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EFFECT OF SALINITY, MOISTURE AND FARMYARD MANURE ON YIELD AND NITROGEN UPTAKE OF WHEAT PLANTS GROWN ON A CALCAREOUS SOIL.

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ABSTRACT

A pot experiment was carried out in the green house of Soils and Water Department, Faculty of Agriculture, Al-Azhar University, during the winter of season (2009). The current work was carried out to study the effect of irrigation water salinity, farmyard manure levels and moisture content on the yield and nitrogen (content and uptake) of wheat grains of wheat plant grown on a calcareous soil**.** Wheat plant (*Triticum aestivum*, L.) Sakha93Variety, used as an indicator plant to experiment treatments.

Four salinity levels of irrigation water were prepared (0.43 (Control), 1.56, 3.12 and 6.25 dSm^{-1}) under different moisture contents (100%, 75% and 60%) of field capacity determined by weight and four organic matter levels (0% (control), 1%, 2% and 4%) farmyard manure(FYM). Twenty grains were sown in each pot and the treatments were three replicates including control. After 15 days, the pots were thinned to 10 seed lings. The obtained results showed that yield of both grains and straw, and nitrogen (content and uptake) in grains were significantly decreased with increasing salinity levels. Increasing of farmyard manure application rates up to 2% increased significantly yield of both grains and straw, and nitrogen (content and uptake) of grains. Yield of both grains and straw and nitrogen (content and uptake) of grains were significantly increased with increasing moisture levels regardless effect of salinity and farmyard manure.

Keywords: Calcareous soil – irrigation water salinity -soil moisture - farmyard manure- nitrogen uptake – wheat.

INTRODUCTION

Salinity is one of the major environmental factors reducing plant growth and productivity worldwide in arid and semi – arid regions (Munns, 2002). Salinity is one of the most serious factors limiting crops production, especially the sensitive ones(Zadeh and Naeini, 2007). Currently, high soil salinity affects the agriculture production in a large proportion in the world's territorial areas (Zhang and Hodson, 2001). Salt affected soils can be managed by reclamation, but due to scarcity of good quality water, low soil permeability and high cost amendments this approach is not feasible on large scale (Qureshi *et al*. 1990).

Organic manure and moisture % are the main factors to improve the saline soil. Wheat, the most important cereal crop, can be classified as a semi tolerant crop to salinity. Organic matter is considered as an important source of plant nutrients, beside it improves the chemical and physical properties of soils, particularly sandy and calcareous soils, subsequently the growth and uptake of nutrients. Organic matter improves soil properties by enhancing redistribution of soil pores (Tate, 1987), which improved water holding capacity aeration improved soil physical properties and nutrient availability (DeLuca, T. H. and D. K. DeLuca, 1987). Also water is one of the limiting factors for agricultural development in developing countries in order to meet the growing demand of the increasing population. In most soils, optimum growth of grown plants occurs when the water retained in soils is kept near the field capacity (to be more easily taken up by plant) or at least did not approach the wilting point (plant suffer from drought), in other words, increasing A.W is a preferable. (Chauhan and Singh, 1993), in field experiment studied that on sandy loam of wheat was irrigated with water having salinity levels of 2-16 dSm^{-1}. The current work was carried out to study the effect of irrigation water salinity, farmyard manure levels and moisture content on the yield and nitrogen (content and uptake) of wheat grains grown on a calcareous soil.

MATERIALS AND METHODS

Calcareous soil samples were selected from EL-Nobaria region ($CaCO_3$ 30%) Cairo Alexandria, Desert Road, and taken from upper surface layer (0 – 30 cm). Soil samples were air dried. And analyzed to determine some physical and chemical characteristics were estimated and given in Table 1. Some samples were air dried, softly crushed and passed through a 2 mm sieve. Some physical and chemical properties of the studied soil were determined according to Klute (1982) and Page *et al.* (1982) respectively. Organic matter was used as farmyard manure (FYM). The farmyard manure was taken from station of Animal production, Faculty of Agriculture, Al-Azhar University. Some chemical characteristics of the organic manure are given in Table 2. an experiment was carried out in green house of Soils and Water Department, Faculty of Agriculture, Al-Azhar University (Nasr city, Cairo, Egypt) during season (2009), Wheat plant (*Triticum aestivum*, L. Variety, Sakha93) used as an indicator to experiment treatments. Plastic pots of 25 cm in side diameter and 30cm depth. Pots were filled with 5.0 kg of calcareous soil sample. The cultivated plants were fertilized according to the general recommendations of Ministry of Agriculture. Twenty grains were sown in each pot and the treatments were three replicates including control. After 15 days, the pots were thinned to 10 seed lings. Completely randomized block design was used

Table 1: Some physical and chemical characteristics of the used soil.

Physical properties									
Particle size distribution (%)				Texture Class	O.M %	$CaCO_3$ %	Moisture content % at :		
Coarse Sand	Fine Sand	Silt	Clay				F.C	W.P	A.W
9.56	57.96	24.98	7.5	Sandy Loam	1.43	30	23.21	9.27	13.94

Chemical Properties									
EC dSm^{-1}	pH	Soluble Cations meq L^{-1}				Soluble anions meq L^{-1}			
		Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	Co_3^{--}	HCO_3^{-}	CL^{-}	SO_4^{--}
2.61	8.11	15.21	3.76	6.92	1.23	0.00	1.83	2.50	22.79

Table 2: Chemical properties of farmyard manure used:

pH (1:10)	EC dSm^{-1} (1:10)	O.M. (%)	O.C. (%)	C/N ratio	Total macronutrient (%)		
					N	P	K
7.62	6.89	42	24.4	17.06	1.43	0.78	1.99

Three salinity levels of irrigation water were prepared (0.43 (Control), 1.56, 3.12 and 6.25 dSm^{-1} pure NaCL salt) under different moisture contents in a green house. Irrigation was practical to maturity when the soil water depletion reached (100%, 75% and 60%) of field capacity determined by weight and four organic matter levels (0%, 1%, 2% and 4%) farmyard manure(FYM) The plant material was oven dried at 70° C to constant weight ground and kept in paper pages for chemical analysis.

RESULTS AND DISCUSSION

Effect of salinity, moisture and farmyard manure on grain and straw yield:

The results presented in Tables 3 and 4 reveale that, grain and straw yield of wheat significantly decreased by increasing salinity levels. This was true with all rates of water salinity, where it reached for grain (13.11, 11.86, 10.26 and 9.16 g pot^{-1}) at salinity levels (Control, 1.56, 3.12 and 6.25 dSm^{-1}), respectively. The corresponding values for straw were (15.91, 14.85, 12.75 and 11.25 g pot^{-1}) at the same levels of salinity. The excessive salt appears to affect the growth and wheat yield by restricting nutrients uptake to extent That a deficiency take place this may be due to a possibility that plants grown under saline condition utilize energy for osmotic adjustment process at the expense of growth and the most important factor which is the high soil water potential hence the water flow from soil to plants very much limited under saline water. These results were in accordance with the findings of Sarhan and Abd El-Salam (1999) they found that, the growth and grain yield of wheat was decreased with the increasing of soil salinity levels .In this respect Mostafa (2001), Hassan and Mostafa (2002) and Kant *et al.*(2007) reported that increasing salinity levels of irrigation water significantly decreased the dry matter yield of Barley plants.

Concerning to the results effect of farmyard manure on grain and straw yield in Tables 3 and 4 show that, application of Farmyard manure significantly increased yield of both grain and straw of wheat plant up to 2 %., where it reached for grain (9.97, 10.85, 11.96 and 11.62 g pot^{-1}) with farmyard manure levels (0, 1, 2 and 4 %), respectively. The corresponding values for straw were (11.58, 13.90, 15.01 and 14.27 g pot^{-1}) at the same levels of farmyard manure. Regardless the treatment either moisture , water salinity it seem that increasing the rate of farmyard manure content up to rate 2% lead to increase grain and straw yield of wheat plant , but the rate of 4% content relatively decease of grain and straw yield . the increasing of grain and straw that caused by increasing the rate of farmyard manure up to 2% may be attributed to one or more of the following reason to reducing soil salinity and /or the increase in the availability of certain plant nutrients due to the decomposition of organic manure. The results consistent with those obtained by Singh and Agarwal (2001), and Uyanoz *et al.* (2006) they found that, the application of farmyard manure increased the grain yield of wheat plants over the control.

Table 3:Grain yield (g pot^{-1}) of wheat plant as affected by levels of salinity, farmyard manure and moisture.

Salinity (S) dSm^{-1}	Moisture (M) %	Grain yield (g pot^{-1}) Farmyard manure (FYM) %				
		0	1	2	4	Mean
Control	100	12.77	13.85	14.45	14.00	13.77
	75	12.03	12.99	13.62	13.44	13.02
	60	11.54	12.54	13.11	13.01	12.55
Mean		**12.11**	**13.13**	**13.73**	**13.48**	**13.11**
1.56	100	10.99	11.73	13.54	13.01	12.32
	75	10.45	11.23	12.95	12.77	11.85
	60	10.02	10.85	12.61	12.11	11.40
Mean		**10.49**	**11.27**	**13.03**	**12.63**	**11.86**
3.12	100	9.42	10.54	11.63	11.33	10.73
	75	8.89	9.95	11.20	10.75	10.20
	60	8.43	9.65	10.85	10.44	9.84
Mean		**8.91**	**10.05**	**11.23**	**10.84**	**10.26**
6.25	100	8.77	9.23	10.12	9.99	9.53
	75	8.33	8.95	9.85	9.44	9.14
	60	7.94	8.66	9.54	9.14	8.82
Mean		**8.35**	**8.95**	**9.84**	**9.52**	**9.16**
M × FYM Means	100	10.49	11.34	12.44	12.08	11.59
	75	9.93	10.78	11.91	11.60	11.05
	60	9.48	10.43	11.53	11.18	10.65
FYM Means		**9.97**	**10.85**	**11.96**	**11.62**	**11.10**
LSD at 5% level						
Salinity (S)			**0.042**			
Moisture (M)			**0.036**			
Farmyard manure (FYM)			**0.042**			
S × M			**0.073**			
S × FYM			**0.085**			
M × FYM			**0.073**			
S × M × FYM			**0.146**			

In this respect, Sheng Mao *et al.*(2006*)* showed that (FYM) supplies some amount of nutrient such as N and K which tend to balance crop requirement and result in improving grain production. The decreased of grain and straw that caused by increasing the rate of farmyard manure up to 4% may be attributed to one or more of the following reason: (1) the high concentration of acids released during the decomposition of farmyard manure which damage the fine roots.

Table 4:Straw yield (g pot^{-1}) of wheat plant as affected by levels of salinity, farmyard manure and moisture.

Salinity (S) dSm^{-1}	Moisture (M) %	Straw yield (g pot^{-1}) Farmyard manure (FYM) %				
		0	1	2	4	Mean
Control	100	14.01	16.53	17.66	16.93	16.28
	75	13.85	16.02	17.06	16.53	15.87
	60	13.43	15.85	16.81	16.21	15.58
Mean		**13.76**	**16.13**	**17.18**	**16.56**	**15.91**
1.56	100	12.89	15.63	16.77	15.98	15.32
	75	12.34	15.12	16.16	15.55	14.79
	60	11.91	14.79	15.87	15.13	14.43
Mean		**12.38**	**15.18**	**16.27**	**15.55**	**14.85**
3.12	100	10.98	13.36	14.63	13.89	13.22
	75	10.56	12.77	14.12	13.42	12.72
	60	10.31	12.31	13.67	12.99	12.32
Mean		**10.62**	**12.81**	**14.14**	**13.43**	**12.75**
6.25	100	9.97	11.77	12.89	11.98	11.65
	75	9.52	11.50	12.47	11.55	11.26
	60	9.21	11.11	12.03	11.04	10.85
Mean		**9.57**	**11.46**	**12.46**	**11.52**	**11.25**
M × FYM Means	100	11.96	14.32	15.49	14.70	14.12
	75	11.57	13.85	14.95	14.26	13.66
	60	11.22	13.52	14.60	13.84	13.29
FYM Means		**11.58**	**13.90**	**15.01**	**14.27**	**13.69**
LSD at 5% level						
Salinity (S)			**0.041**			
Moisture (M)			**0.035**			
Farmyard manure (FYM)			**0.041**			
S × M			**0.071**			
S × FYM			**0.082**			
M × FYM			**0.071**			
S × M × FYM			**0.142**			

Consequently the absorption of water and nutrients decreased. (2) The formation and accumulation of some gases, e.g., methane CH_4, ethylene C_2H_4 and carbon dioxide Co_2 as a result of manure decomposition especially under unsuitable aeration conditions. These gases are known to reduce root elongation as reviewed by Van Cleempant and El- Sabaay (1986). C. F. El-Rahman, M. I. (1996). (Effect of soil moisture on the availability of some macro and micro elements in calcareous soils of Egypt). (3) The high content of salinity of (FYM) used in this a study (Ec 6.89 dSm^{-1}).

Data in Tables 3 and 4 clearly show that, increasing moisture rate significantly increased yield of both grain and straw of wheat plant, where it reached for grain (11.59, 11.05 and 10.65 g pot^{-1}) at moisture rates (100, 75 and 60 % of field capacity), respectively. The corresponding values for straw were (14.12, 13.66 and 13.29 g pot^{-1}) at the same levels of moisture levels. This means that the yield of both grain and straw of wheat plant at 100% of field capacity is higher than that of the other two soil moisture depletions at all organic matter (FYM) application rates under water salinity levels. This means that the yield of both grain and straw of wheat plant decreased with increasing soil moisture depletion. This behavior is attributed to the strong root growth and high nutrients diffusion associated with the high soil moisture content. These results are in harmony with those obtained by many authors (Awad *et al*., 1982,; El –Desouky, 1999, and Dahdoh *et al*., 1994). It is well known, in well watered plants, that photosynthesis products are primarily used in metabolism and growth processes. On the contrary, the decrease of yield due to moisture depletion is due to the fact that, as soil moisture decreases, the growth of roots and the amounts of nutrients in the root zone decrease.

- Nitrogen contents and uptake of wheat grains:

Nitrogen Content and uptake of wheat plant grain as affected by levels of water salinity, farmyard manure and moisture %, were presents in Tables 5 and 6. It was noticed that, increasing salinity levels significantly decreased nitrogen content and uptake in grain of wheat plant. This was true with all rates of water salinity, where nitrogen content in grain reached for (2.97, 2.80, 2.68 and 2.48 %) at salinity levels (Control, 1.56, 3.12 and 6.25 dSm^{-1}), respectively. The corresponding values for nitrogen uptake in grain were (399.03, 333.87, 276.23 and 228.17 mg pot^{-1}) at the same levels of salinity. The adverse effect of salinity on nitrogen content could be attributed to the to the presence of high amount of chloride in soil which depressed nitrogen uptake (Saneoka, *et al.* 1999).

As the effect of Farmyard manure (FYM), the data presented in the Tables 5 and 6 revealed that, Increasing farmyard manure levels significantly increased nitrogen content and uptake up to 2% in grain of wheat plant, where nitrogen content in grain reached (2.56, 2.61, 3.03 and 2.73 %) at application of farmyard manure (0, 1%, 2% and 4%), respectively. The corresponding values for nitrogen uptake in grain were (257.97, 294.20, 366.03 and 319.09 mg pot^{-1}) with the same levels of farmyard manure. It is worthy to mention here that a reverse relation was detected between nitrogen and chloride concentration in grain, which was true for all treatments. This could be attributed to the antagonistic effect of chloride on nitrogen uptake , were Jones *et al*. (1991), Hu and Schmidhalter (1998) and Saneoka *et al*. (1999) stated that increasing salt concentration (chloride) in the substrate reduced total nitrogen content in the plant.

Also, data in Tables 5 and 6 showed that, the Increasing moisture levels significantly increased nitrogen content and uptake in grain of wheat plant, where nitrogen content in grain reached for (2.79, 2.73 and 2.67 %) at moisture levels (100, 75, 60 % of field capacity), respectively. The corresponding values for nitrogen uptake in grain were (327.18, 305.93 and 294.85 mg pot^{-1}) at the same levels of moisture.

Table 5: Nitrogen content (%) of wheat grain as affected by levels of salinity, farmyard manure and moisture.

Salinity (S) dsm^{-1}	Moisture (M) %	N Content (%) in grain Farmyard manure (FYM) % 0	1	2	4	Mean
Control	100	2.83	2.92	3.33	2.98	3.02
	75	2.80	2.87	3.30	2.90	2.97
	60	2.78	2.81	3.29	2.85	2.93
Mean		**2.80**	**2.87**	**3.31**	**2.91**	**2.97**
1.56	100	2.68	2.69	3.20	2.80	2.84
	75	2.65	2.66	3.15	2.75	2.80
	60	2.60	2.61	3.11	2.71	2.76
Mean		**2.64**	**2.65**	**3.15**	**2.75**	**2.80**
3.12	100	2.54	2.64	2.99	2.78	2.74
	75	2.50	2.55	2.92	2.70	2.67
	60	2.49	2.51	2.88	2.65	2.63
Mean		**2.51**	**2.57**	**2.93**	**2.71**	**2.68**
6.25	100	2.35	2.38	2.79	2.75	2.57
	75	2.31	2.35	2.74	2.60	2.50
	60	2.20	2.30	2.70	2.25	2.36
Mean		**2.29**	**2.34**	**2.74**	**2.53**	**2.48**
M × FYM Means	100	2.60	2.66	3.08	2.83	2.79
	75	2.57	2.61	3.03	2.74	2.73
	60	2.52	2.56	3.00	2.62	2.67
FYM Means		**2.56**	**2.61**	**3.03**	**2.73**	**2.73**

LSD at 5% level	
Salinity (S)	**0.036**
Moisture (M)	**0.031**
Farmyard manure (FYM)	**0.036**
S × M	**0.062**
S × FYM	**0.072**
M × FYM	**0.062**
S × M × FYM	**0.125**

Table 6: Nitrogen uptake (mg pot^{-1}) of wheat grains as affected by levels of salinity, farmyard manure and moisture.

Salinity (S) dsm^{-1}	Moisture (M) %	N uptake (mg pot^{-1}) in grain				
		Farmyard manure (FYM)%				
		0	**1**	**2**	**4**	**Mean**
Control	100	361.39	404.42	481.18	417.20	416.05
	75	336.84	372.81	449.46	389.76	387.22
	60	320.81	452.37	431.31	370.78	393.82
Mean		**339.68**	**409.87**	**453.98**	**392.58**	**399.03**
1.56	100	294.53	315.53	433.28	364.28	351.91
	75	276.92	298.71	407.92	351.17	333.68
	60	260.52	283.18	392.17	328.18	316.01
Mean		**277.32**	**299.14**	**411.12**	**347.88**	**333.87**
3.12	100	239.26	278.25	347.73	314.97	295.05
	75	222.25	253.72	327.04	290.25	273.32
	60	209.90	242.21	312.48	276.66	260.31
Mean		**223.80**	**258.06**	**329.08**	**293.96**	**276.23**
6.25	100	206.09	219.67	282.34	274.72	245.71
	75	192.42	210.32	269.89	245.44	229.52
	60	174.68	199.18	257.58	205.65	209.27
Mean		**191.06**	**209.72**	**269.94**	**241.94**	**228.17**
M × FYM Means	100	275.32	304.47	386.13	342.79	327.18
	75	257.11	283.89	363.58	319.16	305.93
	60	241.48	294.24	348.39	295.32	294.85
FYM Means		**257.97**	**294.20**	**366.03**	**319.09**	**309.32**
LSD at 5% level						
Salinity (S)			**3.88**			
Moisture (M)			**3.36**			
Farmyard manure (FYM)			**3.88**			
S × M			**6.72**			
S × FYM			**7.76**			
M × FYM			**6.72**			
S × M × FYM			**13.45**			

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تأثيرالملوحة والرطوبة وسماد المزرعة على المحصول وامتصاص النتروجين لنباتات القمح النامية على تربة جيرية.

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أجريت هذه الدراسة في صوبة بلاستيكية بقسم الاراضى والمياه - كلية الزراعة جامعة الأزهر (مدينة نصر- القاهرة - مصر) خلال موسم 2009 وذلك لدراسة تأثير الملوحة والمستويات المختلفة للرطوبة الأرضية والإضافات المختلفة من المادة العضوية على المحصول وتركيز النتروجين والكمية الممتصة منه فى الحبوب على نبات القمح فى التربة الجيرية وذلك من خلال تأثيرها على انتاجية محصول القمح بها وكذلك محتوى هذا المحصول من العناصر محل الدراسة . وقد تم إجراء هذا البحث على نبات القمح (سخا 93) وذلك بإستخدام مياه رى ذات تركيزات مختلفة من الملوحة (كنترول ، 56, 1 , 12, 3 , 25, 6 ديسيمينز/ م) وكانت المستويات المختلفة للرطوبة (100 % , 75 % , 60 %) من السعة الحقلية وكذلك الإضافات المختلفة من المادة العضوية (كنترول , 1 % ,2 % , 4 %) ً قبل الزراعة من سماد المزرعة . وقد تم زراعة 20 حبة من نبات القمح فى كل أصيص لكل معاملة فى ثلاثة مكرارات وبعد 15 يوم من الزراعة تم خف هذا العدد الى 10 نباتات فى الأصيص.

وقد أشارت النتائج المتحصل عليها إلى إنخفاض محصول الحبوب والقش وأيضاً التركيز والكمية الممتصة من النتروجين فى الحبوب معنوياً بزيادة مستويات الملوحة ، وأيضاً أدت إضافة السماد العضوى إلى زيادة فى محصول الحبوب والقش وأيضاً التركيز والكمية الممتصة من النتروجين فى الحبوب معنوياً عند إضافة 2% من السماد العضوى ، كما أدت زيادة الرطوبة الى زيادة فى محصول الحبوب والقش وأيضاً التركيز والكمية الممتصة من النتروجين فى الحبوب بغض النظر عن تأثير الملوحة والمادة العضوية.

قام بتحكيم البحث

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