J. Agric. Sci. Mansoura Univ., (3): 1589 - 1601, 2004

INFLUENCE OF NITROGEN SOURCES ON GROWTH, YIELD, SOME MACRO AND MICRONUTRIENTS CONTENT OF MAIZE PLANT (*Zea mays*, L.) IN SALT AFFECTED SOILS

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ABSTRACT

Two field experiments were conducted at the Experimental Station of Agricultural Research Station at Tag El-Ezz Dakahlia Governorate during 2000 and 2001 seasons. The used soil was salt affected one. The research aims to study the effect of $N\text{-}NO^-_3$, $N\text{-}NH^+_4$ or N-urea on yield and some characters of maize plant as well as macro-micronutrients content in ear leaves at maturity stage (physiological stage) and seeds. Single hybrid CS 10 of maize was used as testing plant within two seasons (2000 and 2001) and the soil salinity levels were 1.69, 5.3 and 11.10 dS/m in 2000, and 1.69, 5.43 and 11.10 ds/m in 2001 season, denoted as S_1, S_2 and S_3.

The data show that, plant height/cm, ear blade/ cm^2, ear diameter/ cm, ear weight/ gm, 100 grain weight/gm and yield (ardab/fed.) were reduced significantly in third level of salinity while ear length (cm) was not affected and order was $S_2 > S_1 > S_3$.

There is no significant effect of N-sources on parameters under study except ear diameter/cm and 100 grain weight /gm which were affected significantly.

Ammonium nitrate fertilizer gave the greater values than urea and ammonium sulphate. But the interaction effect between salinity levels and N-sources gave a significant differences at all studying characters. Yield was extremely reduced by 52.4% with increasing in salinity levels calculated the differences between the highest and the lowest values (mean for each salinity level).

It was found that, P% in leaves increased significantly with soil progress in soil salinity in both seasons. But K% increased significantly in 2001 season, while, N% decreased significantly at 2000 season. The concentration (ppm) of Zn, Fe and Mn were increased significantly with increasing the soil salinity levels.

Urea gave the highest values for N and P concentrations in leaves, where the effect was a highly significant in both seasons, while ammonium nitrate gave highly significant for K in 2000 season only. No significant effect was found for N-sources on Zn (ppm) in leaves in both seasons, while Mn and Fe were affected significantly. Also, it was found that ammonium nitrate gave the highest values for Mn in both seasons and Fe in 2001 season only. The study also showed that the interactions between salinity and N-source on N concentration in leaves were reduced significantly in 2000 season but K, P, Mn, Zn and Fe were increased significantly in both seasons.

Data show that N, P, K and Fe concentrations in seeds were increased significantly in third levels of soil salinity in most seasons whereas Mn and Zn insignificantly increased. The data revealed that, ammonium nitrate fertilizer gave the greatest value for N, P and K percentage in seeds, but urea fertilizer gave the greatest values for Mn, Zn and Fe concentrations in seeds in both seasons. The data showed that, the differences between N-sources and nutrient elements were significant except Zn.

The interaction effect between salinity and N-source in N% and Fe (ppm) in seeds were increased significantly as salinity increased in both seasons.

It can be conclude, from this study and data discussion that, soil salinity and fertilizers have confounding effects on plant characters and nutrient status of maize crop. Therefor it needs more research to clarifying these points in field (soil-salt system).

INTRODUCTION

Salinity is a major environmental problem that cause a reduction in plant productivity (Irshad *et al.*, 2002 b), especially in arid and semi-arid regions. Salinity stress is causing poor response of crops to fertilizer application as a result to decrease in photosynthesis and photosynthate utilization in the presence of high osmotic pressure in root medium, (Khalil *et al.*, 1967). Maize is a major food crop in most of the countries which face salinity problems especially in Egypt, as a part from arid and semi-arid region. Therefore, it is necessary to manage such soils for profitable agriculture by adopting proper on-farm management practices. Nitrogen (N) plays a vital role in nutritional and physiological status on plants and is also the unique among the minerals nutrients that absorb as NO_3^- and NH_4^+ ions. Also nitrogen fertilization may promote changes in the mineral composition of a plant (Mengel and Kirby, 1982). The relationship between salinity and mineral nutrition are extremely complex, where many studies conducted to clarify this point using sand or solution cultures which are simpler than soil-salt system. So, we need more researches to understand those relations, especially in soil-salt system in field. Therefore, the objective of this study is to investigate the effect of NO_3^- -N, NH_4^+ -N and urea-N on growth, yield and mineral composition of leaves & seeds of maize under salt affected soils.

MATERIALS AND METHODS

Two field experiments were conducted at Agricultural Research Station, Tag El-Ezz, Dakahlia Governorate during summer 2000 and 2001 seasons to study the effect of salinity levels and nitrogen sources on growth, yield and some macro and micronutrient concentrations of maize (*Zea mays*, L. Sc. 10) on salt affected soils of Tag El-Ezz station.

Soil surface samples were taken from three locations represent the different salinity levels denoted as S_1, S_2 and S_3 (low, moderate and high salinity). The samples were air dried, ground and passed through a 2 mm sieve. The samples were analysed to determine some chemical available nutrients and physical properties as shown on Tables 1 and 2 for both seasons.

Chemical analysis of soil samples were carried out according to Richard (1954). Particle size distribution was determined according to Black (1982). Available N, P and K were determined according to the international method (Piper, 1950).

The experiment in both seasons was arranged as a split-plot design in complete randomized blocks design, where the main plots were the salinity levels 1.69, 5.30 and 11.10 dS/m denoted as S_1, S_2 and S_3 but the nitrogen sources were the sub-plots which are urea (46% N_1), ammonium sulphate (20.5% N_2) and ammonium nitrate (33.5% N_3) which were used as 120 kg N/fed for all nitrogen sources. Thus the experimental treatments were 9, which was replicated three times. The experimental plots of the first and second seasons were prepared with dimensions of 3.0 x 3.5 m^2 (1/400 /fed.) and sown with maize (*Zea mays*, L. CS. 10) single hybrid CS. 10.

Table (1): Some chemical, available nutrients and physical properties of experimental soil in 2000 season.

Soil sample No.	Ec_e (dS/m) in soil paste	Soil pH at 1:2.5 (soil : water suspension)	ESP%	Soluble cations meq/L				Soluble anions meq/L			
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{--}	SO_4^{--}	Cl^{-}
1	1.69	7.9	4.5	0.21	0.33	0.44	0.04	0.00	0.43	0.37	0.22
2	5.30	7.9	6.30	1.36	0.68	2.59	0.04	0.00	0.25	2.89	1.53
3	11.10	8.1	9.2	2.77	5.40	22.29	0.05	0.00	0.18	14.81	15.52

Table (1):Cont.

Soil sample No.	Available nutrients by ppm			Available nutrients by ppm			C. sand %	F. sand %	Silt %	Clay %	O.M %	Ca CO_3 %	Texture
	N	P	K	Zn	Mn	Fe							
1	69	12	293	1.4	45	15.50	2.30	5.66	34.12	52.30	2.90	1.90	Clay
2	46	10	278	1.1	30	12.70	2.44	5.80	35.22	54.20	1.60	2.31	Clay
3	38	8	255	0.77	16	11.50	2.35	6.10	33.14	55.10	2.33	1.20	Clay

Table (2): Some chemical, available nutrients and physical properties of experimental soil in 2001 season.

Soil sample No.	Ec_e (dS/m) in soil paste	Soil pH at 1:2.5 (soil : water suspension)	ESP%	Soluble cations meq/L				Soluble anions meq/L			
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{--}	SO_4^{--}	Cl^{-}
1	1.63	8.0	4.5	0.22	0.34	0.46	0.04	0.00	0.41	0.44	0.21
2	5.43	8.0	6.45	1.35	0.62	2.59	0.04	0.00	0.23	2.88	1.56
3	11.10	8.0	9.2	2.73	5.46	22.78	0.05	0.00	0.18	15.23	15.61

Table (2):Cont.

Soil sample No.	Available nutrients by ppm			Available nutrients by ppm			C. sand %	F. sand %	Silt %	Clay %	O.M %	Ca CO_3 %	Texture
	N	P	K	Zn	Mn	Fe							
1	73	12	288	1.4	48	15.78	2.30	5.63	34.12	52.22	3.10	1.90	Clay
2	48	11	281	1.1	33	12.81	2.44	5.78	35.10	54.20	1.66	2.15	Clay
3	36	8	260	0.77	17	11.50	2.36	6.10	33.25	55.10	2.44	1.20	Clay

Before the sowing of seeds all plots received 30 kg P_2O_5/fed as superphosphate 15% P_2O_5 and 24 kg K_2O/fed as potassium sulphate 48% K_2O during preparing the experimental plots. After the emergence of seeds and before the second irrigation, all plants were thinned after 18 days from planting in one plant per hill at 30 cm distance. The nitrogen sources applied and divided to 3 equal doses. The first dose was used as a stimulate dose. Second and third doses were added at first and second irrigation time after planting, respectively. All agricultural practices were done according to the prevailing methods in this area.

Some plant characters which include plant height (cm), ear blade (cm^2), ear length (cm), ear diameter (cm) ear weight (gm), 100-grain weight (gm) and grain yield (ardb /fed) were estimated according to Palaniswamy and Gomez (1974).

Ear leaves samples were taken in maturity stage (as a physiological stage) where the nutrients going to translocation from leaves to ear. All collected leaves sample were dried at 70°C in forced-air circulation oven, ground in a porcelain mortar, so analysed to determine NPK according to Black (1982). All recorded data were statistically analysed according to Gomez and Gomez (1984).

RESULTS AND DISCUSSIONS

I- Plant characters:

The statistical analysis of obtained data in Table 3 show that all plant characters were depressed significantly in third level of salinity except ear length was non significant in both seasons. Whereas the highest values for all studied parameters were obtained from the second level of salinity which stimulates plant growth and yield (Dergne, 1964; and Papadopovlos and Rednding, 1983). The depressing effect of salinity on plant parameters has been reported by many researchers, Rabie and Kumazawa (1988), Mohamed (1996) and Irshad *et al.* (2002 a and b). Saline soils depressed most of plant characters through reducing water absorption, reducing metabolic activities due to salt toxicity and nutrient deficiencies caused by ionic interferences (Yeo, 1983).

Also saline soils adversely affect fertilizer efficiency. The poor response of crop to fertilizer is mainly attributed to decrease photosynthesis and photosynthate utilization in the presence of high osmotic pressure in root medium (Khalil *et al.*, 1967). Generally, 100-grain weight and grain yield were reduced extremely at S_3 level which values were 38.78 gm and 7.73 ardb/fed, respectively as a mean of both seasons. And a trend was arranged as: $S_2 > S_1 > S_3$ at all studied parameters in both seasons.

Irrespective of salinity levels, plant grew better under ammonium nitrate than urea and ammonium sulphate at all studied characters as shown in Table 4 in both seasons. Plant height, grain yield, 100-grain weight, ear weight and ear diameter varied in order: ammonium nitrate > urea > ammonium sulphate in both seasons. No significant effects were found for N sources on ear blade and ear length. The differences between N-sources were significant at most parameters except ear diameter and 100-grain weight were highly significant.

Table (3): Effect of salinity levels on crop characters in both seasons of maize plant.

Salinity levels	Plant height (cm)		Ear blade (cm^2)		Ear length (cm)		Ear diameter (cm)		Ear weight (gm)		100-grain weight (gm)		Grain yield ardab/fed	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
S1	234.67	244.67	570.57	593.13	15.83	16.29	4.09	4.27	201.44	212.33	42.89	45.67	15.33	15.90
S2	255.00	263.89	635.92	672.77	17.12	17.61	4.13	4.29	205.28	217.44	45.67	48.67	15.98	16.47
S3	187.67	197.67	389.01	412.59	14.40	14.67	3.52	3.73	127.56	135.44	37.22	40.33	7.36	8.09
F-test	*	**	*	**			*	**	*	*		*	**	**
LSD at 5%	47.38	21.86	197.62	121.85	NS	NS	0.39	0.28	68.89	45.8	NS	6.07	0.72	0.51
at 1%	--	36.21	--	201.85			--	0.47	--	--		--	1.19	0.83

Table (4): Effect of nitrogen sources on crop characters in both seasons of maize plant.

Nitrogen sources	Plant height (cm)		Ear blade (cm^2)		Ear length (cm)		Ear diameter (cm)		Ear weight (gm)		100-grain weight (gm)		Grain yield ardab/fed	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
N1	224.00	233.22	542.39	571.08	15.26	15.63	3.90	4.10	176.67	188.11	41.56	44.56	12.81	13.56
N2	219.78	228.44	523.58	548.68	15.74	16.19	3.67	3.82	171.71	181.67	38.89	41.67	12.50	13.02
N3	234.56	244.56	529.53	558.74	16.36	16.74	4.17	4.37	186.00	195.45	45.33	48.44	13.36	13.88
F-test		*					**	**			**	**		
LSD at 5%	NS	10.32	NS	NS	NS	NS	0.31	0.19	NS	NS	2.56	1.28	NS	NS
at 1%		--					0.43	0.27			3.59	1.79		

The trend of grain yield as follow in both seasons N3 > N1 > N2 and the differences between them insignificant and their numbers are 13.62, 13.19 and 12.76 ardb/fed, as a mean of both seasons.

The interaction effect between salinity levels and N-sources are found in Table 5. As shown, all differences between treatments are significant on all studied parameters. All studied parameters follow this order: N3 > N1 > N2 at any level of salinity except ear blade in both seasons. The same table indicates that the lowest values of all parameters obtained from the third level of salinity and the highest values were obtained from second level of salinity. Where the grain yield (ardb/fed) are 7.20, 7.27 and 7.60 in 2000 season while 8.10, 7.87 and 8.30 in 2001 season at S3N1, S3N2 and S3N3, respectively. But at the second level of salinity (S2N1, S2N2 and S2N3) the values are 15.93, 15.47 and 16.53 in 2000 season and 16.53, 15.87 and 17.00 ardb/fed, respectively. These results agree with many investigators, Khalil *et al.* (1967), Mohamed (2001) and Irshad *et al.* (2002 a) in maize.

As shown in Table 5 the interaction effect between second level and N-source gave the highest values at most studied parameters, this was attributed to that, at the low levels of salts in the presence of N-inorganic stimulate the growth and increase yield (Dergne, 1964, Papadopoulos and Rending, 1983).

II- Nutrient concentrations:

A- In leaves:

The relation between salinity and nutrient bioavailability is extremely complex and variable depending on the type of plant, salinity and nutrient contents in the soil (Irshad *et al.*, 2002 b). Nitrogen, phosphorous and potassium percentages in leaves at maturity stage are illustrated in Table 6 which refer to that S3 level gives the lowest values for N in 2000 season, while, S2 gave the lowest values in 2001 seasons. And the differences between them are highly significant in both seasons. The data show that, P concentrations increasing with increase of salinity levels and the differences between them are highly significant. These data agree with that obtained by Irshad *et al.* (2002a), while K% increase with increasing salinity levels but this increase insignificant in 2000 season and significant at 5% in 2001 season. These results may be explained as a nutritional unbalance as a result to influence by salinity in this experiment.

The relationship between salinity levels and some micronutrients are also found in Table 6, where Zn content was increased with increasing salinity levels as a mean values for both seasons and these differences were highly significant. This finding is agreement with found by Verma *et al.* (1984) and opposite to that found by Abd El-Hamid *et al.* (1991) who found that the extractable-Zn was not significantly correlated with Ec_e. Mn and Fe trend were highly significant differences which follow this order from highest to lowest values S2>S3>S1 as shown in Table (6) as a mean of both seasons. Generally, the greatest values which obtained from S2 level stimulate the plants to absorb Mn and Fe from the soil solution. As the data pointed out, there is a complexity of the relationship between salinity and trace element nutrition in corn plant.

Table (5): Interaction effect of salinity and nitrogen sources on crop characters in both seasons of maize plant.

Salinity x Nitrogen sources		Plant height (cm)		Ear blade (cm^2)		Ear length (cm)		Ear diameter (cm)		Ear weight (gm)		100-grain weight (gm)		Grain yield ardab/fed	
		2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
S1	N1	238.67	245.33	576.36	600.67	15.53	16.07	4.03	4.23	200.33	213.67	42.67	45.67	15.30	16.03
	N2	222.00	235.33	569.08	586.55	15.50	15.93	3.90	4.07	194.00	203.67	39.67	42.00	14.77	15.33
	N3	243.33	253.33	566.26	592.17	16.47	16.87	4.33	4.50	210.0	219.67	46.33	49.33	15.93	16.33
S2	N1	247.67	257.67	649.20	690.24	16.67	17.13	4.03	4.23	201.03	213.33	45.00	48.00	15.93	16.53
	N2	250.67	257.33	628.54	659.67	16.60	17.10	4.00	4.13	197.80	210.67	42.37	45.33	15.47	15.87
	N3	266.67	276.67	630.03	668.39	18.10	18.60	4.37	4.50	217.00	228.33	49.67	52.67	16.53	17.00
S3	N1	186.67	196.67	401.61	422.32	13.57	13.70	3.63	3.83	128.33	137.33	37.00	40.67	7.20	8.10
	N2	182.67	192.67	373.11	399.80	15.13	15.53	3.10	3.27	123.33	130.67	34.67	37.67	7.27	7.87
	N3	193.67	203.67	392.30	415.64	14.50	14.7	3.83	4.10	131.00	138.33	40.00	43.33	7.60	8.30
F-test		**	**	**	**	*	*	**	**	**	**	**	**	**	**
LSD at 5%		39.97	33.71	183.08	198.72	3.49	4.03	0.42	0.50	61.88	70.54	7.81	8.30	1.16	1.45
at 1%		55.06	46.44	252.26	273.80	--	--	0.58	0.69	85.26	97.19	10.76	11.44	1.60	2.00

Table (6): Effect of salinity levels on macro and micronutrients concentration of maize leaves in both seasons at maturity stage.

Salinity levels	N %		P %		K %		Mn (ppm)		Zn (ppm)		Fe (ppm)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
S1	1.14	1.27	0.21	0.20	2.55	2.58	60.42	58.01	35.83	37.84	179.7	180.0
S2	1.17	1.19	0.22	0.22	2.58	2.60	71.44	68.02	37.41	37.80	204.0	217.8
S3	1.01	1.27	0.31	0.31	2.59	2.60	69.37	67.04	41.11	41.28	200.1	211.0
F-test	**	**	**	**		*		*	**	*	**	**
LSD at 5%	0.062	0.043	0.023	0.017	NS	0.020	NS	7.79	2.22	2.98	7.70	3.90
at 1%	0.103	0.072	0.038	0.028		---		--	3.69	--	12.75	6.47

From Table 6, there is sufficient concentration from Mn, Zn and Fe by ppm in leaves in the experiments in two seasons. These results agreed with that found by Jones (1967) who refer to that the sufficient range for Mn lies between 20-150 ppm, Zn from 20-70 ppm and Fe from 21-250 ppm in ear leaf at maturity stage.

The effect of N-sources of nutrients in leaves at maturity stage found in Table (7) which show that N concentrations reduced in order of ammonium nitrate > ammonium sulphate > urea and this reducing is highly significant in both seasons, while P in order of: urea > ammonium nitrate > ammonium sulphate and the differences is highly significant in both seasons, but K% follow this order: N3> N1> N2 in 2000 season and the differences is highly significant but insignificant in 2001 seasons and follow this order N3> N1= N2. From the data in Table (7), urea gave the highest values for N and P percent which their values are: 1.18, 1.33 for N and 0.26, 0.26 for P in both seasons, respectively, while N3 gave the highest values for K% which are their values: 2.59 and 2.60 in 2000 and 2001 seasons, respectively.

Table (7): Effect of nitrogen sources on macro and micronutrients concentration of maize leaves in both seasons at maturity stage.

Nitrogen sources	N %		P %		K %		Mn (ppm)		Zn (ppm)		Fe (ppm)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
N1	1.18	1.33	0.26	0.26	2.55	2.59	67.38	65.01	38.56	39.34	201.2	195.4
N2	1.12	1.32	0.23	0.23	2.57	2.59	63.99	61.76	38.59	39.41	199.5	194.9
N3	1.00	1.09	0.25	0.24	2.59	2.60	69.87	66.31	37.21	38.17	183.2	218.4
F-test	**	**	**	*	*		**	**			**	**
LSD at 5%	0.053	0.06	0.009	0.010	0.027	NS	3.436	2.38	NS	NS	2.57	3.88
at 1%	0.075	0.085	0.013	0.015	---		4.819	3.35			3.61	5.45

The effect of N-sources on micronutrients gave a highly significant relationship in both of Mn and Fe but was not significant with zinc in both seasons.

The interaction between salinity levels and N-sources are found in Table 8 in leaves at maturity stage. Which show the nitrogen concentrations reducing with salinity progress in both seasons and this reducing is highly significant in 2000 season. But P and K percentages increasing with the progress of salinity levels in 2000 and 20001 seasons and these differences

are highly significant. This data agree with that found by Khalil *et al.* (1967) in maize. Mohamed (1996) in cotton plant and Irshad *et al.* (2002 a and b) in maize. It was found that increasing levels of salinity increasing the concentrations of Mn, Zn and Fe in the ear leaves at maturity stage. This data agreed with those found by Verma (1984) on rice and contradicted with those was found by Hassan *et al.* (1970) on corn.

Table (8): Interaction effect of salinity and nitrogen sources on macro and micronutrients concentration of maize leaves in both seasons at maturity stage.

Salinity x Nitrogen		N %		P %		K %		Mn (ppm)		Zn (ppm)		Fe (ppm)	
		2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
S1	N1	1.28	1.34	0.21	0.21	2.46	2.53	60.00	58.17	34.70	36.60	189.7	182.7
	N2	1.16	1.31	0.19	0.20	2.57	2.59	56.90	55.20	35.53	37.60	169.7	171.7
	N3	0.98	1.18	0.22	0.20	2.60	2.60	64.37	60.67	37.27	39.33	179.8	185.7
S2	N1	1.28	1.31	0.24	0.24	2.60	2.62	71.40	68.40	38.47	38.67	228.6	209.3
	N2	1.22	1.26	0.22	0.21	2.57	2.59	68.23	65.17	37.00	37.47	218.3	205.0
	N3	0.99	1.01	0.20	0.20	2.58	2.60	74.70	70.50	36.77	37.27	165.2	239.0
S3	N1	1.03	1.33	0.32	0.32	2.60	2.62	70.73	68.47	42.50	42.77	185.4	194.3
	N2	0.96	1.40	0.28	0.92	2.57	2.59	66.83	64.90	43.23	43.17	210.4	208.0
	N3	1.04	1.09	0.33	0.33	2.59	2.59	70.53	67.77	37.60	37.90	204.5	230.7
F-test		**		**	**	**	**			*	*	**	**
LSD at 5%		0.093	NS	0.016	0.018	0.036	0.033	NS	NS	3.66	3.57	4.46	6.73
at 1%		0.130		0.022	0.025	0.051	0.046			--	--	6.25	9.43

B- In seeds:

Nitrogen, phosphorous and potassium concentrations in seeds increased with increasing in soil salinity as shown in Table 9 in both seasons. The data show that highly significant were found for P in both seasons, but 2000 season for nitrogen and 2001 for K, while insignificant effect for N in 2001 season and K in 2000 season. About micronutrients, it was found that increasing in salinity levels increasing the concentrations of Mn, Zn and Fe by ppm as general. And the greatest values at the highest level of salinity in both seasons which their values were: 8.356, 52.86 and 237.10 ppm in 2000 season and 7.93, 53.29 and 225.6 ppm in 2001 season for Mn, Zn and Fe, respectively. The data denote that the increasing of Mn and Zn with salinity were not significant but Fe was a significant.

Table (9): Effect of salinity levels on macro and micronutrients concentration of maize-seeds in both seasons.

Salinity levels	N %		P %		K %		Mn (ppm)		Zn (ppm)		Fe (ppm)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
S1	1.76	1.78	0.26	0.24	0.50	0.52	7.528	7.589	51.43	52.12	111.9	101.8
S2	1.74	1.76	0.25	0.23	0.51	0.49	8.200	7.933	45.78	46.36	124.7	134.3
S3	1.83	1.79	0.31	0.29	0.51	0.52	8.356	7.933	52.86	53.29	237.1	225.6
F-test	**		**	**		**					**	**
LSD at 5%	0.019	NS	0.019	0.016	NS	0.012	NS	NS	NS	NS	15.43	14.27
at 1%	0.032		0.032	0.027		0.021					21.87	20.92

The effect of N-sources is found in Table 10. The data show that ammonium nitrate gives the greatest values between all N-sources for N, P and K percent in both seasons and the difference values between the

treatments were highly significant except 2000 season. And the trend was N3>N1>N2 for N and P percent in both seasons and K in 2001 season, but insignificant effect was found for K in 2000 season.

Table (10): Effect of nitrogen sources on macro and micronutrients concentration of maize-seeds in both seasons.

Nitrogen sources	N %		P %		K %		Mn (ppm)		Zn (ppm)		Fe (ppm)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
N1	1.72	1.73	0.27	0.25	0.50	0.51	8.644	8.233	51.47	52.12	178.1	173.0
N2	1.71	1.71	0.25	0.22	0.51	0.48	8.111	7.911	50.23	50.82	156.7	165.6
N3	1.90	1.89	0.31	0.28	0.51	0.53	7.328	7.311	48.37	48.82	138.9	148.7
F-test	**	**	**	**		**	**	*			**	**
LSD at 5%	0.022	0.20	0.012	0.008	NS	0.012	0.621	0.55	NS	NS	17.32	18.43
at 1%	0.032	0.28	0.015	0.011		0.017	0.870	--			19.62	21.26

The effect of N-sources on micronutrient concentrations, the data in Table 10 show the opposite direction compared with N, P and K. where the order was: N1>N2>N3 for Mn, Zn and Fe, respectively in both seasons. Where the urea gives the greatest values which are 8.644, 51.47 and 178.10 ppm for Mn, Zn and Fe in 2000 season, respectively and 8.233, 52.12 and 172.96 ppm in 2001 season, respectively. The differences values between the treatments on the studying parameters were significant in Mn and Fe and non-significant at Zn in both seasons.

The interactions between salinity levels and N-sources reported at Table 11. Which show that, nitrogen concentrations in seeds increasing significantly with increase with soil salinity in both seasons. But the increasing values for P and K percentages were insignificant in both seasons. Whereas the trend of micronutrients were inconsistent for Mn and Zn but Fe increased significantly with salinity increase, in both seasons.

Table (11): Interaction effect of salinity and nitrogen sources on macro and micronutrients concentration of maize-seeds in both seasons.

Salinity x Nitrogen		N %		P %		K %		Mn (ppm)		Zn (ppm)		Fe (ppm)	
		2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
S1	N1	1.73	1.77	0.26	0.24	0.51	0.52	8.00	7.900	54.50	55.07	116.7	106.6
	N2	1.69	1.71	0.23	0.21	0.47	0.49	7.567	7.700	53.73	54.53	104.7	100.6
	N3	1.86	1.86	0.30	0.27	0.52	0.55	7.017	7.167	46.07	46.77	114.2	112.0
S2	N1	1.65	1.66	0.25	0.22	0.49	0.49	8.633	8.233	45.20	45.90	127.1	125.0
	N2	1.69	1.73	0.23	0.20	0.48	0.46	8.367	8.000	44.97	45.50	111.2	107.1
	N3	1.87	1.89	0.27	0.26	0.54	0.51	7.600	7.567	47.17	47.67	135.8	133.7
S3	N1	1.78	1.75	0.31	0.29	0.51	0.51	9.300	8.567	54.70	55.40	290.4	288.3
	N2	1.74	1.70	0.29	0.26	0.48	0.50	8.400	8.033	52.00	52.43	254.2	251.1
	N3	1.98	1.91	0.34	0.31	0.55	0.53	7.367	7.200	51.87	52.03	166.6	161.5
F-test		*	**									**	**
LSD at 5%		0.034	0.034	NS	NS	NS	NS	NS	NS	NS	NS	33.66	31.16
at 1%		---	0.048									47.51	37.04

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تداخل المصادر النتروجينية على النمو والمحصول ومحتوى نبات الذرة من العناصر الكبرى والصغرى فى الأراضى المتأثرة بالأملاح

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نفذت تجربتان حقليتان فى مزرعة محطة البحوث الزراعية بتاج العز دقهلية ممثلة لأراضى متأثرة بالاملاح خلال موسمى ٢٠٠٠ و ٢٠٠١م وذلك لدراسة أثر المصدر النيتروجينى ن ــ ن أ٢ (ن١) و ن ــ ن يد٤ (ن٢) واليوريا (ن٣) منفردين على بعض الخصائص النباتية والمحصول ومحتوى الورقة عند النضج من العناصر الكبرى (نيتروجين ــ فوسفور ــ بوتاسيوم) وبعض العناصر الصغرى (زنك ــ حديد ــ منجنيز). ولقد استخدم صنف هجين فردى (١٠) لنبات الذرة خلال الموسمين وثلاث مستويات ملوحة هى ١,٦٩ و ٥,٣ و ١١,١٠ ديسيمنز /م على التوالى خلال موسم ٢٠٠٠ و ١,٦٣ و ٥,٤٣ و ١١,١٠ ديسيمنز /م على التوالى خلال موسم ٢٠٠١. وأشير عليها على أساس س١ ، س٢ ، س٣ كمجال للدراسة.

ولقد أظهرت النتائج التالى كما هو متوقع لخصائص النبات: ارتفاع النبات / سم ونصل الكوز / سم٢ وقطر الكوز / سم ووزن الكوز / جم ووزن ١٠٠ حبة / جم.والمحصول أردب / ف قد انخفض معنويا بارتفاع مستوى الملوحة. بينما لم يتأثر طول الكوز. وكان الاتجاه كالتالى س٢ > س١ > س٣.

ولم يكن هناك تأثير معنوى للمصادر النيتروجينية على الصفات المدروسة باستثناء قطر الكوز / سم ووزن ١٠٠ حبة / جم كان التأثير عالى المعنوية ولقد أعطى سماد نترات الأمونيوم أعلى القيم أكبر من اليوريا وكبريتات الامونيا على التوالى.

أما تفاعل الملوحة مع المصادر النيتروجينية فقد كانت الاختلافات معنوية بين جميع الصفات المدروسة. ولقد انخفض المحصول بشدة مع زيادة الملوحة ولقد انخفض المحصول بنسبة ٥٢,٤ % بين أعلى قيمة وأقل قيمة للمحصول كمتوسط للموسمين (حيث حسب متوسط كل مستوى ملوحة للموسمين).

ولقد أوضحت النتائج أن تركيز الفوسفور كنسبة مئوية فى الأوراق فى مرحلة النضج قد زاد معنويا مع زيادة الملوحة فى كلا الموسمين بينما زاد البوتاسيوم فى موسم ٢٠٠١ أما النتروجين فقد نقص معنويا فى موسم ٢٠٠٠ وخاصة عند المستوى الثالث للملوحة (١١,١٠ ديسمينز/م). أما تأثير المصادر النتروجينية فلقد أعطى اليوريا أعلى القيم لكل من تركيزات النتروجين والفوسفور فى الأوراق فى مرحلة النضج. وكذلك زاد تركيز الحديد والمنجنيز مع زيادة الملوحة زيادة معنوية وزاد أيضا تركيز الحديد والمنجنيز زيادة معنوية مع الملوحة بمقارنة القيم عند المستوى الاول للملوحة بالمستوى الثالث للملوحة على الرغم من أن أعلى القيم كانت عند المستوى الثانى (٥,٣٠ ــ ٥,٣٤ ديسيمنز / م) للملوحة.

بينما أعطى سماد نترات الأمونيوم أعلى القيم بالنسبة لتركيز البوتاسيوم وكانت الفروق بين القيم معنوية فى معظم المواسم. ولم يكن هناك تأثيرا معنويا للمصادر النيتروجينية على تركيز الزنك فى الأوراق فى كل من الموسمين بينما كان التأثير معنويا على كل من تركيز المنجنيز والحديد ولقد أوضحت الدراسة أن نترات الامونيوم أعطى أعلى القيم لكل من المنجنيز فى موسمى الدراسة وكذلك الحديد فى موسم ٢٠٠١ فقط.

أما تفاعل الملوحة مع المصادر النيتروجينية فقد أظهرت الدراسة أن تركيزات الأوراق من النيتروجين كنسبة مئوية قد انخفض معنويا مع زيادة الملوحة بينما زاد محتوى كل من البوتاسيوم والفوسفور فى كل من الموسمين معنويا. وكذلك تركيز العناصر الصغرى المنجنيز والحديد والزنك.

ولقد أظهرت الدراسة أيضا أن تركيزات البذور من انيتروجين والفوسفور والبوتاسيوم والحديد قد زاد معنويا عند المستوى الثالث للملوحة أما المنجنيز والزنك كانت الزيادة غير معنوية.

ولقد أظهرت الدراسة أيضا أن سماد نترات الامونيوم أعطى أعلى القيم بالنسبة للتركيزات المئوية لكل من النيتروجين والفوسفور والبوتاسيوم فى البذور. بينما أعطى اليوريا أعلى القيم بالنسبة للمنجنيز والزنك والحديد فى البذور فى كل من الموسمين. وكانت الاختلافات بين المصادر على العناصر الغذائية معنوية ما عدا الزنك. وبالنسبة للتفاعل بين الملوحة والمصادر النتروجينية فلقد أوضحت الدراسة أن تركيز كل من النيتروجين كنسبة مئوية والحديد كجزء فى المليون قد زاد معنويا مع زيادة الملوحة فى كل من الموسمين.

ومن هذه الدراسة ومناقشة النتائج يتضح أن للملوحة والتسميد تأثيرات مركبة على نمو النبات والحالة الغذائية للذرة وتحتاج إلى كثير من الدراسات لتوضيح هذه التأثيرات فى الحقل (نظام تربة ــ ملوحة).