22.5	10.66	11.00	1.72	1.35	5.41	5.06	7.51	7.87
	Mean		19.0	17.83	9.66	9.99	1.22	1.21	4.02	3.87	5.51	6.83
	20	With	16.00	16.50	10.00	9.33	1.29	1.17	3.67	4.04	5.68	6.04
	30		25.50	20.33	10.33	10.66	1.87	1.28	7.07	5.23	7.75	8.18
	40		27.00	25.67	11.66	12.00	2.00	1.72	7.39	6.68	8.37	10.75
	Mean		22.83	20.83	10.66	10.66	1.72	1.39	6.04	5.32	7.26	8.32
	Mean		20.92	19.33	10.16	10.33	1.47	1.30	5.03	4.59	6.73	7.57
L.S.D at 0.05 level												
	A		0.33	0.43	0.76	0.38	0.02	0.05	0.11	0.20	0.11	0.30
	B		0.90	0.65	1.36	1.00	0.07	0.08	0.28	0.25	0.28	0.84
	A × B		0.97	0.70	1.48	1.08	0.07	0.09	0.30	0.27	0.30	0.90

As for the effect of peanut cultivars, data presented in the same Table indicated that, there were significant differences between them, and the cultivar Gregory was the best.

Concerning the effect of the interaction between N fertilizers and cultivars, it is clear from data given in Table (3) that there were significant differences among them of all growth characters except No. of branches / plant in both seasons. These results were previously reported by Helal (2007) on sweet pea. The increase in plant growth due to the biofertilizer application under saline condition may referred to the growth substances (mainly IAA, GA and Cyt.) produced by the microorganisms found in biofertilizers (Omay *et al.*, 1993).

2. Leaf water relations:

Data recorded in Table (4) indicate that, relative water content (RWC %), leaf water deficit (LWD) and osmotic pressure (OP) were significantly affected by N-treatments. Addition of nitrogen fertilizers (mineral alone or with bio-) increased RWC % while decreased LWD % and OP in peanut plants grown in saline soil. The inoculation with biofertilizer led to the highest increase in RWC and the maximum reduction in LWD in both seasons. These results are in accordance with Morant-Avice *et al.* (1998) on tritical and Hammad and El-Gamal (2004) on pepper.

Data in the same Table indicate that, there were significant differences in RWC, LWD and OP in leaves of the two peanut cultivars. Gregory showed superiority over Giza 6.

Concerning the effect of the interaction between peanut cultivars and fertilizers, results indicated that there were significant effects among them. This conclusion is in harmony with that reported by El-Garhy (2002) on faba bean. Biofertilizer application alleviated the depressive effect of salinity by increasing water uptake, or by lowered leaf osmotic potential for greater turgor maintenance (Hamdia and El-Komy, 1998).

3. Membrane integrity:

In both seasons, results in Table (4) indicate that, the studied treatments of nitrogen fertilizers significantly affected membrane integrity (MI) of peanut plants grown in saline soil. Application of biofertilizer gave the best results. Moreover, the lowest values of MI were obtained in plants treated with biofertilizer plus 40 kg N / fed. Similar results were obtained by Hammad (2000), who found that, application of mineral-N under saline conditions caused a significant decrease in MI of sweet basil and mint plants. Tolerance of plants due N fertilizer based on the ability to repair and regenerate cellular organelle membranes on stress alleviation. This is often referred to as MI characteristic of tissues and widely used as criteria to identify resistant plants to desiccation (Dhindsa and Bewley, 1977). Significant differences between cultivars were recorded.

Table (4): Some aspects of water relations and membrane integrity in leaves of two cultivars of peanut plant grown in saline soil as affected by treatments of mineral and bio fertilization.

Cultivars	Treatments		Relative water content (%)		Leaf water deficit (%)		Osmotic pressure C.S (bar)		Membrane integrity (%)	
	Mineral kg/fed.	Bio	2008	2009	2008	2009	2008	2009	2008	2009
Giza 6	20	Without	70.2	70.60	29.80	29.40	13.80	12.72	59.00	55.31
	30		73.05	72.85	26.95	27.15	13.25	12.04	52.00	53.42
	40		75.21	74.62	24.79	25.38	12.31	11.65	48.80	49.32
	Mean		72.82	72.69	27.18	27.31	13.12	12.14	53.26	52.68
	20	With	75.30	73.10	24.70	26.20	12.48	12.06	56.40	54.40
	30		78.50	77.30	21.50	22.70	11.62	11.85	42.30	50.13
	40		80.01	79.06	19.99	20.94	10.64	9.62	38.10	41.23
	Mean		77.94	76.49	22.06	23.28	11.58	11.18	45.60	48.58
	Mean		75.37	74.00	24.62	25.29	12.35	11.65	49.43	50.63
Gregory	20	Without	70.81	71.05	29.19	28.95	13.37	12.00	54.20	51.66
	30		74.10	73.50	29.90	26.50	12.53	11.33	50.60	48.15
	40		76.36	76.12	23.86	23.88	11.46	9.51	39.40	41.12
	Mean		73.75	73.56	27.65	26.44	12.45	10.95	48.07	46.98
	20	With	76.40	75.44	23.60	24.56	12.10	11.48	51.30	47.77
	30		79.20	77.36	20.80	22.64	11.50	11.06	41.40	42.55
	40		81.15	80.62	18.85	19.08	10.40	9.42	31.00	40.80
	Mean		78.92	77.80	21.08	22.09	11.33	10.65	41.23	43.70
	Mean		76.33	75.73	23.70	24.26	11.89	10.80	44.55	43.57
L.S.D at 0.05 level										
	A		0.86	0.86	0.99	0.49	0.12	0.05	0.99	0.99
	B		1.31	1.30	1.24	1.45	0.22	0.14	2.73	3.02
	A × B		1.41	1.41	1.34	1.57	0.23	0.15	2.95	3.25

4. Chemical constituents:

a) Photosynthetic pigments:

There were significant increases in chlorophyll a + b and carotenoids concentrations of peanut leaves with increasing mineral-N levels under sandy saline soil (Table 5). The trend was similar in plants received by biofertilizer with mineral-N levels. Moreover, low N level (20 kg N / fed.) resulted in a decrease of the above mentioned compared to other treatments. The obtained results are confirmed by Barakat and Gabr (1998) on tomato. In this respect, the cultivar Gregory showed superiority over Giza 6. The combined treatment included 40 kg N / fed. and biofertilizer was considered the best treatment. The second season showed the same trend. Similar results were observed by Helal (2007) on sweet pea. In this connection, Hegazi (1983) attributed the significant increase in growth parameters of wheat by Azospirillum inoculation to general improvement of the physiological status.

b) Total soluble sugars and total carbohydrates:

It can be noticed that, total soluble sugars (TSS) and total carbohydrates (TC) were highly significant in plants treated with N fertilizers under saline soil especially with high level. Moreover, the low level (20 kg N / fed.) gave significant decrease in TSS and TC in peanut leaves compared to other ones. Generally, Gregory cultivar gave the highest values. These results are confirmed by Hammad (2009) on squash. Regarding the interaction between the application of nitrogen fertilizers and cultivars, data in Table (5) show that, the highest values of TSS and TC were noticed when peanut plants treated with biofertilizer with 40 kg N / fed. The second season showed

Table (5): Chlorophylls (a + b), carotenoids, total soluble sugars and total carbohydrates concentration in leaves of two cultivars of peanut plant grown in saline soil as affected by mineral and bio fertilization treatments.

Cultivars	Treatments		Chlorophyll a + b (mg / g d.w)		Carotenoids (mg / g d.w)		Total soluble sugars (mg / g d. s)		Total carbohydrate (mg / g d.w)	
	Mineral kg/fed.	Bio	2008	2009	2008	2009	2008	2009	2008	2009
Giza 6	20	Without	3.52	3.93	1.46	1.30	21.50	18.32	143.50	138.10
	30		4.03	4.41	1.77	1.27	23.74	21.40	187.40	171.00
	40		4.81	5.01	2.08	1.56	27.62	24.75	199.70	191.40
	Mean		4.12	4.45	1.77	1.38	24.29	21.49	176.80	166.83
	20	With	4.09	4.21	1.85	1.42	22.12	20.31	160.80	154.90
	30		4.81	4.74	1.94	1.70	24.33	22.05	200.10	185.30
	40		5.37	5.20	2.12	1.82	31.61	27.61	215.40	207.60
	Mean		4.76	4.72	1.97	1.65	26.02	23.32	192.10	182.60
	Mean		4.43	4.58	1.87	1.48	25.15	22.40	184.50	154.50
Gregory	20	Without	4.08	4.09	1.87	1.51	24.05	22.81	177.50	163.40
	30		4.75	4.81	2.08	1.88	26.04	25.42	215.30	209.30
	40		5.33	5.19	2.11	2.11	31.77	29.31	231.40	221.50
	Mean		4.72	4.70	2.02	1.83	27.29	25.85	208.10	198.10
	20	With	4.61	4.33	2.00	1.67	26.65	24.55	195.60	187.20
	30		5.14	5.07	2.19	1.98	31.03	28.02	235.10	219.40
	40		5.41	5.32	2.25	2.19	37.40	31.90	245.10	227.00
	Mean		5.05	4.91	2.15	1.95	31.69	28.16	225.30	211.20
	Mean		4.88	4.80	2.08	1.89	29.49	27.00	216.60	204.66
L.S.D at 0.05 level										
A			0.15	0.38	0.07	0.07	0.86	1.32	5.79	2.59
B			0.49	0.63	0.28	0.29	1.45	1.51	8.36	4.82
A × B			0.53	0.68	0.31	0.33	1.57	1.62	9.02	5.22

patterns similar to the first one. These results are in accordance with previously reported findings of Helal (2007) on sweet pea. The biofertilizer application under saline condition may increase plant resistance to salinity by accumulation of soluble compounds leading to osmotic adjustment (Del Zoppo *et al.,* 1999).

c) Total amino acids and proline concentrations:

Data listed in Table (6) reveal that, total amino acids (TAA) and proline concentrations were significantly increased with the increase of added N as mineral or bio fertilization of peanut plants grown in saline soil. Biofertilizer in combination with mineral-N gave the maximum significant increment of these parameters. In this respect, the highest values were obtained by biofertilizer treatment plus 40 kg N / fed. in both seasons. The results are in harmony with those recorded by Hammad and El-Gamal (2004) on pepper and Del Zoppo *et al.* (1999) on wheat. In this connection Hamdia and El-Komy (1998) reported that, proteins were progressively increased accompanied

Table (6): Total free amino acids, proline, phenoloxide activity and total phenols in leaves of two cultivars of peanut plant grown in saline soil as affected by mineral and bio fertilization treatments.

Cultivars	Treatments		Total free amino acids (mg / g d.w)		Proline (µg / g d.w)		Phenoloxide activity (O.D / g f.w)		Total phenols (mg/100 g d.w)	
	Mineral kg/fed.	Bio	2008	2009	2008	2009	2008	2009	2008	2009
Giza 6	20	Without	45.92	40.81	165.40	170.40	0.31	0.28	20.10	19.45
	30		49.23	47.30	170.40	182.30	0.38	0.33	22.73	23.20
	40		55.52	53.70	180.30	195.90	0.45	0.40	25.31	24.95
	Mean		50.22	47.27	172.00	182.67	0.38	0.34	22.71	22.47
	20	With	52.62	51.41	300.90	277.40	0.34	0.32	23.90	22.33
	30		53.33	54.02	318.30	285.30	0.42	0.35	24.51	25.30
	40		61.24	62.30	330.40	300.90	0.49	0.43	25.83	26.04
	Mean		55.73	55.91	316.50	287.90	0.42	0.37	24.75	24.56
	Mean		52.97	51.59	244.20	235.30	0.39	0.35	23.70	23.51
Gregory	20	Without	51.32	46.05	169.90	215.40	0.38	0.47	21.11	20.07
	30		55.91	52.91	176.40	280.40	0.43	0.51	23.43	22.81
	40		58.50	59.10	187.30	287.50	0.50	0.57	26.22	24.51
	Mean		55.24	52.69	177.90	261.10	0.44	0.52	23.59	22.46
	20	With	57.42	56.72	320.30	315.10	0.42	0.47	24.75	22.66
	30		59.61	60.31	351.40	338.20	0.47	0.55	27.30	25.74
	40		67.32	65.65	365.20	345.20	0.58	0.61	29.25	28.40
	Mean		61.45	60.89	345.60	332.80	0.49	0.54	27.11	25.60
	Mean		58.34	56.79	261.70	296.90	0.46	0.53	25.34	24.03
L.S.D at 0.05 level										
A			0.98	0.80	9.99	5.00	0.007	0.013	1.06	0.99
B			3.32	3.20	12.40	13.69	0.014	0.014	1.83	1.58
A × B			3.58	3.49	13.42	14.77	0.015	0.015	1.93	1.71

with a general promotion in the contents of amino acids when maize plant was inoculated with *Azospirillum*. Thus *Azospirillum* application might play an important role in the protein biosynthesis by direct N supply (through fixation of N) or indirectly by enhancing the uptake of soil N or by promoting the photosynthetic apparatus. In addition accumulation of proline leads to osmotic adjustment and can serve as a protector of enzyme denaturation (Hamada and Khulaef, 1995).

The data in the same Table show that, the influence of the studied N treatments on TAA and proline in peanut leaves with Gregory cultivar was superior as compared with Giza 6 cultivar.

Also, the interaction between fertilizers and cultivars affected significantly TAA and proline concentrations.

d) Enzyme activity:

Phenoloxidase activity of peanut leaves was increased significantly by increasing mineral-N levels (Table 6). Biofertilizer in combination with mineral-N gave the highest values compared to mineral-N alone. Similar results were reported by Azcon *et al.* (1996) who found that, enzymatic activity was affected by inoculation of lettuce plants with mycorrhizal fungi under drought conditions. Moreover, phenoloxidase activity of peanut leaves of Gregory cultivar surpass that of Giza 6 cultivar. Significant increases in phenoloxidase activity were obtained by the interaction between cultivars and fertilizers in both growth seasons.

e) Total phenols:

Data given in Table (6) demonstrate that, application of mineral N fertilizer either alone or in combination with N fixing bacteria (salt tolerant) resulted in a significant increment of total phenols concentration in peanut leaves especially with high level of mineral N (40 kg N / fed.). The same trend for these result was recorded in the second growth season. On the other hand, there was a significant decrease in total phenols in plants tread with 20 kg N / fed. compared to other ones. Similar results were obtained by Hammad and El-Gamal (2004) on pepper, Hammad (2009) on squash and Azcon *et al.* (1996) who found that phenolic compounds increase due to inoculation of lettuce plants with mycorrhizal fungi under drought conditions.

The data in both growth seasons revealed that cultivars exerted a highly significant influence on total phenols conc. which Gregory cultivar was superior as compared with Giza 6 cultivar.

5. Yield and yield quality:

a. Dry matter yield:

The presented data in Table (7) show that, dry matter yield (kg / fed.) of both shoots and seeds and also the weight of 100 seed (g) of Giza 6 or Gregory cultivar were significantly increased with increasing of mineral N, but the rate of this increase was decreased at high application rate of mineral N. Aiad (2010) and El-Gendy (2010) obtained on similar results with different plants. At different application rates of mineral N, dry weight of the previous three parameters of Gregory cultivar was higher than those of Giza 6 cultivar. This trend show high response of Gregory cultivar to mineral N fertilization compared to that found with Giza 6 cultivar. This positive effect of N fertilization on plant growth was reported by many studies such as which carried by El-Shouny *et al.* (2009) and Aiad (2010).

Table (7): Combined effect of mineral and bio-fertilization on the dry matter yield of two cultivars of peanut plant grown in saline soil in the two growth seasons.

Cultivars	Treatments		Shoots (kg/fed.)		Seeds (kg / fed.)		100 seeds (g)	
	Mineral kg/fed.	Bio	2008	2009	2008	2009	2008	2009
Giza 6	20	Without	1243.0	1245.0	480.0	477.0	50.5	50.9
	30		1255.0	1258.0	495.0	495.0	58.5	58.1
	40		1270.0	1275.0	502.0	505.0	62.0	62.1
	Mean		1256.0	1259.3	492.3	492.3	57.0	57.0
	20	With	1340.0	1345.0	490.0	493.0	52.1	52.3
	30		1375.0	1370.0	510.0	512.0	65.5	65.7
	40		1385.0	1387.0	520.0	520.0	70.0	70.2
	Mean		1366.7	1367.3	506.7	508.3	62.5	62.7
	Mean		1311.3	1313.3	499.5	500.3	59.8	59.9
Gregory	20	Without	1275.0	1280.0	514.0	515.0	58.1	58.5
	30		1300.0	1295.0	533.0	530.0	64.3	64.3
	40		1310.0	1310.0	540.0	545.0	68.0	68.2
	Mean		1295.0	1295.0	529.0	530.0	63.5	63.7
	20	With	1300.0	1300.0	525.0	528.0	63.5	64.0
	30		1385.0	1400.0	552.0	550.0	75.9	76.0
	40		1417.0	1417.0	560.0	561.0	80.1	80.1
	Mean		1367.3	1372.3	545.7	546.3	73.2	73.4
	Mean		1331.2	1333.7	537.3	538.2	68.3	68.5
L.S.D at 0.05 level								
A			2.59	3.06	1.00	1.04	0.09	0.11
B			0.85	0.95	3.13	3.21	0.12	0.17
A × B			0.92	1.16	3.38	3.47	0.13	0.17

The data in the same Table also show that, the treatments of bio fertilization were resulted in clear increases of the obtained dry matter yield of peanut shoots and seeds and also the weight of 100 seeds. The results of Abdalla *et al.* (2009) showed that, inoculation of both peanut cultivars with Bradyrhizobium and other strains increased dry matter yield compared with control and full dose of N-fertilizer. Such positive effect of bio fertilization on plant growth and dry matter yield was found by Al-Kahal *et al.* (2008) and Shaban and Attia (2009) on cotton and corn plants, respectively. Gregory cultivar appeared high responses to bio fertilization compared with that recorded with Giza 6 cultivar. This trend was found in the two growth seasons and also at different application rates of mineral N fertilizer.

Dry matter yield of shoot, seeds and weight of 100 seeds of the two cultivars of peanut plant were significantly increased as affected by different combined treatments of mineral N and bio fertilization (Table 7). The high values of these three parameters were found with the treatments of 40 kg mineral N / fed. with bio fertilization especially with Gregory cultivar. So, in this respect and under saline conditions peanut plant growth and its tolerance to high salinity levels were improved and increased as a result for the treatments of mineral N individually and / or in combination with bio fertilization.

b. Macronutrients content (%):

The presented data in Table (8) show that, the content of N, P and K (% and kg / fed) in either of shoots or seeds were increased significantly with the increase rate of mineral N fertilization individually or in combination with bio fertilization. Also, the treatments of bio fertilization were associated with more increase of N, P and K content in both shoots and seeds.

With different fertilization treatments under study the seeds concentrations of N, P and K were higher than these in shoots. These findings were recorded with the two peanut cultivars in the two growth seasons. There are no clear differences within the conc. of the determined macronutrients of shoots or seeds among the two growth seasons at the same fertilization treatment. Also, at the same treatment, the conc. of N, P and K in both shoots and seeds of Gregory cultivar were higher than those found with Giza 6 cultivar. So, the highest conc. of N, P and K were found in the seeds of Gregory cultivar treated by mineral N at application rate of 40 kg/fed. in combination with bio fertilization, but the lowest values were found in the shoots of Giza 6 cultivar treated by mineral N alone at 20 kg / fed. These data sured the importance role of mineral and bio fertilization in peanut growth especially under saline conditions. These results are in harmony with those obtained by Rashed (2006), Shaban and Omar (2006), Abdalla *et al.* (2009) and El-Shouny *et al.* (2009).

c. Micronutrients content:

The micronutrients concentration (mg / kg) and its uptake (g / fed.) by both shoots and seeds of Gregory and Giza 6 cultivars as affected by the studied treatments of mineral and bio fertilization is listed in Table (9). These results show that, in the two growth seasons both concentration and uptake of these micronutrients in shoots and seeds were significantly increased with increasing of mineral N levels. Other confirmed results with these findings were reported by El-Shouny *et al.* (2009) and Aiad (2010). The results show

Table (8): Macronutrients concentration of shoots and seeds of two cultivars of peanut plant grown in saline soil as affected by mineral and bio fertilization treatments.

Cultivars	Treatments		Shoots												Seeds											
			N				P				K				N				P				K			
	Mineral kg/fed.	Bio	Conc. (%)		Uptake (kg/fed)		Conc. (%)		Uptake (kg/fed)		Conc. (%)		Uptake (kg/fed)		Conc. (%)		Uptake (kg/fed)		Conc. (%)		Uptake (kg/fed)		Conc. (%)		Uptake (kg/fed)	
			2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Giza 6	20	Without	2.15	2.16	26.72	26.89	0.21	0.22	2.61	2.74	1.82	1.80	22.62	22.41	3.24	3.25	15.55	15.50	0.51	0.50	2.45	2.39	1.30	1.25	6.24	5.96
	30		2.19	2.18	27.48	27.42	0.27	0.25	3.39	3.15	1.86	1.86	23.34	23.40	3.31	3.30	16.38	16.34	0.53	0.55	2.62	2.72	1.34	1.34	6.63	6.63
	40		2.21	2.21	28.07	28.18	0.31	0.30	3.94	3.83	1.89	1.90	24.00	24.23	3.44	3.46	17.27	17.47	0.58	0.58	2.91	2.93	1.36	1.35	6.83	6.82
	Mean		2.18	2.18	27.38	27.45	0.26	0.26	3.27	3.27	1.86	1.85	23.36	23.30	3.33	3.34	16.44	16.44	0.54	0.54	2.66	2.66	1.33	1.31	6.55	6.45
	20	With	2.17	2.20	29.08	29.59	0.28	0.29	3.75	3.90	1.90	1.92	25.46	25.82	3.48	3.50	17.05	17.26	0.52	0.52	2.55	2.56	1.30	1.30	6.37	6.41
	30		2.30	2.30	31.63	31.51	0.36	0.36	4.95	4.93	1.97	1.97	27.09	26.99	3.54	3.55	18.05	18.18	0.59	0.61	3.01	3.12	1.36	1.36	6.94	6.96
	40		2.35	2.36	32.55	32.73	0.39	0.40	5.40	5.55	2.00	2.10	27.70	29.13	3.68	3.70	19.14	19.24	0.68	0.67	3.54	3.483.	1.38	1.40	7.18	7.28
	Mean		2.27	2.29	31.02	31.31	0.34	0.35	4.65	4.78	1.96	2.00	26.79	27.35	3.57	3.58	18.09	18.20	0.60	0.60	3.04	05	1.35	1.35	6.84	6.86
	Mean		2.23	2.24	29.24	29.42	0.30	0.30	3.93	3.94	1.91	1.93	25.05	25.35	3.45	3.46	17.23	17.31	0.57	0.57	2.85	2.85	1.34	1.33	6.69	6.65
Gregory	20	Without	2.18	2.18	27.80	27.90	0.28	0.28	3.57	3.58	1.85	1.85	23.59	23.68	3.52	3.50	18.09	18.03	0.52	0.53	2.67	2.73	1.41	1.40	7.25	7.21
	30		2.26	2.25	29.38	29.14	0.34	0.35	4.42	4.53	1.96	1.84	25.48	25.12	3.65	3.65	19.45	19.35	0.55	0.55	2.93	2.92	1.47	1.50	7.84	7.95
	40		2.312.	2.30	30.26	30.13	0.38	0.40	4.98	5.24	2.10	2.15	27.51	28.17	3.70	3.72	19.98	20.27	0.60	0.58	3.24	3.16	1.52	1.52	8.21	8.28
	Mean		25	2.24	29.14	29.01	0.33	0.34	4.27	4.40	1.97	1.98	25.51	25.64	3.62	3.62	19.15	19.19	0.56	0.55	2.96	2.92	1.47	1.47	7.78	7.79
	20	With	2.20	2.19	28.60	26.47	0.30	0.30	3.90	3.90	1.95	1.95	25.35	25.35	3.55	3.55	18.64	18.74	0.54	0.55	2.84	2.90	1.44	1.44	7.56	7.60
	30		2.32	2.32	32.13	32.48	0.38	0.40	5.26	5.60	2.05	2.15	28.39	30.10	3.70	3.68	20.42	20.24	0.61	0.63	3.37	3.47	1.52	1.54	8.39	8.47
	40		2.38	2.39	33.72	33.87	0.42	0.42	5.95	5.95	2.25	2.25	31.88	31.88	3.80	3.82	21.28	21.43	0.66	0.65	3.70	3.65	1.58	1.56	8.85	8.75
	Mean		2.30	2.30	31.45	31.56	0.37	0.37	5.06	5.08	2.08	2.12	28.44	29.09	3.68	3.68	20.08	20.10	0.60	0.61	3.27	3.33	1.51	1.51	8.24	8.25
	Mean		2.28	2.27	30.35	30.27	0.35	0.36	4.66	4.80	2.03	2.05	27.02	27.34	3.65	3.65	19.61	19.64	0.58	0.58	3.12	3.12	1.49	1.49	8.01	8.02
LSD at 0.05 level																										
	A				2.88	2.06			0.02	0.03			0.25	0.16			0.11	0.14			0.18	0.20			0.19	0.22
	B				5.18	4.11			0.08	0.08			0.73	0.43			0.13	0.15			0.25	0.27			0.30	0.35
	A × B				5.59	5.45			0.08	0.10			0.83	0.46			0.14	0.16			0.28	0.29			0.33	0.39

Table (9): Micronutrients conc. of shoots and seeds of two cultivars of peanut plant grown in saline soil as affected by mineral and bio fertilization treatments.

Shoots

Cultivars	Mineral kg/fed.	Bio	Fe Conc. (mg/kg) 2008	Fe Conc. (mg/kg) 2009	Fe Uptake (g/fed) 2008	Fe Uptake (g/fed) 2009	Mn Conc. (mg/kg) 2008	Mn Conc. (mg/kg) 2009	Mn Uptake (g/fed) 2008	Mn Uptake (g/fed) 2009	Zn Conc. (mg/kg) 2008	Zn Conc. (mg/kg) 2009	Zn Uptake (g/fed) 2008	Zn Uptake (g/fed) 2009
Giza 6	20	Without	38.84	150.50	153.40	72.24	73.17	28.00	28.50	13.44	13.59	14.10	6.77	6.92
	30		45.29	165.00	166.00	81.68	82.17	34.00	35.00	16.83	17.33	19.10	9.45	9.45
	40		51.00	172.00	171.00	86.34	86.36	37.00	37.00	18.57	18.69	21.80	10.94	11.21
	Mean		44.96	162.50	163.50	80.00	80.49	33.00	33.50	16.25	16.49	18.30	9.01	9.16
	20	With	160.00	161.50	78.40	79.62	30.00	30.20	14.70	14.89	18.50	19.00	9.07	9.37
	30		172.00	171.00	87.72	87.55	35.90	36.00	18.31	18.43	25.00	26.00	12.75	13.31
	40		175.30	176.50	91.16	91.78	39.50	40.00	20.54	20.80	27.80	27.20	14.46	14.14
	Mean		169.10	169.70	85.68	86.26	35.10	35.40	17.79	17.99	23.80	24.10	12.06	12.25
	Mean		165.80	166.60	82.82	83.35	34.10	34.50	17.03	17.26	21.10	21.30	10.54	10.66
Gregory	20	Without	157.00	158.10	80.70	81.42	33.00	33.50	16.96	17.25	16.20	16.50	8.33	8.50
	30		170.00	171.20	90.61	90.74	38.90	38.50	20.73	20.41	22.50	21.80	11.99	11.55
	40		175.80	176.50	94.93	96.19	40.00	40.30	21.60	21.96	26.20	27.10	14.15	14.77
	Mean		167.60	168.60	88.66	89.36	37.30	37.40	19.73	19.82	21.60	21.80	11.43	11.55
	20	With	168.00	168.50	88.20	88.97	35.50	36.00	18.61	19.01	21.50	21.80	11.29	11.51
	30		177.90	178.50	98.20	98.18	42.80	42.60	23.63	23.43	30.00	30.50	16.56	16.78
	40		182.40	181.50	102.14	101.82	46.70	47.30	26.15	26.54	34.50	34.00	19.32	19.07
	Mean		176.10	176.20	96.10	96.26	41.70	42.00	22.76	22.94	28.70	28.80	15.66	15.73
	Mean		171.90	172.40	92.36	92.79	39.50	39.70	21.22	21.37	25.20	25.30	13.54	13.62
LSD at 0.05 level														
	A				0.18	0.15			0.14	0.19			0.01	0.03
	B				0.28	0.25			0.31	0.38			0.31	0.39
	A × B				0.31	0.28			0.34	0.46			0.33	0.46

Seeds

Cultivars	Mineral kg/fed.	Bio	Fe Conc. (mg/kg) 2008	Fe Conc. (mg/kg) 2009	Fe Uptake (g/fed) 2008	Fe Uptake (g/fed) 2009	Mn Conc. (mg/kg) 2008	Mn Conc. (mg/kg) 2009	Mn Uptake (g/fed) 2008	Mn Uptake (g/fed) 2009	Zn Conc. (mg/kg) 2008	Zn Conc. (mg/kg) 2009	Zn Uptake (g/fed) 2008	Zn Uptake (g/fed) 2009
Giza 6	20	Without	85.50	84.80	106.28	105.58	65.50	65.50	65.50	81.42	81.55	31.20	31.20	38.78
	30		93.10	93.50	116.84	117.62	117.62	73.10	73.350	91.74	92.46	36.50	36.00	45.81
	40		97.80	98.00	124.21	124.95	124.95	77.70	78.10	98.68	99.58	39.50	40.00	50.17
	Mean		92.10	92.10	115.68	115.98	115.98	72.10	72.40	90.56	91.14	35.70	35.70	44.84
	20	With	88.80	89.00	118.99	119.71	67.00	67.50	89.78	90.79	37.20	37.50	49.85	50.44
	30		96.00	96.50	132.00	132.21	75.80	76.50	104.23	104.81	44.50	45.00	61.19	61.65
	40		100.00	99.50	138.50	138.01	81.30	80.90	112.60	112.21	48.90	48.50	67.73	57.27
	Mean		94.90	95.00	129.70	129.89	74.70	75.00	102.09	102.55	43.50	43.70	59.46	59.75
	Mean		93.50	93.60	122.61	122.92	73.40	73.70	96.25	96.79	39.60	39.70	51.93	52.14
Gregory	20	Without	86.40	87.00	110.16	111.36	68.30	69.00	87.08	88.32	33.20	33.70	42.33	43.14
	30		96.30	97.00	125.19	125.62	74.00	79.50	96.20	102.95	38.90	39.50	50.57	51.15
	40		99.50	99.00	130.35	129.69	83.40	84.00	109.25	110.04	41.80	42.10	54.76	55.15
	Mean		94.10	94.30	121.86	122.12	75.20	77.50	97.38	100.36	38.00	38.40	49.21	49.73
	20	With	96.50	96.00	125.45	124.80	75.80	76.50	98.54	99.45	41.50	42.00	53.95	54.60
	30		107.80	108.50	149.30	151.90	83.90	83.00	116.20	116.20	49.10	50.00	68.00	70.00
	40		112.50	112.00	159.41	158.70	87.80	88.40	124.41	125.26	53.80	54.30	76.23	76.94
	Mean		105.60	105.50	144.39	144.78	82.50	82.60	112.80	113.35	48.10	48.80	65.77	66.97
	Mean		99.80	99.90	132.85	133.24	78.90	80.10	105.03	106.83	43.10	43.60	57.37	58.15
LSD at 0.05 level														
	A				0.04	0.06			0.06	0.08			0.18	0.16
	B				0.13	0.14			0.17	0.19			0.31	0.29
	A × B				0.14	0.15			0.18	0.21			0.33	0.31

also that, Gregory cultivar has more response to mineral N fertilization compared with Giza 6 cultivar. The significant increase in the conc. of determined micronutrients was associated the bio fertilization in combination with mineral N fertilization treatments. With different fertilization treatments under study in the two growth seasons, the conc. of the micronutrients in the seeds of Giza 6 and Gregory cultivars were higher than these of shoots. The high conc. of Fe, Mn and Zn were found in the seeds of peanut plants fertilized by mineral N and bio fertilization treatments especially with Gregory cultivar. There are no clear differences within the conc. of the micronutrients in the two growth seasons at different fertilization treatments under study. The synergistic effect of rhizobacteria on peanut yield may be elucidated by their ability to enhance the nodulation development, nitrogen fixation performance and nutrients availability and uptake from soil such as phosphorous and micronutrients. This may result in a various mechanisms mainly the production of substances like hormones, siderophores and phosphates. It leads to an improvement of nutrients and water uptake by increasing the root perforation. Such mechanisms have been proved by many investigators (Dobbelaere *et al.,* 2003 and Fuentes-Ramirez and Caballero-Mellado, 2005).

d. Oil content:

The presented data in Table (10) show that, different application rates of mineral N individually or in combination with bio fertilization resulted in a significant increase in the seeds content (%) of oil, where the high contents were found in the combination treatments. At different fertilization treatments in the two growth seasons, the oil contents in the seeds of Gregory cultivar were higher than those in the seeds of Giza 6 cultivar. Unclear effect in the two growth seasons on the seeds content of oil was observed with the two cultivars of peanut. Sarhan (2001) obtained similar results.

Table (10). Oil content (%) of seeds of the two cultivars peanut plant grown in saline soil as affected by mineral and bio-fertilization treatments.

Mineral fertilization (kg/fed.)	Giza 6				Gregory			
	Without bio fertilization		With bio fertilization		Without bio fertilization		With bio fertilization	
	2008	2009	2008	2009	2008	2009	2008	2009
20	39.50	39.50	40.80	41.20	44.50	45.00	47.00	47.20
30	42.80	43.00	44.60	44.90	47.50	47.30	98.60	48.90
40	45.10	44.80	46.50	46.50	48.50	48.20	50.50	50.50
Mean	42.46	42.43	43.97	44.20	46.83	46.83	48.60	48.86

6. Soil properties and nutrients content:

The presented data in Table (11) show that, very small decrease of soil pH and small increase of soil EC (dSm^{-1}) were associated with the treatments of mineral N individually or in combination with bio fertilization, where this trend was increased in the combination treatments. Also, this trend was found in the two growth seasons with both cultivars of peanut plant. The obtained increase of soil EC may be resulted from soluble salts presented in the irrigation water of El-Salam Canal which accumulated in the soil especially in the surface layer of the soil profile (Shaban and Abd El-Rhman, 2007). In this respect, El-Fayoumy and Ramadan (2002) and Shaban and Helmy (2005) obtained similar results.

Table (11): Mean values of soil pH, EC and its content of available macro- and micro-nutrients as affected by mineral and bio fertilization treatments during the two growth seasons.

Cultivars	Treatments		pH (1:2.5) soil:water sus.	EC (dSm^{-1})	Available macro-nutrients (mg/kg)			Available micro-nutrients (mg/kg)		
	Mineral mg/fed.	Bio			N	P	K	Fe	Mn	Zn
Giza 6	20	Without	8.09	8.93	45.60	5.81	175.00	1.30	3.10	0.65
	30		8.05	9.10	47.80	6.11	173.00	1.28	3.07	0.62
	40		8.03	9.23	50.10	6.15	168.00	1.25	2.98	0.60
	Mean		8.06	9.09	47.83	6.02	172.00	1.28	3.05	0.62
	20	With	8.08	8.90	46.50	6.11	170.00	1.26	3.05	0.63
	30		8.02	9.00	50.80	6.15	165.00	1.22	2.95	0.60
	40		7.96	9.12	53.60	6.15	161.00	1.22	2.87	0.55
	Mean		8.02	9.01	50.30	6.14	165.33	1.23	2.96	0.59
	Mean		8.04	9.05	49.06	6.08	168.67	1.26	3.00	0.61
Gregory	20	Without	8.10	8.87	45.50	5.90	172.00	1.30	3.10	0.65
	30		8.05	9.10	48.00	6.05	170.00	1.27	3.05	0.61
	40		8.04	9.18	49.60	6.20	166.00	1.25	3.00	0.58
	Mean		8.06	9.05	47.70	6.05	169.33	1.27	3.05	0.61
	20	With	8.09	8.80	46.50	6.10	170.00	1.25	3.02	0.62
	30		8.01	9.10	51.00	6.20	160.00	1.20	2.90	0.58
	40		7.95	9.15	54.00	6.22	157.00	1.18	2.80	0.53
	Mean		8.02	9.02	50.50	6.17	162.33	1.21	2.91	0.57
	Mean		8.04	9.03	49.10	6.11	165.83	1.24	2.98	0.59

The soil content of available N, P and K (mg / kg) was small affected by the fertilization treatments under study (Table 11). A clear increase of the soil content of available N was associated with the treatments of mineral N individually or in combination with bio fertilization, where the high content was found in the combination treatments. This positive effect was resulted from the effect of inoculation process on the increase of nodulation and nitrogen fixation activity. Also, the data show little decrease in the soil content of available P resulted from mineral and bio fertilization treatments. The soil content of available P with the bio-fertilization treatments was higher than that found with mineral N treatments.

This effect was resulted from the influence of fertilization treatments on soil microorganisms and its effect on the mineralization of P compounds. On the other hand, the fertilization treatments under study resulted in a little decrease of soil content of available K. This decrease was resulted from the high rate of K uptake by the cultivated plants. The obtained data of the content of available N, P or K showed the same trend with Giza 6 and Gregory cultivars in the two growth seasons. Rashed *et al.* (2006) and Shaban and Abd El-Rhman (2007) obtained similar results.

The presented data in Table (11) show that, with different treatments of mineral and bio fertilization, the contents of the determined micronutrients were slightly decreased. These decreases were resulted from the high rate of uptake by peanut plants and its essential roles in plant metabolism synthesis, tissue development and sugar translocation facility (Marschner, 1998). These decreases in the plots cultivated by Gregory cultivar were high than those found in the plots cultivated by Giza 6 cultivar. Also, the high decreases were found in the plots fertilized by mineral and bio fertilizers together. These trends were similar in the two growth seasons. These results are in agreement with those obtained by Dakora (2003), Ashmawy *et al.* (2008) and El-Shouny *et al.* (2009).

Conclusion:

Under saline conditions, the productivity of peanut plant could be increased by seeds inoculation in combination with mineral N fertilization. Gregory cultivar has more response to mineral and bio fertilization and also more tolerance for high levels of soil salinity compared with Giza 6 cultivar.

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تحسين إنتاجية بعض أصناف الفول السودانى النامية فى أرض رملية ملحية باستعمال بعض معاملات النيتروجين

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الملخص العربى

أجريت تجربتان حقليتان على الأرض الملحية بمنطقة سهل الطينة خلال فصل الصيف ٢٠٠٨ ، ٢٠٠٩ لدراسة إستجابة صنفى جيزة ٦ وجريجورى من الفول السودانى لكلٍ من التسميد النيتروجينى المعدنى والحيوى وأثر ذلك على بعض القياسات الخضرية والفسيولوجية والتركيب الكيميائى والمعدنى وكذلك محصول كل من القش والبذور . كما تم دراسة تأثير معاملات الدراسة على بعض خواص الأرض وكذلك محتواها من بعض المغذيات الكبرى والصغرى الميسرة . وأضيف السماد النيتروجينى على صورة يوريا (٤٦% نيتروجين) عند معدلات ٢٠ ، ٣٠ و ٤٠ كجم نيتروجين / فدان . وأشارت النتائج إلى أن إستخدام السماد النيتروجينى المعدنى منفرداً أو مع السماد الحيوى يُزيد جميع صفات النمو المتمثلة فى طول النبات وعدد الأفرع / نبات وكذلك الوزن الجاف لأعضاء النبات . علاوةً على ذلك أدى التلقيح بالسماد الحيوى أو إضافة السماد المعدنى إلى تحسين فى العلاقات المائية فى أوراق الفول السودانى فيزداد محتوى الماء النسبى ويتحسن نقص الماء الورقى والضغط الإسموزى ونفاذية الجدر مما أدى إلى التغلب على التأثير الضار للملوحة . أدت إضافة السماد النيتروجينى (معدنى منفرداً أو مع حيوى) إلى زيادة طردية فى صبغات البناء الضوئى (كلوروفيل أ + ب والكاروتونيدات) والسكريات الكلية والكربوهيدرات الكلية والأحماض الأمينية والبرولين . عموماً فإن إضافة السماد الحيوى كان أكثر تأثيراً مقارنةً بالمعدنى منفرداً. كذلك أوضحت النتائج تفوق الصنف جريجورى فى جميع الصفات المدروسة عن جيزة ٦ . أوضحت كل التفاعلات تأثير معنوياً على جميع الصفات تحت الدراسة ما عدا عدد الأفرع / نبات . وعموماً أدى إستخدام السماد الحيوى مع ٤٠ كجم ن / فدان إلى الحصول على أفضل النتائج . وكذلك

فقد أوضحت النتائج وجود إنخفاض طفيف فى رقم حموضة الأرض وكذلك وجود زيادة طفيفة فى المحتوى من الأملاح الكلية الذائبة بزيادة المضاف من التسميد النيتروجينى المعدنى منفرداً أو مع التسميد الحيوى وإزداد المحصول لكل من القش والبذور وكذلك وزن ١٠٠ بذرة بزيادة المضاف من التسميد النيتروجينى . وكان أعلى محصول قد تحصل عليه عند إضافة السماد النيتروجينى المعدنى والحيوى معاً . وكان الصنف جريجورى أكثر استجابة للتسميد النيتروجينى وكذلك أكثر تحملاً لمستويات الملوحة العالية مقارنةً بصنف جيزة ٦ .