RESPONSE OF WHEAT YIELD AND APPARENT NITROGEN RECOVERY OF FERTILIZER TO MINERAL NITROGEN AND BIOFERTILIZER APPLICATION IN SALT AFFECTED SOILS.

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ABSTRACT

Three field experiments were carried out during two successive seasons of, 2005/06 and 2006/07.at farmers field with different salinity soils EC = 2.6 dS m^{-1} , E.C.=5.4 dS m^{-1} and EC =10 dS m^{-1}. Grain yield of wheat cv.Sakha 94 decreased significantly with increasing soil salinity. The data recorded decrease in grain yield by about 13.74% and 24.11% of the mean value for medium and highly saline sodic soil as compared with normal soil .The mean values recorded a decrease of straw yield by about 23.46% and 32.85%due to increasing soil salinity under medium and highly saline sodic soil, respectively as compared to non saline soil .Grain and straw yield of wheat were highly significantly increased during the two growing seasons due to increasing nitrogen fertilization (N), where the grain yield had recorded the highest mean values (23.126),(20.406) and (18.499) ardb Fed.$^{-1}$ by N_{140} application in normal soil, medium saline and highly saline sodic soils in the two the seasons.

Nitrogen recovery by wheat yield decreased by 3.37% and 15.64% under medium and highly saline sodic soils, respectively, as compared with normal soil .N-recovery by wheat decreased with increasing N-level from 40 up to 140kg/Fed..N-recovery by wheat recorded the relative variation were 15.09%, 16.08 and 22.60% with nitrobien , phosphorien and nitrobien + phosphorien application, respectively.

Nitrogen use efficiency (NUE) decreased by 5.34% with increasing soil salinity from normal soil to high saline soils. NUE by wheat decreased by increasing N-level up to 140kg/Fed.. NUE by wheat recorded the highest relative variation were 6.77%, 8.14 and 11.30% with nitrobien, phosphorien and nitrobien + phosphorien application respectively. Crude protein content in grains of wheat decreased by about 0.44% and 1.23% under medium and highly saline soils, respectively, as compared with normal soil. Crude protein content in grains of wheat increased with increasing N-levels up to 140kg/Fed..Crude protein content in grains of wheat recorded the highest percentages of increase over the control were 2.66%, 3.66 and 5.68% with nitrobien, phosphorien and nitrobien + phosphorien application, respectively.

To achieve the highest grain yield of wheat (*Triticum aestivum*) cv.Sakha 94, it is recommended to apply nitrogen at the rate of 120kgN/Fed. and mixture nitrobien (BNF)+ phosphoerin (BDP) in non saline soil, and application of N at the rate of 140kgN/Fed.and mixture nitrobien (BNF)+ phosphoerin (BDP) as biofertilizer in medium saline and highly saline sodic soil, respectively.

INTRODUCTION:

Soil salinity is an increasing constraint threatening crop production globally. Around 30% of cultivated soils are affected by accumulation of salts, (Zhu et al., 1997). Soil salinity generally results from excess accumulation of Na Cl and exerts detrimental effects on crop production by causing ion toxicity and inducing osmotic stress (water deficiency) in root environment and in plants, (Zhu et al., 1997 and Zhu, 2001).Plants are not incompatible to salts, but most of the plants do not grow in saline soils. Globally, soil salinity is more common in arid and semi-arid regions than in humid regions. An understanding of responses of plants to salinity is of a great practical significance. High concentrations of salts have detrimental effects on plant growth (Garg and Gupta ,1997). The obtained results revealed that increasing soil salinity (2.0,4.1.7.3,11.2.and 14.1dSm^{-1}) decreased the dry matter and grain yield , (Sarhan and Abdel Salam 1999). Soil salinity is one of the major environmental stresses affecting crop productivity. The effect of salinity on plants vary widely depending on the developmental stage of the plant as well as the types and concentrations of salts. The responses to salinity on N uptake differ in different plant species and also depend on the type and extent of salinity. In the majority of the plant species studied, salinization in the soil affects N uptake, (Sharma and Gupta, 1986).

Soils have little capacity to retain oxidized forms of nitrogen, while ammonium accumulation in soils is small; consequently, most of the soil nitrogen is associated with organic matter. Release of nitrogen from organic matter is slow and unpredictable. If soil organic matter is depleted, as occurs in cultivated soils, nitrogen for plant growth is limited. Nitrogen is usually the most deficient nutrient in cultivated soils of the world, and fertilization of these soils with nitrogen is required. To maintain or increase productivity of soils, worldwide consumption of nitrogen fertilizers continues to increase with time (Allen and Pilbean, 2007). Results indicated that increasing N-level from 0 to 120KgN feddan^{-1} significantly increased grain yield (Sabry et al.1999). It was found that peak maximum grain yield (20.85) ardb/Fed. was obtained with application of 131.89KgN feddan^{-1} (El-Naggar2003).While the grain and straw yield of wheat were significantly increased with increasing N level up to 110Kg feddan^{-1} (Mousa1995).

Nitrogen fertilization significantly increased the grain yield and the interaction between salinity and nitrogen fertilization has a appositive effect on the previous parameters concerning the normal soil and 105KgN fed.$^{-1}$ (Sarhan and Abdel Salam 1999).

Plant inoculations by the phosphate solubilizing bacteria resulted in 10-15% increases in crop yields in 10 out of 37 experiments (Tandon, 1987).Inoculated plants with serealin recorded higher values of grain and straw yield feddan^{-1} than unioculated ones by 5.41% and 2.52 % in silty clay loam soil, respectively. (Attallah and El-Karamity1997). Inoculation increased the accumulation of shoot dry matter and grain yield by about 35%, relative to the control treatment it is obvious that inoculation, in general, enhanced the N fertilizer utilized by both shoots and grains of wheat plants. In conclusion, the application of biofertilization technology to a coarse-textured soil with low fertility had a positive effect on plant growth Galal et al., (2000), and Ozturk, and Caglar, (2003).

Inoculation with *Azospirillum* and *Azotobacter* can save more than half the recommended dose of mineral nitrogen fertilizer (Sabry et al.2000).It was found that inoculated wheat grains with cerialine recorded the highest mean values of grain yield and major components compared with uninoculatied and save about 25 to 50% of N-fertilizer cost (Bassal et al.2001).Grain yield of wheat was increased with N_2-Fixer (cerialine) by 11.95%, 5.25%, 3.34%with 40, 60 and 80Kg fed.$^{-1}$ application, respectively (Abd El-Maksoud 2002).Inoculation with cerialine at the rate 750g fed.$^{-1}$ was more benefit for wheat where caused remarkable increase in yield and yield components, by increasing the nutrient uptake, photosynthesis rate and translocation (Ibrahim et al.2004). it seems that inoculation at the high rate combined with 75mg N Kg^{-1} soil gave maximum obtained grain yield and 1000 grain weight.(El Garhi et al., 2007).

Nitrogen recovery by grain and straw yield of wheat increased with fertilization up 120kgN plus 50 kgK_2O fed.$^{-1}$ in non saline soil (Amer, 2005).Crop plants are able to use about 50% of the applied fertilizer N, while 25% is lost from the soil–plant system through leaching, volatilization and denitrification, (Saikia and V. Jain 2007).Grain protein content and yield increases were obtained when the inorganic fertilizers were applied in combination with the biofertilizer (Nitrobien) than when applied singly (Sonbol et al., 2000).Grain protein content and nitrogen use efficiency were increased up N_{120} plus K_{50} application fertilization for Giza168 and Sids7 in normal soil, (Amer, 2005).

Very little or no data are available in the literature about the effect of mineral nutrition and biofertilization on wheat under different level of soil salinity. Therefore, the main target of this investigation was to study the effect of nitrogen and biofertilization under different levels of soil salinity on wheat yield and N-uptake, together with nitrogen recovery , nitrogen use efficiency, crude protein content in grains of wheat under different level of soil salinity.

MATERIALS AND METHODS

To achieve the objectives of the present work, Three field experiments were carried out during two successive seasons of, 2005/06 and 2006/07.at farmers field with different salinity as follows: One site normal soil (EC = 2.6 dS m^{-1}, pH = 8.0 SAR = 7.4, CEC = 42.5, OM = 1.85%, available nitrogen =17.5 ppm and texture was clayey), EL-Hamra Village, Kafr El-Sheikh District, Kafr El-Sheikh Governorate, and two sites medium saline soil (E.C.=5.4 dS m^{-1}.pH= 8.2 SAR=13.75,CEC = 42.0, OM =1.79%, available nitrogen.=10.5 ppm and texture was clayey) and high saline sodic soil (EC = 10dS m^{-1}, pH= 8.4, SAR =16.1, CEC = 42.0, OM = 1.7%, available nitrogen.=12.0 ppm and texture was clayey), Gad ALLAH village, Sidi Salem District, Kafr El-Sheikh Governorate. The experiment was conducted in split- plot design, with four replicates. The main plots were assigned to soil salinity levels: (EC = 2.6 dS m^{-1}, 5.4dSm^{-1} and 10dSm^{-1}) The sub plots were assigned to nitrogen levels : 0, 40, 80, 120 and 140kgN feddan^{-1} and the sub sub plots subjected to inoculation treatments with bio nitrogen fixation (BNF) nitrobien, bio dissolved phosphour (BDP) phosphorien, BNF+ BDP nitrobien plus phosphorien and without inoculation as control. The area of each plot was 3x3.5 (1/400 feddan) and seeds of wheat

(*Triticum aestivum*) cv.Sakha 94 were sown at 15th November 2005 , 13th November 2006 and harvesting at 8 May 2006 and 10 May 2007, respectively. Nitrogen was added as urea (46%N), nitrogen rate was split into four doses : the first (20%) at sowing, the second (40%) at first irrigation (25 days from sowing), the third (30%) at following irrigation (55days from sowing) and the rest of N (100%) was added at the third irrigation (75 days from sowing). Surface soil samples (0-30cm depth) from each plot were taken before planting and after harvest in the two seasons and prepared for physical and chemical analysis (Piper, 1950).Soil samples were air-dried, ground and passed through 2.0 mm sieve for the following chemical analysis. Soil reaction (pH) was measured in 1: 2.5, soil: water suspension at 25 ^{0}C. according to Jackson (1967)Total water soluble salts was measured by the electrical conductivity meter apparatus in the extract of water soil paste (Richards, 1954).Cation exchange capacity (CEC) was determined using sodium and ammonium acetate method as described by Gohar (1954).Available N was extracted by 1.0M K_2SO_4 and determined by MgO and devarda alloy using Kjeldahl method (Jackson 1967).Mechanical analysis (sand, silt and clay) was determined according to the pipette methode (Piper, 1950). Plant samples were taken randomly from ¼ m^2 of each plot after 45 and 90 day from sowing to determine the following: Shoots dry matter at booting stage. Plant samples were taken at booting, and harvesting growth stages in each season wash by distilled water and dried in an oven at 70 o C for 48 hrs, ground , mixed and wet digested using hot sulfuric acid with repeated additions of 30% hydrogen peroxide (H_2O_2) as described by Wolf (1982) and analyzed as follows: Nitrogen content was determined by micro-Kjeldahl method (Jackson, 1967), Protein concentration was calculated from the volume of total nitrogen after multiplied by 6.25 according (A. O. A. C. 1980) and apparent nitrogen recovery of fertilizer (%) was calculated for each treatment according to the following equation (Crasswell and Godwin , 1984) :

$$\text{\% Recovery of N fertilizer} = \frac{\text{N-uptake from treatment} - \text{N-uptake from control}}{\text{N-applied to treatment}} \times 100\%$$

$$\text{N use efficiency} = \frac{\text{Grain yield from treatment} - \text{grain yield from control}}{\text{N-applied to treatment}} = \text{Kg grains / Kg N}$$

$$\text{Relative variation (\%)} \quad \frac{\text{treatment-control}}{\text{control}} \times 100$$

Data obtained were analyzed statistically according to the procedures outlined by Cochran and Cox (1960).

RESULTS AND DISCUSSIONS

Effect of Soil salinity:

Table (1) and Fig (1) showed that grain yield of wheat decreased significantly with increasing soil salinity. The relative decrease in grain yield was about 13.74% and 24.11% of the mean value for medium saline and high saline sodic soils, respectively as compared with the normal soil (value over mean the two seasons of study). Similar results were obtained by Sarhan and Abdel Salam (1999) and Oosterbaan (2003).Concerning wheat straw yield, data also reveal high significant effect during the two seasons of study. The mean values recorded a decrease of straw yield by about 23.46% and 32.85% due to increasing soil salinity under medium saline soil and high saline soil, respectively as compared to non saline soil. Similar results were obtained by Oosterbaan (2003).Table (1) showed that the shoots dry weight of wheat at booting stage and the dry weight grain and straw yield of wheat decreased significantly with increasing soil salinity during the two seasons of the study Similar results were obtained by Sarhan and Abdel Salam (1999), Oosterbaan (2003). and Sangwan et al.(2003)

Table (1): Yield and dry weight of wheat as affected by level of soil salinity in the two growing seasons (2005/2006& 2006/2007)

Yield		Season	Soil salinity (dSm^{-1}) 2.6	5.4	10	$F_{test.}$	$LSD_{0.05}$	$LSD_{0.01}$
Grain (ardbfed.$^{-1}$)		1st	15.524	13.408	11.76	* *	0.079	0.03
		2$_{nd}$	15.640	13.473	11.891	* *	0.046	0.119
		Mean	15.58	13.44	11.83			
Relative variation %				-13.74	-24.11			
Straw (tonfed.$^{-1}$)		1st	3.385	2.566	2.281	* *	0.004	0.006
		2$_{nd}$	3.372	2.606	2.256	* *	0.005	0.008
		Mean	3.379	2.586	2.269			
Relative variation %				-23.46	-32.85			
Dry weight (tonfed^{-1})	Shoots	1st	1.806	1.683	1.634	* *	0.008	0.036
		2$_{nd}$	1.620	1.486	1.468	* *	0.012	0.054
		Mean	1.71	1.58	1.55			
	Relative variation %			-7.5	-9.5			
	Grain yield	1st	2.112	1.762	1.537	* *	0.165	0.250
		2$_{nd}$	2.055	1.786	1.557	* *	0.216	0.327
		Mean	2.08	1.77	1.55			
	Relative variation%			-14.85	-25.75			
	Straw yield	1st	3.045	2.363	2.050	* *	0.075	0.113
		2$_{nd}$	3.015	2.383	2.050	* *	0.175	0.265
		Mean	3.03	2.373	2.05			
	Relative variation %			-21.7	-32.3			

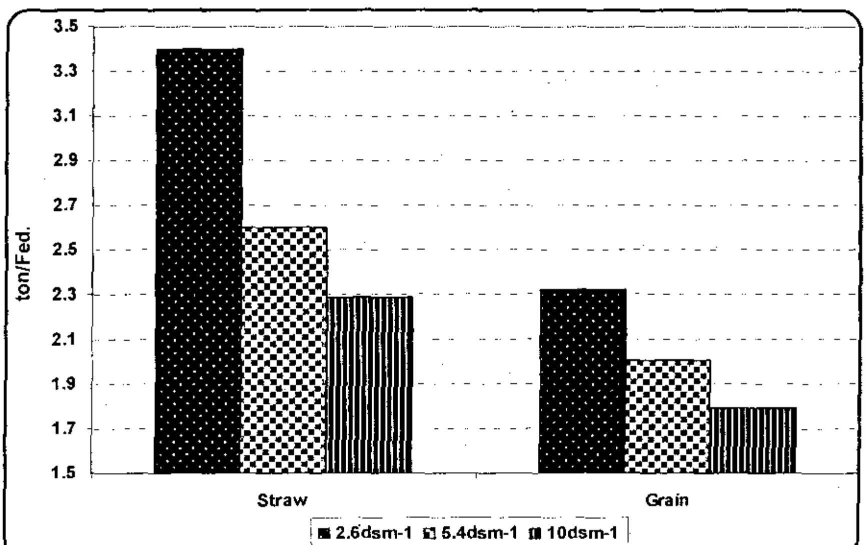

Fig. (1): The relation between the mean values of the grain and straw yield of wheat with the salinity of the three soils

Effect of nitrogen fertilization :

Table (2) and Fig (2) showed that the grain yield of wheat had significantly increased with increasing nitrogen fertilization during the two growing seasons. The mean values recorded relative increase by about 489% with N_{140} as compared to that treatment without N application, over the two seasons. Similar results were obtained by Sarhan and Abdel Salam (1999), FAO (2000), Amer (2005) and Zeidan et al. (2005). Table (2) indicated that there were highly significantly effects on grain yield and straw yield of wheat during the two growing seasons due to the interaction between nitrogen fertilization (N) and soil salinity (S) where the grain yield were recorded highest mean values 23.126, 20.406 and 18.499 ardbfed.$^{-1}$ by N_{140} application for non saline soil , medium saline soil and high saline soil in two seasons (2005/2006 & 2006/2007) respectively. Similar results were obtained by Khalifa (2002), El-Naggar (2003) and El Naggar and El Ghamry (2004).Table (2) showed that the dry weight of shoots at booting stage had significantly increased with increasing nitrogen fertilization during the two seasons. The mean values, over the two seasons, recorded relative increase of about 335.2% by N_{140} as compared to that treatment without N application. The obtained results similar with those obtained by Amer (2005) and Zeidan et al. (2005).Table (2) showed that the dry weight of grain yield had significantly increased with increasing nitrogen fertilization during the two seasons. The mean values over the two seasons recorded relative increase of about 376.7% by N_{140} as compared to that treatment without N application. Similar results were reported by Amer (2005) and Zeidan et al. (2005).Table (2) showed that the dry weight of straw yield had significantly increased with increasing nitrogen fertilization during the two seasons. The mean values, over the mean of two the seasons recorded relative increase of about 240.6% by N_{140} as compared to that treatment without N application. Similar results were obtained by Amer (2005) and Zeidan et al. (2005).Table (2) indicated that there were highly significant effects on the dry weight of shoots at booting stage, dry weight of grain and straw yield of wheat during the two growing seasons due to the interaction between nitrogen fertilization (N) and soil salinity (S).The dry weight of shoots at booting stage, dry weight of grain and straw yield of wheat recorded highest mean values with N_{140} application under different soil salinity in two seasons (2005/2006&2006/2007) (Fig 2,3). Similar results were obtained by Sarhan and Abdel Salam (1999).

Table (2):Response of yield and dry weight of wheat to nitrogen fertilization and interactions effect in the two growing seasons (2005/2006 & 2006/2007)

Yield		Season	Main effect of Nitrogen fertilization (Kg fed.$^{-1}$)					F_{test}	$LSD_{0.05}$	$LSD_{0.01}$	NxS
			0	40	80	120	140				
Grain (ardb fed.$^{-1}$)		1st	3.57	9.41	15.15	19.01	20.68	**	0.096	0.129	**
		2nd	3.46	9.50	15.41	19.21	20.76	**	0.039	0.053	**
		Mean	3.52	9.45	15.27	19.11	20.72				
Relative variation (%)			-	+169	+ 334	+ 443	+489				
Straw (ton fed.$^{-1}$)		1st	1.217	2.282	2.705	3.676	3.975	**	0.005	0.006	**
		2nd	1.093	2.323	2.756	3.543	4.008	**	0.006	0.009	**
		Mean	1.155	2.303	2.731	3.610	3.992				
Relative variation (R.V%)			-	+ 99	+136	+ 213	+246				
Dry weight (ton fed.$^{-1}$)	Shoots	1st	0.577	0.718	2.183	2.342	2.765	**	0.008	0.028	**
		2nd	0.570	0.752	2.041	2.034	2.227	**	0.011	0.037	**
		Mean	0.574	0.735	2.112	2.188	2.496				
	R.V. %		-	+28	+ 268	+ 282	+338				
	Grain	1st	0.693	1.232	1.991	2.495	2.718	**	0.177	0.193	**
		2nd	0.455	1.247	2.018	2.522	2.754	**	0.228	0.237	**
		Mean	0.574	1.240	2.005	2.509	2.736				
	R.V. %		-	+116	+ 249	+ 337	+377				
	Straw	1st	1.063	2.051	2.434	3.308	3.575	**	0.085	0.108	**
		2nd	1.047	2.081	2.480	3.195	3.611	**	0.163	0.219	**
		Mean	1.055	2.066	2.457	3.252	3593				
	R.V. %		-	+96	+133	+208	+241				

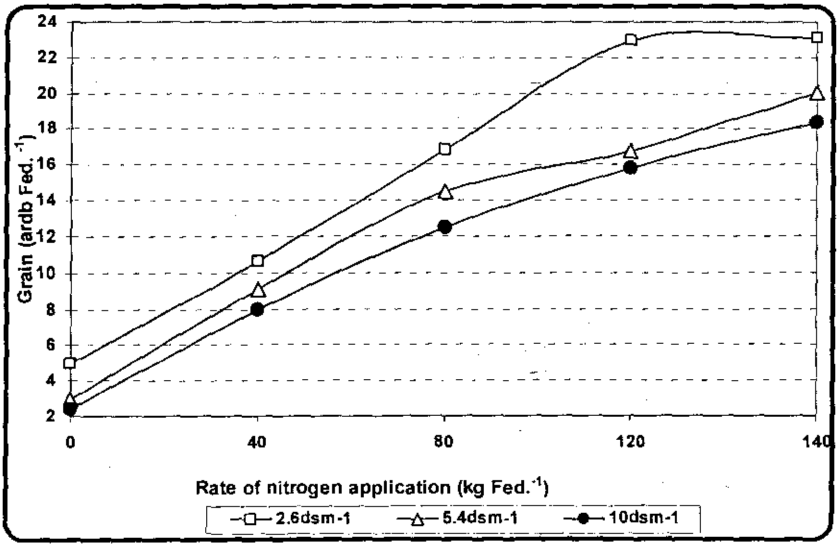

Fig. (2): Grain yield of wheat as affected by nitrogen application under different soil salinity

Table (2) and Fig (3) showed that straw yield of wheat had significantly increased with increasing nitrogen fertilization during the two seasons of the study. The mean values recorded relative increase by about 245.6%. by N140 as compared to that treatment without N application.

It's notes that, the slope of response curve for grain yield with N-levels has reach saturation with non saline soils slope = 0 at about 120kg N fed-1 .Where as, in the medium and high saline sodic soils , the curve increasing steadily to 140 N fed-1 dose . This reveal that , the grain yields still response between application of N 120 &140 rates under medium and high saline sodic soils . And also straw yield take the same effect under different soil salinity

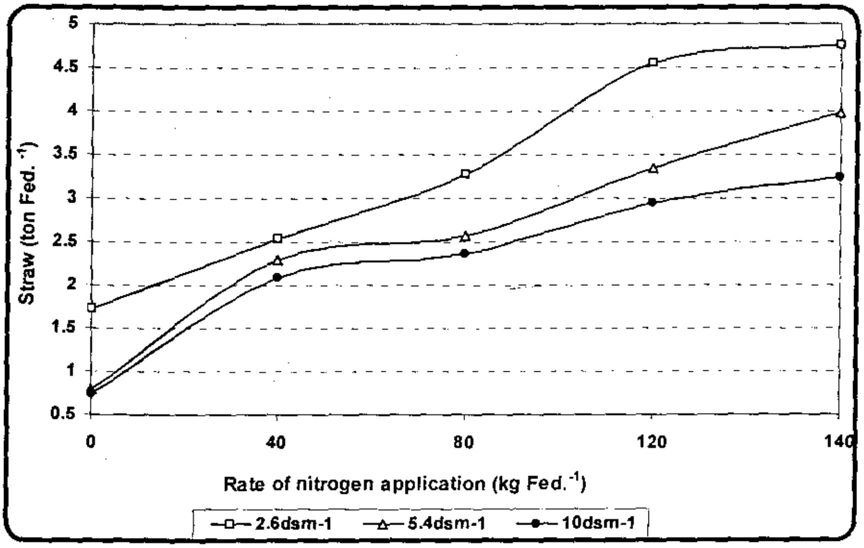

Fig. (3): Straw yield of wheat as affected by nitrogen application under different soil salinity

Effect of biofertilization :

Table (3) and Fig (4) showed that the grain yield of wheat was highly significantly increased due to biofertilizer application. The mean values over the two seasons, recorded increases by about 9.5 %, 10.1% and 11.5% with nitrobien (BNF), phosphorien (BDP) and BNF+BDP respectively, as compared to treatment without biofertilizer application. Inoculation with biofertilizer was more benefit for wheat where caused remarkable increase in yield and yield components, by increasing the nutrient uptake, photosynthesis rate and translocation. Similar results were obtained by El Sebsy and Sharma (2003), Ibrahim et al.(2004), Zeidan et al. (2005), El Sirafy (2006) and Khan and Zaidi (2007).

Table (3) and Fig.(5) showed that the straw yield had significantly increased due to biofertilizer application. The mean values over the two seasons, recorded increases by about 4.0 %, 4.83% and 7.66% with nitrobien (BNF), phosphorien (BDP) and BNF+BDP respectively, as compared to treatment without biofertilizer application. Similar results were obtained by Attallah and El Hawary et al.(2002), Abd El-Hameed (2002), El Sebsy and Abd El Maaboud (2003), Sharma (2003), Ibrahim et al.(2004), El Sirafy (2006) and Khan and Zaidi (2007).Table (8) indicated that there were highly significant effects on the grain and straw yields of wheat during the two growing seasons due to the interaction between treatments used in the experiments in the two seasons (2005/2006 & 2006/2007). Similar results were obtained by Sharif et al.(2000). El Naggar and El Ghamry (2004)

Table (3) showed that dry weight of shoots at booting stage of wheat were highly significantly increased due to biofertilizer application during the two seasons of the study. The mean values, over the two seasons, recorded increases by about 2.1 %, 2.1% and 4.9% with nitrobien (BNF), phosphorien (BDP) and BNF+BDP respectively, as compared to that treatment without biofertilizer application. Similar results were obtained by Galal et al. (2000) and Zeidan et al. (2005).Table (3) showed that the dry grain yield had significantly increased due to biofertilizer application during the two seasons of the study. The mean values over the two seasons recorded increases by about 9.0 %, 9.6% and 13.4% with nitrobien (BNF), phosphorien (BDP) and BNF+BDP respectively, as compared to treatment without biofertilizer application. Similar results were obtained by Sabry et al.(2000), Galal et al. (2000) and Zeidan et al. (2005).Table (3) showed that dry straw yield of wheat was highly significantly increased due to biofertilizer application during the two seasons of the study. The mean values over the two seasons recorded increased by about 1.2 %, 1.4% and 13.1% with nitrobien (BNF), phosphorien (BDP) and BNF+BDP respectively, as compared to that treatment without biofertilizer application. Similar results were obtained by Sabry et al.(2000), Galal et al. (2000) Muhammad.et al. (2004), Zeidan et al. (2005) and El Garhi et al. (2007).

Table (3) indicated that there were highly significant effects on dry weight of wheat shoots at booting stage during the two growing seasons due to the interaction between treatments used in the experiments, except the interaction between BxS in 1st season were it was non significant .Table (3) indicated that there were highly significant effects on dry grain yield of wheat during the two growing seasons due to the interaction between treatments used in the experiments.

Table (3) indicated that there were highly significant effects on dry straw yield of wheat during the two growing seasons due to the interaction between treatments used in the experiments, except the interaction between BxNxS in two seasons were significant however the interaction between BxS were non significant in the 2nd season (2006/2007).

Table (3):Response yield and dry weight of wheat to biofertilization and the interactions effect in the two growing seasons (2005/06 &2006/07)

Main effect of Biofertilizer	Grain (ardb fed.$^{-1}$)		Straw (ton fed.$^{-1}$)		Dry weight (ton fed.$^{-1}$)					
					Shoots		Grain		Straw	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control	12.508	12.756	2.633	2.586	1.655	1.507	1.639	1.697	2.370	2.411
Nitrobien	13.819	13.843	2.702	2.726	1.700	1.527	1.816	1.819	2.429	2.410
Phosphorien	13.855	13.966	2.675	2.796	1.706	1.521	1.820	1.835	2.407	2.443
BNF+BDP	14.075	14.106	2.649	2.970	1.771	1.545	1.938	1.845	2.739	2.668
$F_{test.}$	**	**	**	**	*	**	**	**	**	**
$LSD_{0.05}$	0.08	0.04	0.01	0.001	0.03	0.01	0.15	0.06	0.07	0.147
$LSD_{0.01}$	0.11	0.07	0.02	0.002	0.04	0.02	0.20	0.26	0.09	0.195
BxS	**	**	**	**	ns	**	**	**	**	ns
BxN	**	**	**	**	**	**	**	**	**	**
BxNxS	**	**	**	**	**	**	**	**	**	*

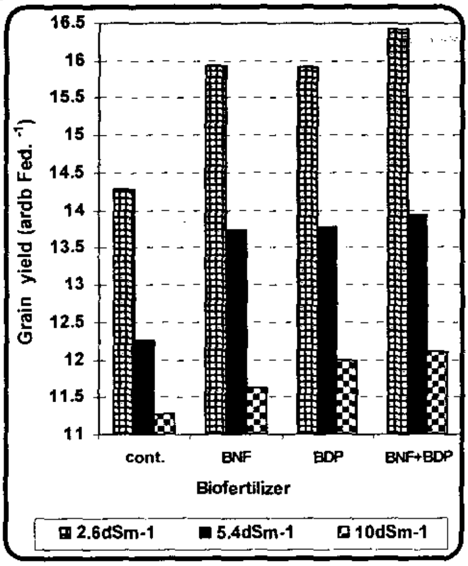

Fig. (4): Grain yield of wheat as affected by biofertilizer under different soil salinity

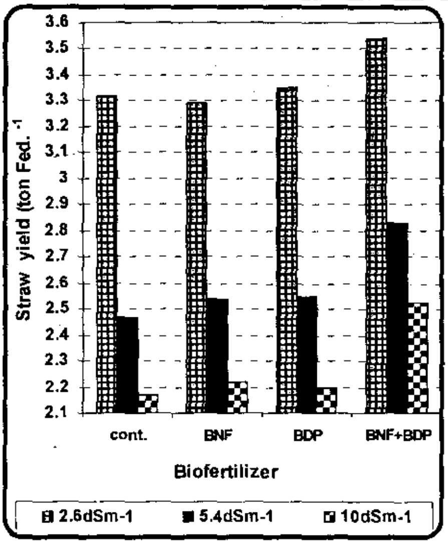

Fig. (5):Straw yield of wheat as affected by biofertilizer under different soil salinity

Nitrogen uptake:

With regard to data in Table (4) increasing soil salinity decreased N uptake of wheat grains by about 13.63% and 25.14% under medium saline soil and high saline sodic soil, respectively. Table (4) showed that N uptake by grain increased by increasing N-level up to 140kgfed.$^{-1}$, where the highest relative variation 1018.52% as compared to that treatment without N application. Similar results were obtained by Amer (2005). It has been reported that a good supply of nitrogen for the plant is important also for the uptake of the other nutrients, (FAO, 2000).Table (4) revealed that increasing soil salinity (from normal soil to medium saline soil and high saline sodic soil) decreased N uptake straw, by about 23.05% and 32.84% under medium saline soil and high saline soil respectively.

Table (4) showed that N uptake straw increased by increasing N-level up to 140kg fed.$^{-1}$, where the highest relative variation reached 367.76% as compared to that treatment without application. Similar results were reported by Amer (2005).Data in Table (4) revealed that increasing soil salinity from 2.6dS m^{-1} to 5.4dSm^{-1} and 10dSm^{-1} decreased N uptake by wheat plants at booting stage, by about 8.98%

and 15.25% under medium saline soil and high saline soil, respectively. Table (4) showed that N uptake of wheat plants at booting stage increased by increasing N-level up to 140kg fed^{-1}, where the highest relative variation reached 488.02% as compared to the treatment without application. Similar results were found by Amer (2005).

Table (4) indicated that biofertilization has a high effect on N uptake by grain. The highest relative variation were 13.75%, 14.58 and 18.54% with nitrobien (BNF), phosphorien (BDP) and BNF+BDP application respectively. These results were supported by Galal et al. (2000). Panwar and Singh, (2000), Sharma (2003), and El Maddah et al. (2005).Table (4) indicated that biofertilization has a high effect on N uptake by straw. The highest relative variation were 3.28%, 4.98% and 16.52% with nitrobien (BNF), phosphorien (BDP) and (BNF+BDP) application respectively. Similar results were reported by Galal et al. (2000), Panwar and Singh, (2000) and El Maddah et al. (2005).It can concluded that Inoculation with BNF+BDP was more benefit for wheat where caused remarkable increase in N-uptake in salt affected soil.

Recovery of nitrogen by yield of wheat:

Table (5) and Fig (6 and 7) revealed that increasing soil salinity from $2.6dSm^{-1}$ to $5.4dSm^{-1}$and $10dSm^{-1}$ decreased nitrogen recovery of wheat yield, by about 3.37% and 15.64% under medium saline soil and high saline sodic soil, respectively. Table (5) and Fig (6) showed nitrogen recovery of wheat yield, decreased by increasing N-level up to 140kg $fed.^{-1}$, where the highest relative variation reached 19.78% compared with 40kgN $fed.^{-1}$as the control. Table (5) and Fig (7) indicated that biofertilization has a high effect on nitrogen recovery of wheat yield. The highest relative variation were 15.09%, 16.08 and 22.60% nitrobien (BNF), phosphorien (BDP) and BNF+BDP as compared to that treatment without biofertilizer application, respectively.

It's of interesting to note striking decreased nitrogen recovery of wheat yield with increasing N-fertilizer application the negative slope, where the biofertilizer gave the rather positive slope. it is obvious that inoculation, in general, enhanced the N fertilizer utilized by yield of wheat plants. Where crop plants are able to use about 50% of the applied fertilizer N, while 25% is lost from the soil–plant system through leaching, volatilization and denitrification.

Table (4):Nitrogen uptake of grain and straw yield (kg fed.$^{-1}$) of wheat in the two growing seasons (2005/2006 and 2006/2007)

Treatment		Grain				Straw			
		1st	2$_{nd}$	Mean	Relative variation (%)	1st	2$_{nd}$	Mean	Relative variation (%)
Soil salinity(dSm^{-1})	2.6	39.90	40.32	40.29	0.0	11.57	11.50	11.54	-
	5.4	34.62	34.84	34.80	-13.63	8.77	8.99	8.88	-23.05
	10	30.02	30.27	30.16	-25.14	7.75	7.74	7.75	-32.84
Main effect of N-application (kg fed.$^{-1}$)	0	5.16	5.09	5.13	0.00	3.01	3.07	3.04	0.00
	40	22.95	23.18	23.07	+ 349.7	7.59	7.78	7.69	+ 152.9
	80	38.83	39.49	39.16	+ 663.4	9.24	9.41	9.33	+ 206.9
	120	50.08	49.31	49.70	+ 868.8	12.88	12.47	12.68	+ 317.11
	140	57.20	57.56	57.38	+ 1018.5	14.10	14.33	14.22	+ 367.8
Main effect of Bio-fertilization	0	30.92	31.75	31.34	0.00	8.79	8.89	8.84	0.00
	BNF	35.76	35.53	35.65	+ 13.75	9.17	9.08	9.13	+ 3.28
	BDP	35.71	36.1	35.91	+ 14.58	9.21	9.35	9.28	+ 4.98
	BNF +BDP	37.1	37.2	37.15	+ 18.54	10.29	10.31	10.30	+ 16.52

Table (5):Recovery of nitrogen (%) by wheat yield, in the two growing seasons (2005/2006 and 2006/2007)

Treatments		Recovery of nitrogen (%) by wheat yield			Relative variation (%)
		1st	2$_{nd}$	Mean	
Soil salinity(dSm^{-1})	2.6	52.29	53.31	52.80	-
	5.4	50.83	51.21	51.02	-3.37
	10	44.31	44.76	44.54	-15.64
Main effect of N-application (kg fed.$^{-1}$)	0	-	-	-	-
	40	55.94	57.01	56.48	-
	80	49.88	50.92	50.40	-10.76
	120	45.66	45.59	45.62	-19.23
	140	45.09	45.52	45.31	-19.78
Main effect of Bio-fertilization	0	42.85	44.34	43.59	-
	Nitrobien	50.21	50.14	50.17	+ 15.09
	Phosphorien	50.23	50.98	50.60	+ 16.08
	BNF+BDP	53.29	53.58	53.44	+ 22.60

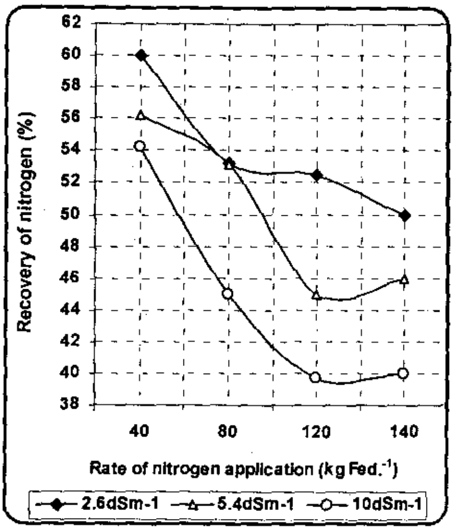

Fig. (6): Recovery of nitrogen (%) by wheat as affected by rate of N- application under different soil salinity

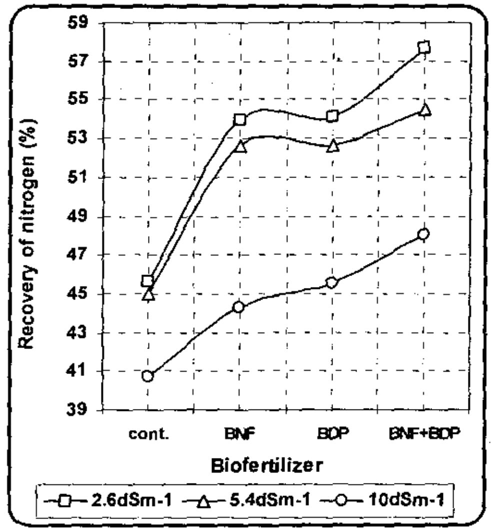

Fig. (7): Recovery of nitrogen (%) by wheat as affected by bio-fertilizer under different soil salinity

Nitrogen use efficiency of wheat:

Table (6) revealed that increasing soil salinity from 2.6dSm^{-1} to 5.4dsm^{-1} increased NUE by about 1.89% on the other hand NUE decreased by about 5.34% by increasing soil salinity from 2.6dSm^{-1} to 10dSm^{-1} .Table (6) showed nitrogen use efficiency (NUE) of wheat decreased by increasing N-level up to 140kg fed.$^{-1}$, where the highest relative variation 22.14% compared with 40kgN fed.$^{-1}$ as the control. Similar results were obtained by Amer (2005).Table (6) indicated that biofertilization has a high effect on nitrogen use efficiency (NUE) of wheat. The highest relative variation were 6.77%, 8.14 and 11.30% with nitrobien, phosphorien and nitrobien + phosphorien as compared to that treatment without application, respectively. it is obvious that inoculation with bio nitrogen fixation as nitrobien and bio dissolved phosphour as phosphorien (BNF+ BDP), enhanced the N fertilizer utilized by yield of wheat plants. Similar results were found by Galal et al. (2000).

Crude protein content in grains

Table (7) revealed that increasing soil salinity from 2.6dSm^{-1} to 5.4dSm^{-1} and 10dSm^{-1} decreased crude protein content of wheat, by about 0.44% and 1.23% under medium saline soil and high saline sodic soil respectively. Table (7) showed crude protein content in grains of wheat increased by increasing N-level up to 140kg fed.$^{-1}$, where the highest relative variation reached 88.56% as compared to the treatment without application. Similar results were reported by Abd EL Hadi (2004) and Amer (2005).

Table (7) indicated that biofertilization has a high effect on crude protein content in grains of wheat. The highest relative variation were 2.66%, 3.66 and 5.68% with nitrobien (BNF), phosphorien (BDP) and BNF+BDP as compared without application, respectively. Inoculation of cereal seed with nitrogen fixing bacteria such as *Azotobacter* pluses phosphate solubilising bacteria has been reported to decrease fertilizer needs and improve the crude protein, Reddy et al. (2003).

Table (6): Nitrogen use efficiency of wheat in the two growing seasons (2005/2006 and 2006/2007).

Treatments		Nitrogen use efficiency of wheat (Kg grains / Kg N)			Relative variation (%)
		1st	2nd	Mean	
Soil salinity(dSm^{-1})	2.6	20.90	21.45	21.18	100%
	5.4	21.54	21.61	21.58	+ 1.89
	10	18.86	21.23	20.05	- 5.34
Main effect of N-application (kg fed.$^{-1}$)	0	-	-	-	-
	40	22.13	25.28	23.71	-
	80	21.83	22.39	22.11	-6.75
	120	19.38	19.54	19.46	-17.92
	140	18.40	18.52	18.46	-22.14
Main effect of Bio-fertilization	0	17.82	21.47	19.65	-
	Nitrobien	20.97	20.98	20.98	+ 6.77
	Phosphorien	21.13	21.37	21.25	+ 8.14
	BNF+BDP	21.82	21.92	21.87	+ 11.30

Table (7): Protein content (%) of wheat grains in the two growing seasons (2005/2006 and 2006/2007).

Treatments		Protein content of wheat grains (%)			Relative variation (%)
		1st	2nd	Mean	
Soil salinity (dSm^{-1})	2.6	11.33	11.36	11.35	0.0
	5.4	11.29	11.30	11.30	-0.44
	10	11.21	11.21	11.21	-1.23
Main effect of N-application ($kg\ fed.^{-1}$)	0	6.99	6.98	6.99	0.00
	40	11.58	11.60	11.59	+ 65.81
	80	12.15	12.15	12.15	+ 73.82
	120	12.49	12.52	12.51	+ 78.97
	140	13.16	13.19	13.18	+ 88.56
Main effect of Bio-fertilization	0	10.92	10.92	10.92	0.00
	Nitrobien	11.36	11.06	11.21	+ 2.66
	Phosphorien	11.30	11.33	11.32	+ 3.66
	BNF+BDP	11.53	11.55	11.54	+ 5.68

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الملخص العربي

استجابة محصول القمح للتسميد الأزوتى والحيوي والنيتروجين الممتص تحت ظروف الأراضي المتأثرة بالأملاح

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- تشير النتائج إلى تناقص عالى ا لمعنوية لمحصول الحبوب والقش بزيادة ملوحة التربة،حيث بلغ معدل التناقص لمحصول الحبوب ١٣,٧٤%، ٢٤,١١% لكل من الأراضي متوسطة الملوحة والصودية عالية الملوحة مقارنة بالأراضي غيرا لملحية.

- تبين من النتائج زيادة معنوية لمحصول الحبوب والقش مع إضافة الأزوت حتى مستوى ١٤٠كجم/فدان حيث سجل محصول الحبوب ٢٣,١٣، ٢٠,٤١، ١٨,٥أردب/فدان لكل من الأرضي غير الملحية و الأراضي

متوسطة الملوحة والصودية العالية الملوحة بالترتيب ،زادت المادة الجافة في مرحلتي النضج والحمل زيادة معنوية نتيجة التفاعل بين التسميد النيتروجيني والملوحة وبلغت أقصاها مع إضافة ١٤٠كجم ن/فدان.

- تشير النتائج إلى زيادة معنوية لمحصول الحبوب والقش بإضافة التسميد الحيوي.

- تناقص النيتروجين المستعاد بمعدل٣,٣٧%، ١٥,٦٤% لكل من الأراضي متوسطة الملوحة والعالية الملوحة مقارنة بالأراضي غير الملحية أيضا تناقص النيتروجين المستعاد بمعدل ١٩,٧٨ % بزيادة الأزوت المضاف حتى١٤٠ كجم ن/فدان، مقارنة بإضافة٤٠كجم ن/فدان ولكن زاد النيتروجين المستعاد بإضافة التسميد الحيوي ، حيث بلغ معدل زيادة ١٥,٠٩%،١٦,٠٨% ،٢٢,٦٠% بإضافة نيتروبينBNF، فوسفورينBDP، نيتروبين+ فوسفورين بالترتيب.

- تناقصت كفاءة إستخدام النيتروجين لكل من الأراضي عالية الملوحة، مقارنة بالأراضي غير الملحية،ومن ناحية أخرى زادت كفاءة إستخدام النيتروجين بمعدل١,٨٩% لكل من الأراضي متوسطة الملوحة والعالية الملوحة مقارنة بالأراضي غير الملحيةايضا تناقصت كفاءة إستخدام النيتروجين بمعدل ٢٢,١٤ % بزيادة الأزوت المضاف حتى١٤٠ كجم ن/فدان، مقارنة بإضافة٤٠كجم ن/فدان بينما زادت كفاءة استخدام النيتروجين بإضافة التسميد الحيوي ،وأيضا تناقص محتوى الحبوب من البروتين لكل من الأراضي متوسطة الملوحة والعالية الملوحة مقارنة بالأراضي غير الملحية بينما تزايد محتوى الحبوب من البروتين حتى١٤٠ كجم ن/فدان، مقارنة بدون إضافة، وزيادة محتوى الحبوب من البروتين بإضافة التسميد الحيوي .

-ونستخلص من نتائج هذه الدراسة التوصية التالية : للحصول على أعلى محصول من القمح لصنف سخا ٩٤ يمكن أن نوصى بإضافة ١٢٠كجم أزوت/فدان مع إضافة نيتروبين+ فوسفورين (BNF+BDP) تحت ظروف الأراضي غير الملحية؛ وإضافة ١٤٠كجم أزوت/فدان مع إضافة نيتروبين+ فوسفورين(BNF+BDP) تحت ظروف الاراضى ذات الملوحة المتوسطة ،والعالية الملوحة بالترتيب.