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THE COMBINED EFFECT OF SALINITY AND NITROGEN FERTILIZATION ON ALCAREOUS SOIL PROPERTIES AND OIL CROPS GROWTH

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ABSTRACT: This investigation was carried out to study the combined effect of irrigation water salinity and N-fertilization on some physical and chemical properties of calcareous soil and oil crops growth. Seven saline solutions have different contents of total soluble salts (TSS), SAR and Ca/Mg ratio were used as irrigation water. Plus tap water control. The characteristics of these solutions with respect to TSS (ppm)-SAR-Ca: Mg ratio were: 1500-3-1: 2; 2500-3-1:2; 2500-6-1:2; 2500-10-1:2; 2500-3-2:3; 2500-3-1:1 and 3500-3-1:2 respectively. N-fertilizer was applied at rates of 30, 50 and 70 ppm N. Pots experiment (5kg/pot) was carried out using calcareous soil which collected from El-Sadat City area Minufiya Governorate. The pots were cultivated by either of maize (*Zea Maize, L*), sunflower (*Helianthus Annuus, L*) or safflower (*Carthamus Tinctoriuso, L*) as oil crops. The experiment was design in complete randomized blocks system in three replicates.

The obtained data show that, increasing EC value of irrigation water caused an increase of soil bulk density, total porosity, hydraulic conductivity, soil EC and soluble ions whereas the soil content of $CaCO_3$ and soil pH were decreased. Increasing SAR values of irrigation water resulted in an increase of soil EC, pH and soluble ions but its decreased $CaCO_3$ content (%), bulk density, total porosity and hydrolic conductivity. Also, increasing Ca: Mg ratio in irrigation water increased soil pH, EC, bulk density, total porosity, hydrolic conductivity $CaCO_3$ content.

Increasing EC, SAR and Ca/Mg ratio of irrigation water leads to decrease dry matter yields of oil crops (straw and grains). The cultivated oil crops varied in this decrease. N-fertilization increased the dry matter yield of oil crops. Also, N-fertilization lowered the harmful effect of salinity on plants grown on calcareous soil.

Key words: **Salinity, SAR, Ca: Mg ratio, Nitrogen fertilizers, Oil crops, Calcareous soil.**

INTRODUCTION

Due to the problem of intense population and costs of having several countries to bring new lands under cultivation, most of which were calcareous in nature as in several locations in Egypt. This aim has to be achieved by conquering the desert and using other sources of water such as ground water, drainage water and even sea water. The total concentration of soluble salts and the relative proportion of sodium to other cations appear to be the most important characteristics in determining the quality of irrigation water. However, the fact that sodium chloride of the sea water amounts to about 75% of total salts, necessitates the counteraction for other cations. Also, suggestion has been forwarded that antagonistic relationship between potassium and sodium may serve as the solution for the determined action of sodium on plant growth under the highly saline condition.

Assessing the influence of salinity and sodicity on soil structural and hydraulic characteristics, can help to prevent irreversible deterioration of soil quality and to find basic indication for irrigation management aimed to prevent and control extension of desertification (Shainberg *et al.*, 1981; Lima *et al.*, 1990 and Grescimanno and Iovino 1995).

Water quality and nutrients are the major limiting factors to oil crops. This work aims to study the interaction effect of irrigation water quality (total soluble salts, SAR and Ca:Mg ratio) and nitrogen fertilization on some physical and chemical properties of calcareous soil, oil crops (maize, sunflower and sufflower) growth and nitrogen fertilizer agronomic efficiency.

MATERIALS AND METHODS

Virgin sandy calcareous soil sample was collected from surface layer (0-30cm) of El-Sadat City area, Minufiya Governorate: The sample was air-dried, and ground to pass through a 2mm sieve. Physical and chemical analysis were undertaken according to the methods described by Black (1965) and Jackson (1973) and the obtained data are recorded in Table (1).

The complete randomize block design was used with three replicates. Five Kg of soil sample were put in each platic pot. The pots were divided to three main groups (72 pot for each main group). Five seeds of maize (*Zie maize*), sunflower (*Helianthus Annuus L*) and sufflower (*Carthamus Tienctoriuso L*) were planted in each pot of first, second and third main group respectively. All pots were irrigated using tap water around 60% of water holding capacity. After 10 days of planting, the plants were thinned to two plants in each pot. All pots were fertilized by P and K at rates of 30 ppm P_2O_5 and 50ppm K_2O as superphosphate (15.5% P_2O_5) and potassium sulphate (48%K_2O) respectively. Each main group was divided to three subgroup (24 pot for each subgroup). The three subgroups were treated with amonium nitrate (NH_4NO_3) (33.5%N) as N-fertilizer at rates of 30 (basic dose or control), 50 and 70ppm N. Each subgroup was divided to eight sub-subgrous (3 pot for each one). One of eight sub-subgroups was irrigated by tap water and other seven were irrigated using seven saline solutions differed in their contents of total soluble salts (TSS), sodium adsorption ratio (SAR) and Ca: Mg ratio. The chemical composition of used seven saline solution was, 1500-3-1:2, 2500-3-1:2, 2500-6-1:2 , 2500-10-1:2, 2500-3-2:3, 2500-3-1:1 and 3500ppm-3-1:2 for TSS (ppm)-SAR-Ca:Mg ratio respectively. All salts were used in Cl.-form. After thinning, the pots were irrigated during growth period (100-120 day) at 60% of W.H.C every two days. When the plants maturity, the two plants of each pot were harvested, divided to straw and grains, air-dried, oven-dried at 70°C and weighed. The soil in the pots were air-dried, ground, sieved through a 2mm sieve and kept in plastic bags. The prepared soil samples were analyzed for pH, EC, soluble ions (cations and anions) $CaCO_3$, bulk density, total porosity and hydraulic conductivity.

Table (1): Physical and chemical properties of used sandy calcareous soil.

a- Physical properties

W.H.C %	Particles size distribution (%)				Textural grade	Bulk density g/cm^3	Total porosity	$CaCO_3$ (%)	Hydraulic conductivity cm/day
	Coarse sand	Fine Sand	Silt	Clay					
23.1	52.21	33.97	9.60	4.22	Sand	1.62	38.5	43.20	3.83

b- Chemical properties

pH in 1: 2.5 soil/water susp.	E.C. dSm^{-1}	Soluble ions (meq/L)								O.M %	CEC meq/100 g soil
		Cations				Anions					
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3^{-}	Cl^{-}	SO_4^{2-}		
8.31	1.46	2.80	1.40	9.9	0.5	-	1.2	11.0	2.4	0.32	10.20

RESULTS AND DISCUSSION

Soil physical properties:

Data in Table (2) show that the content of calcium carbonate ($CaCO_3$) was decreased as the level of irrigation water salinity increase up to 3500 ppm. This may be due to the action of salts in irrigation water which may help in increasing the solubility of $CaCO_3$ in soil (Mohammed, 1975).

On the other hand, irrigation with water having SAR 10 caused more decrease in $CaCO_3$ content (%) comparing with the others irrigation water. This may be due to higher alkalinity action enhances the dissolution of $CaCO_3$ in soil. Similar results were obtained by Abd El-Nour (1989), who found that, irrigating calcareous soil with solution having different SAR values decreased $CaCO_3$ content.

Regarding the effect of Ca:Mg ratio of irrigation water, the results in Table (2) show that, the ratio 1:1 of Ca:Mg increased the soil content of $CaCO_3$ compared with the other ratios. Similar results were obtained by Alperovitch *et al.*, (1981), who found that, high Mg content in soil enhanced the dissolution of $CaCO_3$ in calcareous soil. This resulted from the high solubility of $MgCO_3$ compared with that of $CaCO_3$.

Data in Table (2) show that soil hydraulic conductivity (cm/h) are relatively increased by irrigation with different saline solutions compared with control treatment. This increase was parallel to salt concentration in saline solutions (irrigation water). So, the highest values of soil hydraulic conductivity was attained for the treatments of 3500 ppm followed by the treatments of 2500 and 1500 ppm. This may be due to the effect of high saline concentrations on the soil particles aggregation which become more stable under saturation conditions of calcareous soils. Similar results were obtained by Rizk (1986) and Abd El-Nour (1989), who found that, hydraulic conductivity values increased from 2.0 to 2.8 cm/h with increasing the concentration of saline irrigation solutions from 5 to 25 me/L,

According to the data presented in Table (2), the value of soil hydraulic conductivity was decreased with increasing values of SAR of saline irrigation water. This can be attributed to increasing the value of ESP on soil complex, which causes dispersion for soil particles. Shainberg *et al.*, (1981) and Abd

Table (2): Effect of irrigation water quality on physical and chemical properties of a calcareous soil

Treatments			Physical properties			Chemical properties									
									Soluble ions (meq/L)						
									Cations				Anions		
T.S.S* ppm	SAR	Ca:Mg ratio	HC** cm/h	B.D*** g/cm^3	T.P**** %	$CaCO_3$ %	pH (1:2.5) soil: water susp.	EC dSm^{-1}	Ca^{2+}	Mg^{2+}	Na^+	K^+	HCO_3^-	Cl^-	SO_4^{2-}
Control (top waer)			3.80	1.62	38.2	43.10	8.30	1.25	2.80	1.42	10.00	0.53	1.20	10.80	2.50
1500	3	1: 2	4.20	1.60	39.5	40.30	8.25	2.25	4.30	2.80	13.20	0.58	1.25	14.90	4.80
2500	3	1: 2	4.70	1.59	41.2	38.60	8.25	2.55	4.80	3.00	14.60	0.67	1.10	13.30	7.90
2500	6	1: 2	5.30	1.58	39.1	38.90	8.35	2.30	5.30	2.70	14.00	0.66	1.11	13.50	6.30
	10	1: 2	4.90	1.60	38.8	37.3	8.62	2.35	10.50	2.80	14.1	0.67	0.92	12.20	6.40
	3	2: 3	5.55	1.59	38.0	39.70	8.30	2.27	4.10	2.80	14.5	0.63	0.91	20.10	7.20
	3	1: 1	5.10	1.57	38.5	38.00	8.40	2.26	5.50	2.65	14.1	0.63	1.09	24.50	7.00
3500	3	1: 2	5.10	1.56	47.7	36.40	8.22	3.15	6.50	3.70	16.30	0.70	0.90	10.30	12.70

**HC = Hydraulic conductivity, ***BD = Bulk density , ****TP = Total porosity , *T.S.S = Total soluble salts (ppm).

Ellah (1988) found that increasing SAR values from 5.08 to 12.66 generally decreased hydraulic conductivity of alluvial and calcareous soils.

The effect of Ca: Mg ratio on soil hydraulic conductivity as shown from the data in Table (2) reveals that increasing Ca/Mg ratio of saline the irrigation water resulted in an increase of soil hydrolic conductivity. This means that, increasing Mg content in the saline irrigation solutions decreased soil hydraulic conductivity. This effect may be due to the disperative effect of high Mg concentrations in the saline irrigation solutions. Rizk (1986) found that soil relative hydraulic conductivity values were increased with increasing Ca/Mg ratio from 1: 1 to 10:1.

Apparent or bulk density of soil is a main physical property where it is related to total soil porosity, aggregation process, pore size distribution, hydraulic conductivity and soil moisture content. The data in Table (2) show that irrigating calcareous soil by saline water caused a decrease in values of soil bulk density (g/cm^3) where this decrease was increased as salinity level of irrigation water increased. This effect resulted from the neutral salts effect on enhancing the flocculation and volume of soil voids increases, so bulk density decreases. Poonca and Pole (1976) and Abd El-Nour (1989) found that irrigating loamy soil with saline water resulted in a slight compactness of lower layers and bulk density was reduced. Also, Antar (2000) found that, the tile drainage system establishment resulted in a relative increase of soil bulk density where this effect was attributed to the increase of salts leaching from soil profile especially in the surface layer. On the other hand, the obtained data show that irrigating calcareous soil by saline water having different values of SAR lead to increased the soil bulk density. This may be attributed to distructure effect of solutions having high values of SAR of high concentrations or sodium ions (Na^+). Similar results were obtained by Abo-Soliman (1984), who found that, alkalinity solutions is rendered to dispersion effect of sodium ions which lead to high bulk density. Abd El-Nour (1989) pointed that the salt effect may overcomes the deleterious effect of sodium ions in these solutions.

Also, the data in Table (2) show the effect of Ca: Mg ratio in saline irrigation solutions on soil bulk density. Data show that, increasing Mg content in saline irrigation solutions caused an increase of soil bulk density where the presence of exchangeable Mg^{2+} enhances the dissolution of $CaCO_3$ in calcareous soil (Alperovitch *et al.*, 1981).

Data in Table (2) show the effect of different treatments under study on values of total porosity (%) of calcareous soil. Total porosity is parallel to salt concentration in the used saline irrigation solutions where the values of total porosity increased with the increase of salinity irrigation water. On the other hand, the effect of SAR values of used saline irrigation solution on total soil porosity have little different effect. However, by increasing SAR and Mg concentration in saline irrigation solutions compared with Ca concentration lead to decrease total soil porosity. This may be attributed to the distructure effect of Na^+ and Mg^{2+} ions (Rizk, 1986).

Generally, the studied soil physical properties were not affected by either of N-fertilization treatments or oil crops, so the tabulated data did not include this effect.

Soil chemical properties

Data in Table (2) show that, pH values of calcareous soil decreased as the salinity level of used irrigation water increased up to 3500 ppm. This may be due to that H^+ ions are released from the exchange complex by the effect of the other soluble cations in the used saline irrigation solutions (Niane, 1984). Abou Hussien and Abou El-Khir (1999) and Antar (2000) reported that, leaching soluble salts after the tile drainage system establishment resulted in an increase in soil pH within different layers of soil profile. Data also show that soil pH slightly increased, with increasing SAR value of irrigation water increase. This effect was attributed to the lower efficiency of Na^+on H^+ releases from exchangeable co-mplex compared to that with Ca^{2+} and Mg^{2+}. Also, the increase of Ca: Mg ratio lead to a decrease in soil pH (Niane, 1984).

The effect of salinity irrigation water on of total soluble salts calcareous soil content (Electrical Conductivity values) was recorded in Table (2). Data show that, total soluble salts increased with increasing salinity level of the used saline irrigation water where the high of its content was found when the concentration of salinity irrigation water was 3500 ppm. Since irrigation water salinity is progressively affect the EC of soil solution. This may be due to the surface of soil adsorb more soluble and exchangeable cations of saline irrigation solutions. These results are in agreement with that obtained by Hussan (1981) and Tomar and Yadav (1992), who found that, there is significant increase in soil EC when soil irrigated with saline irrigation water.

On the other hand, the effect of either of SAR values or Ca: Mg ratio of saline irrigation solutions on soil EC as recorded in the Table (2) show that, increasing values of SAR or Ca: Mg ratio leads to increase EC values of calcareous soil compared to control treatment where the difference between the effect of SAR or Ca: Mg ratios on EC values was not clear. Similar results were obtained by Abd El-Nour (1989).

The recorded data in Table (2) show that, chloride (Cl^-) content in calcareous soil irrigated with saline water was increased with increasing salinity level of applied irrigation water. Similar trend was found with sulphate (SO_4^{2-}) and bicarbonate (HCO_3^-). This was in agreement with that found by Baginova (1971) and El-Hifny *et al.*, (1975). The highest content of HCO_3^- was found when the salinity levels of irrigation water was 2500 ppm where its decrease at the level of 3500 ppm. This effect may be due to the high salinity level (3500 ppm) of saline irrigation water inhibit the dissolve of non soluble forms of carbonate compounds. Abd El-Nour (1989) obtained similar results. In general, increasing irrigation water salinity progressively increase the content of different anions content different anions content (Cl^-, SO_4^{2-} and HCO_3^-) of calcareous soil sharply increased by replacing tap water (control treatment) by saline solution of 1500 ppm. While anions content in different treatments was slightly increased by increasing salt concentrations (2500 and 3500 ppm). This may be due to the ability of some initial soil components to be soluble by applying saline irrigation solutions. Data also show that increasing SAR and Ca: Mg ratio of saline irrigation water resulted in a decrease in soil content of HCO_3^- and in an increase in soil content of Cl^- and SO_4^{2-}.

Results in Table (2) show that, calcium (Ca^{2+}) and magnesium (Mg^{2+}) content were clearly increased as a result of irrigation by saline water and high content was existed at level of 3500 ppm. Similar results were obtained by Alowi *et al.*, (1980) and Abd El-Nour (1989), who found that, the content of Ca^{2+} and Mg^{2+} ions were increased through soil profile after three years of irrigating with saline water. Considering the effect of SAR on the content of soluble Ca^{2+} in soil, data show that, the high content of soluble Ca^{2+} was obtained by applied solution of SAR 6 as compared with that of SAR 10. These results are in agreement with that recorded by El-Sewify and Swindal (1970) and Abd El-Nour (1989). The obtained data showing the effect of Ca: Mg ratio of saline irrigation solution on soluble Ca^{2+}, where the high content was found when this ratio was 1:1. The high ratio (1:1) contains higher amount of Ca^{2+}. Regarding the effect of two SAR values of used saline irrigation water on the soil content of soluble Mg^{2+} was very clear where its increase with increasing SAR value. Concerning the effect of Ca: Mg ratio as compared with control, data in table (2) show that, soluble Mg^{2+} is highly increased by using saline irrigation water of both Ca: Mg ratios, but this increase in soluble Mg^{2+} in case of 2:3 (Ca: Mg) ratio solution was slightly more than the solution of 1:1 (Ca: Mg) ratio. This may be attributed to increasing the amount of adsorbed Mg^{2+} ions on soil colloidal complex. These results are in agreement with that obtained by Yadav and Girdher (1974) and Abd El-Nour (1989).

The effect of irrigation water salinity on soluble sodium (Na^+) is recorded in Table (2) where it was similar to that of soluble Cl^-. These results are in agreement with that obtained by Jean and Rhoades (1985) and Abd El-Nour (1989), who found that, the soil content of soluble Na^+ increased with increasing irrigation water salinity, and added that, the salinity level of irrigation water is the main factor affecting soluble Na^+ in soil. Concerning the effect of either SAR values or Ca: Mg ratio of irrigation water on Na^+ content, it was generally increased as compared with the control treatment, where these increases were clear at all studied treatments of SAR (6 and 10) and Ca: Mg ratio (2:3 and 1:1). On the other hand, data in Table (2) show that increasing salinity level of irrigation water lead to increase the soil content of soluble potassium (K^+). This effect may be due to that, saline solutions contain high amounts of soluble Ca^{2+} and Mg^{2+} ions which replace exchangeable K on soil components and release to soil solutions. These results are in harmony with that found by Baginova (1971), Niane (1984) and Abd El-Nour (1989), who found that, increasing salt concentration in irrigation water increased the soil solution content of K. As for SAR value and Ca: Mg ratio in used irrigation water, obtained results show that, their effect on soluble K^+ was similar to that found with soluble Na^+.

Generally, chemical properties of the studied soil were not affected by either of N-fertilization treatments, or oil crops so the tabulated data was not include this effect.

Straw and grains yield

Data in Table (3) show the effect of irrigation water salinity, SAR and Ca:Mg ratio and N-fertilization on the growth of the three cultivated oil crops. Negative relationship can be existed between the salinity level and DMY as a result of the harmful effect of salts, which accumulated in the root zone. Similar results were obtained by Gendy and Hammad (1993), Radwan *et al.*, (1993) and Abou Hussien *et al.*, (1994), who found that, plant growth was reduced under saline conditions and they attributed the results to the retard of the enzymatic process and reduction in photosynthes. Regarding the absolute values of DMY, the obtained data reveal that maize plant was more affected by salinity water than sunflower and sufflower. For example, in the treatment of 39 ppm N (control), the relative increase (RI, %) of straw DMY [(DMY of treated plants-DMY of untreated plants)] X100 was -41.86, -46.07 and -65.17% for maize, -22.05, -38.20 and -50.48% for sunflower and -27.35-40.83 and 46.35% for safflower when salinity water was 1500, 2500 and 3500 ppm respectively. The values of RI for grains yield for the same treatments were, -26.51, -36.55 and 45.78% for maize, -24.55, -35.45 and -49.09% for sunflower and -30.21, -34.90 and -47.40% for safflower. Also, increasing SAR values resulted in a more decrease of straw and grains yield of oil crops. So, the RI values for straw were -1.75 and -21.07% for maize, -15.19 and 20.42% for sunflower and -10.86 and -21.71% for safflower when SAR value of irrigation

Table (3): Dry matter yield (straw and grains) of cultivated oil crops (g/pot) as affected by irrigation water quality and N-fertilizer in calcareous soil.

Plant type	Treatments			Grains					Straw				
	TSS* ppm	SAR	Ca/Mg ratio	N-fertilizer added (ppm)					N-fertilizer added (ppm)				
				30	50		70		30	50		70	
				g/pot	g/pot	A.E**	g/pot	A.E	g/pot	g/pot	A.E**	g/pot	A.E
Maize	Control (tap water)			24.9	30.9	0.120	33.1	0.117	71.2	85.2	0.280	60.0	0.269
	1300	3	1:2	18.3	22.7	0.108	24.1	0.083	41.4	53.4	0.240	58.7	0.239
	2500	3	1:2	15.8	11.7	0.079	20.9	0.072	39.1	50.2	0.236	53.8	0.220
	-	6	1:2	15.2	20.0	0.096	21.4	0.064	38.4	51.1	0.240	54.5	0.220
	-	10	1:2	14.6	18.8	0.082	20.2	0.080	31.1	40.4	0.186	43.8	0.181
	-	3	2:3	15.7	20.2	0.096	21.3	0.080	39.2	52.3	0.262	56.4	0.246
	-	3	1:1	16.4	20.9	0.090	21.5	0.070	42.3	55.0	0.254	59.5	0.246
	3500	3	1:2	13.5	17.1	0.071	16.5	0.071	124.8	34.2	0.188	37.2	0.177
Sunflower	Control (tap water)			22.0	27.7	0.114	29.5	0.107	51.7	60.5	0.176	63.7	0.171
	1500	3	1:2	16.6	21.8	0.104	23.9	0.104	40.3	49.9	0.192	53.5	0.186
	2500	3	1:2	14.2	19.5	0.106	20.9	0.097	38.2	47.5	0.186	50.5	0.176
	-	6	1:2	12.4	17.5	0.102	18.6	0.091	32.4	39.9	0.150	42.4	0.143
	-	10	1:2	11.5	16.5	0.100	17.5	0.089	30.4	38.1	0.154	13.5	0.123
	-	3	2:3	13.1	18.1	0.102	19.2	0.087	35.7	43.5	0.150	15.8	0.144
	-	3	1:1	13.4	18.7	0.106	20.1	0.096	39.2	39.5	0.168	47.9	0.157
	3500	3	1:2	11.2	15.5	0.086	16.9	0.081	25.6	31.9	0.126	34.1	0.121
Safflower	Control (tap water)			19.2	24.1	0.100	26.1	0.099	45.8	57.5	0.234	61.8	0.229
	1500	3	1:2	13.4	17.9	0.090	18.5	0.073	34.0	45.1	0.222	48.2	0.203
	2500	3	1:2	12.5	16.8	0.081	17.9	0.077	30.4	38.9	0.170	41.7	0.161
	-	6	1:2	10.8	14.7	0.078	15.8	0.071	27.1	34.8	0.159	38.1	0.157
	-	10	1:2	10.5	14.0	0.070	14.9	0.063	23.8	31.1	0.146	33.2	0.134
	-	3	2:3	11.7	15.9	0.084	17.1	0.077	29.0	37.5	0.170	40.4	0.163
	-	3	1:1	11.9	16.5	0.092	18.0	0.063	33.6	41.9	0.176	46.5	0.170
	3500	3	1:2	10.1	12.9	0.056	13.7	0.051	22.8	29.5	0.134	32.1	0.133

* = Total soluble salts

** = Agronomic efficiency = $\frac{\text{Crop yield of treated plants} - \text{Crop yield of untreated plants}}{\text{N} - \text{added}}$

(Sisworo *et al.*, 1990)

water increased from 3 to 6 and 10 respectively. At the same values of SAR the RI for grains were -3.80 and -8.23; -12.68 and -19.01 and -13.60 and -16.00% for maize, sunflower and safflower fertilized by 30 ppm respectively. Similar results were obtained by Radwan, *et al.*, (1993). On the other hand, data in Table (3) show that, at salinity level of 2500 ppm under different N-fertilization levels, the increase of Ca: Mg ratio from 1:2 to 2:3 and 1:1 decreased DMY of straw and grains of cultivated crops. In addition DMY at different values of Ca: Mg ratio was less than that found in the control treatment. The calculated RI of straw DMY for the three crops fertilized by 30 ppm N and irrigated by saline water at 2500 ppm was, -0.26 and 2.48% for maize, -6.54 and 3.40% for sunflower and -4.61 and 10.20% for safflower at 2:3 and 1:1 Ca: Mg ratio respectively, and RI values for grains yield at the same ratio of Ca: Mg ratio were, -0.63 and 3.80, -7.75 and -5.63 and -6.40 and -4.80% for mazie, sunflower and safflower respectively. The effect of SAR on reducing the obtained dry matter yield of straw and grains of the three crops was more than that of Ca: Mg ratio. This effect may be attributed to the harmfull effect of Na^+ on plant growth and photosynthes process (Gendy and Hammad, 1993, Radwan *et al.*, 1993 and Abou Hussien *et al.*, 1994).

Concerning the effect of N-fertilization, DMY (straw and grains) of studied crops grown on calcareous soil irrigated by saline water is recorded in Table (3). The recorded data show that under different saline treatments, the obtained DMY (straw and grains) of planted oil crops significantly increased with the increase of added N fertilizer where this increase was than lowered as salinity level increase. Bakhati *et al.*, (1976) found that, application of N-fertilizer at a rate of 40 kgN/fed overcome salinity effect. Doubling dose of N-fertilizer continued to improve the yields and resulted in relative increase than the control treatment. Gendy and Hammad (1993) and Radwan *et al.*, (1993) found that, drop in grains yield of soybean and wheat was occurred when salinity level increased.

Data in Table (3) show the agronomic efficiency (AE) of N-fertilizer for oil crops cultivated on calcareous soil irrigated by saline water. The cultivated oil crops varied in the response to N-fertilization. The agronomic efficiency of N-fertilizer clearly depended on irrigation water quality where this efficiency decreased with increasing salinity level, SAR value and Ca: Mg ratio of irrigation water. Data also show that, agronomic effeciency of N-fertilizer at rates of 50 ppm was higher than that at 70 ppm at different salinity treatments. These results were found with straw and grains. These results are in agreement with that obtained by Abd El-Nour (1989) and Delgado and Raya (1999). Data concluded that, N-fertilizer application increased the dry matter yield (straw and grains) of oil crops. Also its lowered the harmful effect of salinity on crops planted on calcareous soils increased oil corps tolerance to salinity when it was planted in calcareous soil.

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التأثير المشترك للملوحة والتسميد النيتروجيني على خواص الأرض الجيرية ونمو محاصيل الزيت

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يهدف هذا البحث إلى دراسة التأثير المشترك لملوحة ماء الري والتسميد النيتروجيني على بعض الخواص الطبيعية والكيميائية للأرض الجيرية ونمو محاصيل الزيت. بالإضافة إلى ماء الصنبور (مقارنة) فقد استخدم سبع محاليل ملحية كماء ري مختلفة في محتواها من الأملاح الكلية الذائبة (جزء في المليون) ونسبة الصوديوم المدمص والنسبة ما بين الكالسيوم (كا) إلى الماغنسيوم (مغ) وتركيب هذه المحاليل هو على الترتيب ١٥٠٠-٣-١: ٢ و ٢٥٠٠-٣-١: ٢و ٢٥٠٠-٦-١: ٢و ٢٥٠٠-١٠-١: ٢و ٢٥٠٠-٣-٢: ٣و ٢٥٠٠-٣-١:١ و ٣٥٠٠-٣-١: ٢ وأضيف النيتروجين عند معدلات إضافة ٣٠و ٥٠ و ٧٠ جزء في المليون نيتروجين للأصيص. وأجريت تجربة أصص (٥كجم/أصيص) باستخدام أرض جيرية أخذت من منطقة مدينة السادات- محافظة المنوفية وتم تصميم التجربة بنظام القطع كاملة العشوائية في ثلاث مكررات. زرعت الأصص بأحد محاصيل الزيت وهي الذرة وعباد الشمس والقرطم.

أوضحت النتائج المتحصل عليها ان زيادة تركيز الأملاح الكلية الذائبة في ماء الري تؤدي إلى زيادة الكثافة الظاهرية والمسامية الكلية والتوصيل الهيدروليكي وكذلك محتوى الأرض من الأملاح الكلية الذائبة والأيونات الذائبة بينما سببت نقصاً في محتوى الأرض من كربونات الكالسيوم وكذلك رقم حموضة الأرض pH. كما أدت زيادة قيمة نسبة الصوديوم المدمص في ماء الري إلى زيادة رقم حموضة الأرض وكذلك محتوى الأرض من الأملاح الكلية الذائبة والأيونات الذائبة بينما أدت إلى نقص محتوى الأرض من كربونات الكالسيوم والكثافة الظاهرية والمسامية الكلية والتوصيل الهيدروليكي وأيضاً فقد تسببت زيادة نسبة الكالسيوم: الماغنسيوم في ماء الري إلى زيادة رقم حموضة الأرض ومحتوى الأرض من الأملاح الكلية الذائبة وكربونات الكالسيوم والكثافة الظاهرية والمسامية الكلية والتوصيل الهيدروليكي.

كما أدت زيادة محتوى ماء الري من الأملاح الكلية الذائبة وكذلك زيادة قيم نسبة الصوديوم المدمص ونسبة الكالسيوم : الماغنسيوم إلى نقص نمو محاصيل الزيت المنزرعة حيث انخفض محصول المادة الجافة المتحصل عليه لكل من القش والحبوب. وقد أدى التسميد النيتروجيني إلى زيادة نمو محاصيل الزيت. وكذلك أدى التسميد النيتروجيني إلى تقليل التأثير الضار للأملاح.