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IMPACT OF DIFFERENT SALINITY LEVELS OF IRRIGATION WATER AND LEACHING REQUIREMENTS ON SOME SOIL CHEMICAL PROPERTIES OF SOIL AND SUNFLOWER YIELD IN RAS SUDR AREA, SOUTH SINAI

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ABSTRACT: *Field experiment was conducted at a calcareous sandy loam soil at Experimental Station, Desert Research Centre, Ras Sudr - South Sinai. This experiment carried out to study the impact of irrigation water salinity levels under leaching requirements on some soil chemical properties (pH, ECe, and ESP) as well as sunflower yield. Three irrigation water salinities (7.2, 8.14 and 10.46 dSm^{-1}) and three leaching requirements levels as fraction (0.0, 0.1 and 0.2) were used in this experiment. The increasing irrigation water salinity levels with or without leaching requirement increased soil salinity of studied soil depth at the end of flowering and harvesting stages. Moreover, the soil salinity values of surface depth (0 - 15cm) were higher than that obtained other soil depth. The obtained results indicated that the increasing leaching requirement levels with studied irrigation water salinities decreased soil salinity for the studied soil depths at the end of flowering and harvesting stages. Also, the results showed that the increasing irrigation water salinity levels with or without leaching requirement slightly increased pH value of studied soil depth at the end of flowering and harvesting stages. The increasing irrigation water salinity levels with or without leaching requirement increased ESP values of studied soil depth at the end of flowering and harvesting stages.The results revealed that the increasing irrigation water salinity levels significantly decreased plant height. Also, the results showed that the increasing leaching requirement levels with studied irrigation water salinities, in general, significantly increased plant height of sunflower. Moreover, the increasing irrigation water salinity levels significantly reduced seed yield of sunflower. The seed yield reduction percentage was 20.9 % at 8.15 dSm^{-1} irrigation water salinity level and was 54.2 % at 10.46 dSm^{-1} irrigation water salinity level relative to low studied irrigation water salinities. The increasing leaching requirements levels with studied irrigation water salinities significantly increased seed yield of sunflower. The highest value of sunflower seed yield was found at 7.2 dSm^{-1} irrigation water salinity level with 0.2 leaching requirement, while, the lowest value was found at 10.46 dSm^{-1} irrigation water salinity level without leaching requirement.*

Key words: *Irrigation water salinity, soil salinity, exchangeable sodium percentage, leaching requirements and sunflower yield.*

INTRODUCTION

The major part of Rus Sudr s area have arid climate that they have little rainfall and high evaporation and ultimately these factors lead to salt accumulation in soil.

Unscientific uses of brackish waters reduce the quality and productivity of soils. Accumulation of soluble salts in the soils imposes stress on crops leading to decreased yields, Francois *et al.*, (1989) and that of sodium (soluble& adsorbed) affects soil physical properties, which in turn greatly affect crop production, Shainberg & Letey, (1984). Irrigated agriculture using saline water in the arid and semi-arid region can lead to salt accumulation in soil profile, reduction in yield of corps and deterioration in soil resource, if proper management practices are not adapted Ould *et al.*, (2007).

Mostafazadeh *et al.* (2007) showed that the as the irrigation water salinity increased the soil salinity and soil sodium adsorption ratio increased and the effects were greater for the top as compared to lower layer soil. the increase in irrigation water salinity had no effect on the soil acidity, but it decreased the water holding capacity. with increase in leaching level, the damages due to increased irrigation water salinity decreased significantly but the soil acidity increased.

El-Boraie (1997) found that soil salinitys values increased with increasing salinity of irrigation water and decreased soil moisture depletion in calcareous soil of Maryut, Egypt. Dosoky (1999) found that the increasing of irrigation salinity from 0.58 to 3.67 dSm- increased total soil salinity from 1.87 to 24 83 dSm-.Thus the salts accumulation in soil was closely related to the salt concentration of irrigation water. Zein El-Abedine *et al.* (2004) found that the soil salinity and alkalinity parameters relatively increased by 195.54 and 360.49%for EC,174.73 and 280.11% for SAR as a result of the use of mixed and drainage waters, respectively as compared those of soils irrigated from canal water. El-Boraie (1997) found that soluble Ca+2,Mg+2 and Na+ increased with increasing salinity level of irrigation water, while soluble K+ decreased with increasing salinity levels and irrigation frequency decreased the hazardous effects. Ragab (2001) studied the use of irrigation water qualities on chemical properties of soil. He observed that, there was progressive and significant increase in soil salinity values as the salinity of irrigation water increases. Drainage water produced the highest soil salinity values compared to soil of irrigated with canal water. Ragab et al.,(2008) found that irrigation with saline water increases the total soluble salts in the soil. Soil electrical conductivity increased as a result of increasing salinity levels of irrigation water, it is more pronounced in calcareous soil.

Studies of Gupta (1990) showed that the different plants tolerance of salinity is different and the amount of a particular plant tolerance of salinity at different stages is different. Also salinity is effective on growth and yield of plants thorough increasing osmotic pressure and concentration of specific ions.

Researches of distinguished that effects of irrigation water salinity are different .When salinity is more than 1 dS/m unfavorable effects on seed germination starts so in these cases special management should be applied. Some adverse effects of salinity are spots in the field, delayed growth, inadequate size of plants and bluish green leaves Ayers and Westcot (1985). Also, studies on the germination and growth of wheat in saline soils showed that leaching before planting and apply special management, in the use of saline waters can reduced a considerable percentage of damage due to salinity.

The objectives of the present study are to investigate the impact of irrigation water salinities and leaching requirements on some soil chemical properties, water holding capacity and plant height plant as well as sunflower yield.

MATERIALS AND METHODS

A field experiment was carried out at Experimental Station Farm, Desert Research Center-Ras Sudr during summer season 2011. The station is located at latitude of 32° 42' 48" N and longitude of 29° 37' 28" E. The soil was classified as calcareous sandy loam (63 % sand, 24 % silt and 13 % clay) with 48.50 % total calcium carbonate and 1.47 g/cm^3 bulk density. Particle size distribution was determined dry sieving method according to Kulte (1986). Total carbonate was determined as $CaCO_3$ %, Jackson (1967) while the bulk density was determined by core method accordingly, Kulte (1986). The electric conductivity of soil paste extract value (ECe) was 8.1 dS m^{-1} and soil reaction, pH, value was 7.6 as well as sodium adsorption ratio (SAR) value was 10.1 and exchangeable sodium percentage, ESP, value was 12 %. The soil is highly saline and non alkali. Soil salinity (ECe) as total soluble salts were determined in the soil saturation extract, Richards (1954). Soil reaction (pH) was measured in soil paste using Ph meter according to Page (1982).

Sunflower seeds (*Helianthus annuus*, L. Sakha 53) were planted at rate 7.5 kg/fed on 25 May 2011 and the date of harvesting was on 25 September. Land preparation before planting ploughed and mixed with mono calcium phosphate (15.5 % P_2O_5) with a rate of 200 kg/fed. During the growing season, N fertilizers as ammonium nitrate (33.5 % N) applied with a rate of 80 kg /fed, and K fertilizers as potassium sulphate (48 % K_2O) with a rate of 100 kg K/fed.

Gated pipe system was used in this investigation. It was consisted of 9 experiment plots for 3 irrigation water salinity levels of 7.2, 8.14 and 10.46 Ds/m and 3 leaching requirement levels as fraction of 0.0 (without leaching requirement), 0.1 and 0.2. The chemical composition of studied irrigation water salinity levels are presented in Table (1). Each experiment plot included 10 lateral lines and 40 m long with space between lines 0.5 m under studied irrigation system, space between plants 20 cm. The experimental design was completely randomized in split plot with three replications.

The soil salinity, pH, Na^+, Ca^{++} and Mg^{++} were determined for 0 – 15, 15 – 30 and 30 – 45 cm soil depth at the end of flowering stage and the end of harvesting stage. The exchangeable sodium percentage, ESP, of 0 – 15, 15 – 30 and 30 – 45 cm soil depth at middle and end growth season were estimated according to Richards (1954) using the following equation:

$$ESP = \frac{100\,(-0.0126 + 0.01475\,SAR)}{1 + (-0.0126 + 0.01475\,SAR)}$$

SAR is sodium adsorption ratio and was calculated by the following, Richards (1954):

$$SAR = Na^{+1} / \sqrt{((Ca^{+2} + Mg^{+2})/2)}$$

Plant height, cm, and seed yield were measured at the end of the harvesting growth stage. Analysis of variance was used to test the degree of variability among the obtained data. Least significant difference (LSD) test was used for the comparison among treatments means, Steel and Torrie (1980).

RESULTS AND DISCUSSION

Soil salinity

The results in Table (2&3) and Figure (1&2) show that the effect of irrigation water salinity levels and leaching requirement levels on soil salinity, ECe, at the end of flowering and harvesting stages. Generally, the results revealed that the increasing irrigation water salinity levels without leaching requirement increased soil salinity at surface soil depth (0 – 30 cm) compared to initial soil salinity (8.1 dSm^{-1}). At the end of flowering stage, the increase percentage of soil salinity of surface soil depth was 16.9, 28.0 and 54.7 % relative to initial soil salinity at 7.2, 8.15 and 10.46 dSm^{-1} irrigation water salinity levels, respectively. At the end of harvesting stage, the increase percentage of soil salinity of surface soil depth was 24.8, 33.2 and 57.0 % relative to initial soil salinity at 7.2, 8.15 and 10.46 dSm^{-1} irrigation water salinity levels, respectively. These results were confirmed with Ragab *et al.*, (2008) and Zein El-Abedine, *et al.* (2004). Also, the increasing irrigation water salinity levels with or without leaching requirement increased soil salinity of studied soil depth at the end of flowering and harvesting stages. Moreover, the soil salinity values of surface depth (0 - 15cm) were higher than that obtained other soil depth. The soil salinity of the studied soil depths at the end of harvesting stage as affected by irrigation water salinity was higher than that obtained at the end of flowering stage. This higher might be attributed to the increase salt accumulation in soil resulting the adding more amount of saline irrigation water.

Table (1). Chemical composition of the studied saline water.

water quality	pH	$ECdSm^{-1}$	cations meq/L				Anions meq/L				SAR
			Co^{++}	Mg^{++}	Na^+	K^+	$CO_3^=$	$HCO_3^=$	CL^-	$SO_4^=$	
S1	7.72	7.20	25.5	11	35.0	0.30	-	1.50	39.2	31.1	8.10
S2	7.80	8.15	26.7	12	42.0	0.26	-	1.76	47.2	32.0	9.50
S3	7.87	10.46	28.0	15	61.5	0.20	-	3.40	64.8	36.5	13.20

Table (2). Some soil chemical properties as affected by irrigation water salinity levels (S) and leaching requirements levels (LR) at the end of flowering stage.

Irrigation water salinity dS.m^{-1}	LR	Soil depth cm	pH	ECe dSm^{-1}	Cation, me/l			SAR	ESP
					Ca^{++}	Mg^{++}	Na^{+}		
7.20	0.00	0-15	7.26	10.55	22.85	28.12	88.22	17.48	19.69
		15-30	7.32	8.38	15.45	12.20	56.58	15.22	17.49
		30-45	7.41	6.69	32.30	14.47	61.93	12.81	14.99
	0.10	0-15	7.27	9.06	17.24	11.72	59.94	15.75	15.98
		15-30	7.35	7.38	22.57	15.96	52.39	11.9	14.10
		30-45	7.48	6.03	17.39	11.96	38.40	10.00	11.88
	0.20	0-15	7.31	8.24	75.06	37.11	84.00	11.22	13.27
		15-30	7.40	6.87	0.90	0.64	8.65	9.90	11.78
		30-45	7.52	5.18	0.83	0.50	6.98	8.60	10.26
	mean		7.37	7.60	22.73	14.74	50.79	12.65	14.37
8.15	0.00	0-15	7.31	11.42	40.65	23.53	112.07	19.8	21.85
		15-30	7.37	9.32	20.84	13.89	69.55	16.96	18.95
		30-45	7.41	7.56	28.68	21.69	69.86	13.92	16.16
	0.10	0-15	7.32	9.93	0.97	0.65	15.16	16.86	18.13
		15-30	7.40	8.21	31.99	16.37	64.63	13.14	15.85
		30-45	7.48	6.90	1.84	1.43	14.13	11.05	13.08
	0.20	0-15	7.36	9.11	18.05	8.73	48.37	13.22	15.43
		15-30	7.45	7.71	75.06	37.11	83.91	11.20	13.24
		30-45	7.52	6.04	3.00	2.16	15.43	9.61	11.44
	mean		7.40	8.47	24.56	13.95	54.79	13.93	15.98
10.46	0.00	0-15	7.33	14.37	22.00	8.34	85.4	21.93	23.71
		15-30	7.35	10.68	20.38	15.77	80.02	18.18	20.92
		30-45	7.48	8.42	14.00	7.33	48.85	14.96	17.24
	0.10	0-15	7.34	12.88	0.99	0.63	15.95	17.80	20.00
		15-30	7.38	9.57	1.10	1.03	15.95	15.46	17.73
		30-45	7.55	7.76	2.00	1.54	15.98	12.01	14.13
	0.20	0-15	7.38	12.06	4.38	3.46	25.79	13.03	17.29
		15-30	7.43	9.07	5.34	2.50	25.75	13.01	15.21
		30-45	7.59	6.91	5.46	3.73	22.61	10.55	12.51
	mean		7.42	10.19	8.40	4.93	37.37	15.27	17.63
mean Total			7.39	8.73	18.56	11.20	47.65	13.95	15.99
LR mean	0.00		7.36	9.36				16.80	19.00
	0.10		7.38	8.63				13.77	15.65
	0.20		7.44	7.91				11.14	13.38
LSD 0.05	*LSD S		0.030	0.027				0.128	0.060
	**LSd LR		n.s	n.s				0.093	0.630
	***SxLR		n.s	n.s				0.159	n.s

*LS D_S is lest significant difference for irrigation water salinity levels.
**LSD_{LR} is lest significant difference for leaching requirements levels.
***LSD $_{SxLR}$ is lest significant difference for interaction between salinity and leaching.

Table (3). Some soil chemical properties as affected by irrigation water salinity levels (S) and leaching requirements levels (LR) at the end of harvesting stage.

Irrigation water salinity $dS.m^{-1}$	LR	Soil depth cm	pH	ECe dSm^{-1}	Cation, me/l			SAR	ESP
					Ca^{++}	Mg^{++}	Na^{+}		
7.20	0.00	0-15	7.29	11.16	38.68	17.02	84.88	16.08	18.34
		15-30	7.35	9.05	1.10	1.03	15.95	15.46	17.73
		30-45	7.43	7.25	1.71	1.00	14.30	12.29	14.97
	0.10	0-15	7.32	9.07	18.17	12.00	51.85	13.35	15.56
		15-30	7.41	7.47	33.96	17.79	59.23	11.60	13.69
		30-45	7.54	6.35	6.06	5.51	22.64	9.41	11.21
	0.20	0-15	7.39	8.21	5.46	3.73	22.61	10.55	12.51
		15-30	7.48	6.86	18.00	8.50	34.78	9.56	11.38
		30-45	7.61	5.46	8.98	6.58	22.65	8.12	9.69
	mean		7.42	7.88	14.68	8.13	36.54	11.82	13.90
8.15	0.00	0-15	7.33	11.86	0.85	0.48	15.24	18.67	20.81
		15-30	7.39	9.72	20.25	17.55	74.22	17.07	19.30
		30-45	7.43	7.85	11.00	7.67	43.48	14.23	16.48
	0.10	0-15	7.35	9.77	17.24	11.72	59.67	15.76	18.02
		15-30	7.45	8.13	4.38	3.46	25.85	13.06	15.26
		30-45	7.54	6.95	2.8	2. 00	16.65	10.75	12.73
	0.20	0-15	7.43	9.28	40.41	23.72	72.56	12.80	14.98
		15-30	7.52	7.56	5.36	3.35	22.83	10.94	12.95
		30-45	7.61	6.06	1.39	0.69	8.57	9.40	11.20
	mean		7.45	8.58	11.52	7.85	37.71	13.63	15.75
10.46	0.00	0-15	7.34	14.60	13.82	16.23	86.17	22.23	23.96
		15-30	7.42	10.84	10.13	6.27	54.53	19.04	21.16
		30-45	7.50	8.63	20.92	4.04	54.00	15.29	17.55
	0.10	0-15	7.37	12.51	10.13	6.27	54.54	19.05	21.17
		15-30	7.48	9.25	1.94	1.11	18.35	14.85	17.12
		30-45	7.60	7.73	33.96	17.79	59.30	11.70	13.79
	0.20	0-15	7.44	11.65	23.68	17.15	71.67	15.86	18.13
		15-30	7.55	8.68	45.68	26.99	76.16	12.56	14.81
		30-45	7.67	6.84	4.00	2.02	17.80	10.26	12.26
	mean		7.49	10.08	18.25	10.87	54.72	15.66	17.77
mean Total			7.44	8.84				13.70	15.79
LR mean	0.00		7.38	10.11				16.70	18.92
	0.10		7.45	8.58				13.28	15.39
	0.20		7.52	7.84				11.12	13.10
LSD 0.05	*LSD S		0.063	0.018				n.s	0.038
	**LSd LR		n.s	n.s				n.s	0.350
	***SxLR		n.s	n.s				n.s	n.s

*LS D_S is lest significant difference for irrigation water salinity levels.
**LSD_{LR} is lest significant difference for leaching requirements levels.
***LSD $_{S \times L R}$ is lest significant difference for interaction between salinity and leaching.

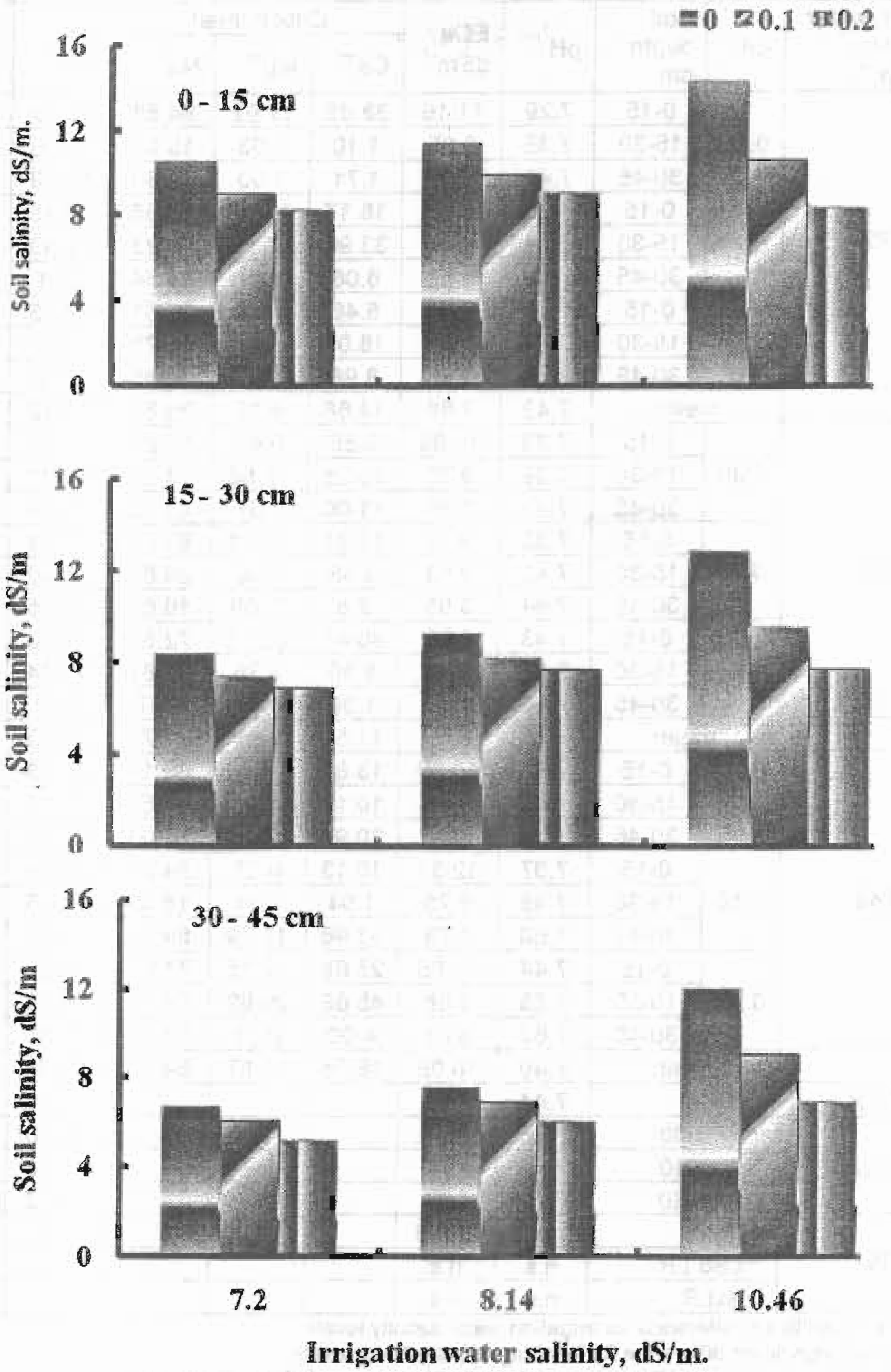

Fig.(1). Soil salinity as affected by irrigation water salinity and leaching requirements (0, .1 and 0.2) at the end of flowering stage.

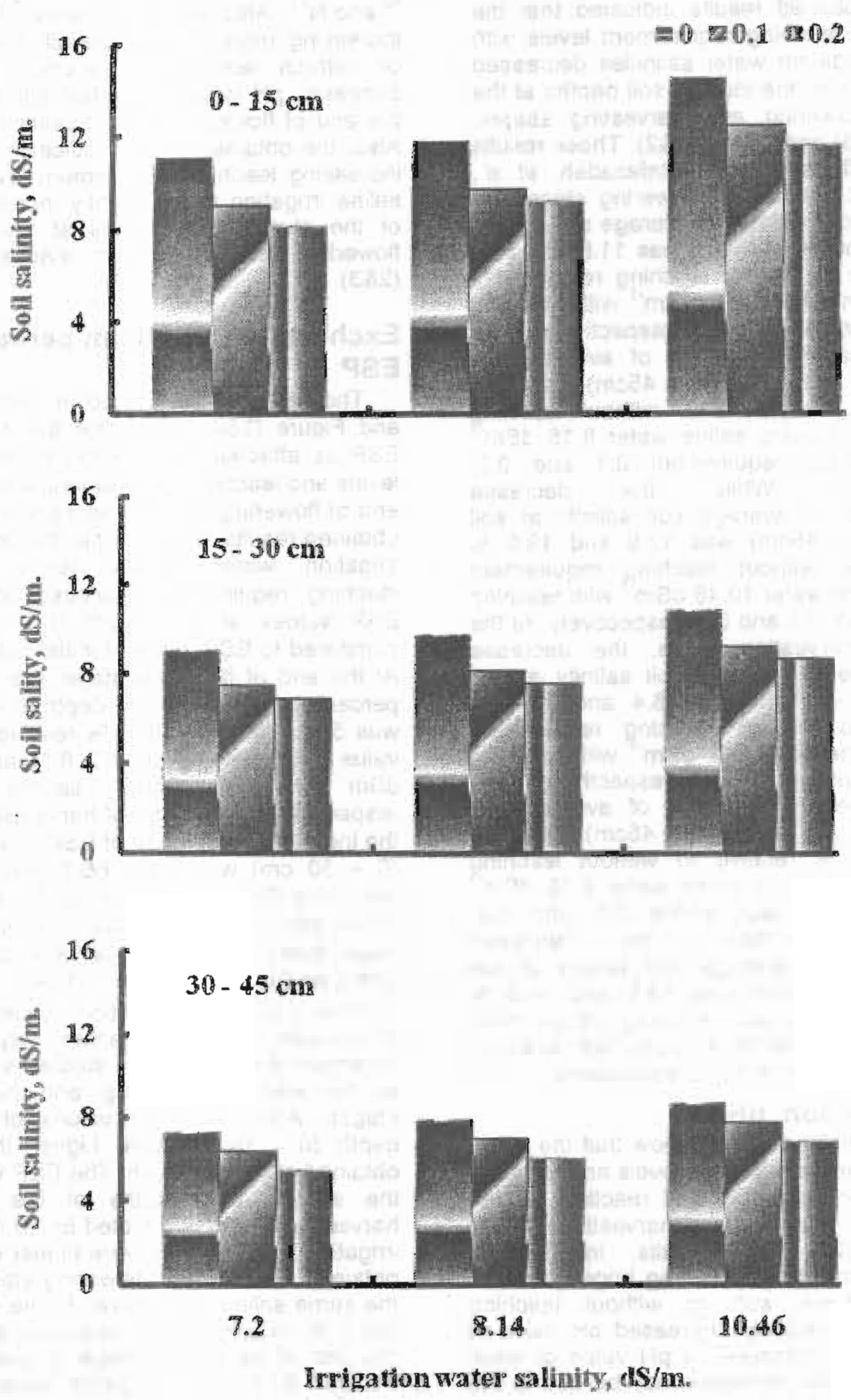

Fig. (2). Soil salinity as affected by irrigation water salinity and leaching requirements (0, .1 and 0.2) at the end of harvesting stage.

The obtained results indicated that the increasing leaching requirement levels with studied irrigation water salinities decreased soil salinity for the studied soil depths at the end of flowering and harvesting stages, Table (2&3) and Figure (1&2). These results were confirmed with Mostafazadeh, *et al.*, (2007). At the end of flowering stage, the decrease percentage of average soil salinity at soil depth (0 – 45cm) was 11.8 and 20.0 % relative to without leaching requirement using saline water 7.2 dSm^{-1} with leaching requirement 0.1 and 0.2, respectively. Also, the decrease percentage of average soil salinity at soil depth (0 – 45cm) was 13.3 and 19.1 % relative to without leaching requirement using saline water 8.15 dSm^{-1} with leaching requirement 0.1 and 0.2, respectively. While, the decrease percentage of average soil salinity at soil depth (0 – 45cm) was 12.9 and 19.0 % relative to without leaching requirement using saline water 10.46 dSm^{-1} with leaching requirement 0.1 and 0.2, respectively. At the end of harvesting stage, the decrease percentage of average soil salinity at soil depth (0 – 45cm) was 6.4 and 16.1 % relative to without leaching requirement using saline water 7.2 dSm^{-1} with leaching requirement 0.1 and 0.2, respectively. Also, the decrease percentage of average soil salinity at soil depth (0 – 45cm) was 15.6 and 22.2 % relative to without leaching requirement using saline water 8.15 dSm^{-1} with leaching requirement 0.1 and 0.2, respectively. While, the decrease percentage of average soil salinity at soil depth (0 – 45cm) was 13.5 and 20.2 % relative to without leaching requirement using saline water 10.46 dSm^{-1} with leaching requirement 0.1 and 0.2, respectively.

Soil reaction, pH

The obtained results show that the effect of irrigation water salinity levels and leaching requirement levels on soil reaction, pH, at the end of flowering and harvesting stages, Table (2&3). The results, in general, revealed that the increasing irrigation water salinity levels with or without leaching requirement slightly decreased pH value at soil depths compared to pH value of initial soil (7.6). This decrease may be due to the using saline irrigation water caused increasing salt accumulation in the soil, consequently increase the ions of Ca^{+2}, Mg^{+2} and N^{+1}. Also, the results showed that the increasing irrigation water salinity levels with or without leaching requirement slightly increased pH value of studied soil depth at the end of flowering and harvesting stages. Also, the obtained results indicated that the increasing leaching requirement levels with saline irrigation water slightly increased pH of the studied soil depths at the end of flowering and harvesting stages, Table (2&3).

Exchangeable sodium percentage, ESP

The data are presented in Table (2&3) and Figure (3&4) show that the estimated ESP as affected by irrigation water salinity levels and leaching requirement levels at the end of flowering and harvesting stages. The obtained results revealed that the increasing irrigation water salinity levels without leaching requirement obviously increased ESP values at soil depth (0 – 30 cm) compared to ESP value of initial soil (12 %). At the end of flowering stage, the increase percentage of ESP at soil depth (0 – 30 cm) was 55.0, 70.0 and 85.8 % relative to ESP value of initial soil using 7.2, 8.15 and 10.46 dSm^{-1} irrigation water salinity levels, respectively. At the end of harvesting stage, the increase percentage of ESP at soil depth (0 – 30 cm) was 50.0, 66.7 and 88.3 % relative to ESP of initial soil for 7.2, 8.15 and 10.46 dSm^{-1} irrigation water salinity levels, respectively. These results were confirmed with Zein El-Abedine, *et al.* (2004).

The increasing irrigation water salinity levels with or without leaching requirement increased ESP values of studied soil depth at the end of flowering and harvesting stages. Also, the ESP values of surface depth (0 - 15cm) were higher than that obtained other soil depth. The ESP values of the studied soil depths at the end of harvesting stage as affected by 10.46 dSm^{-1} irrigation water salinity were higher than that obtained at the end of flowering stage using the same saline water level. In the contrast, the ESP values of the studied soil depths at the end of harvesting stage as affected by 7.2 and 8.15 dSm^{-1} irrigation water salinity levels were lower than that obtained at the end of flowering stage using the same saline water levels.

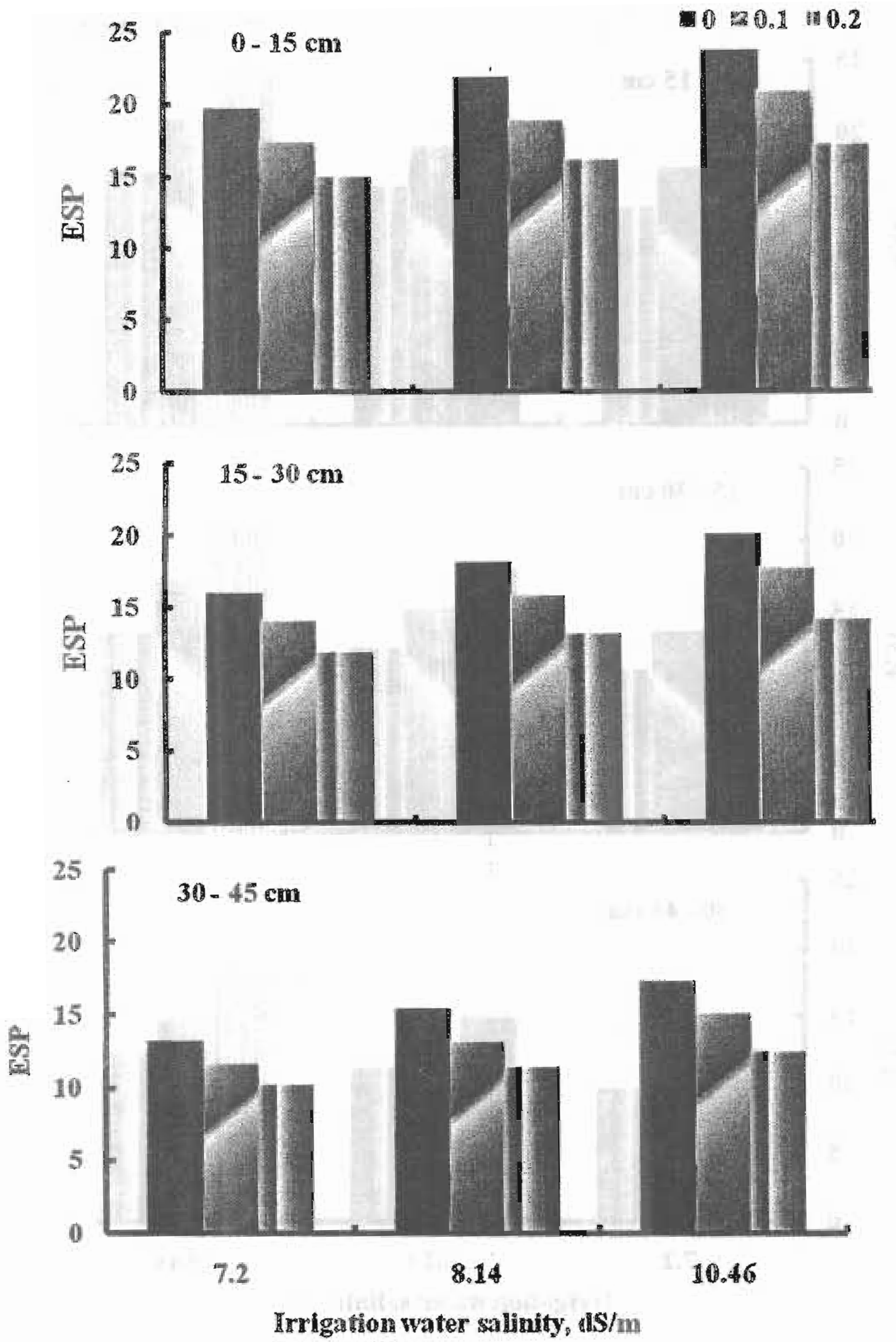

Fig.(3). Exchangeable sodium percentage as affected by irrigation water salinity and leaching requirements (0, .1 and 0.2) at the end of flowering stage.

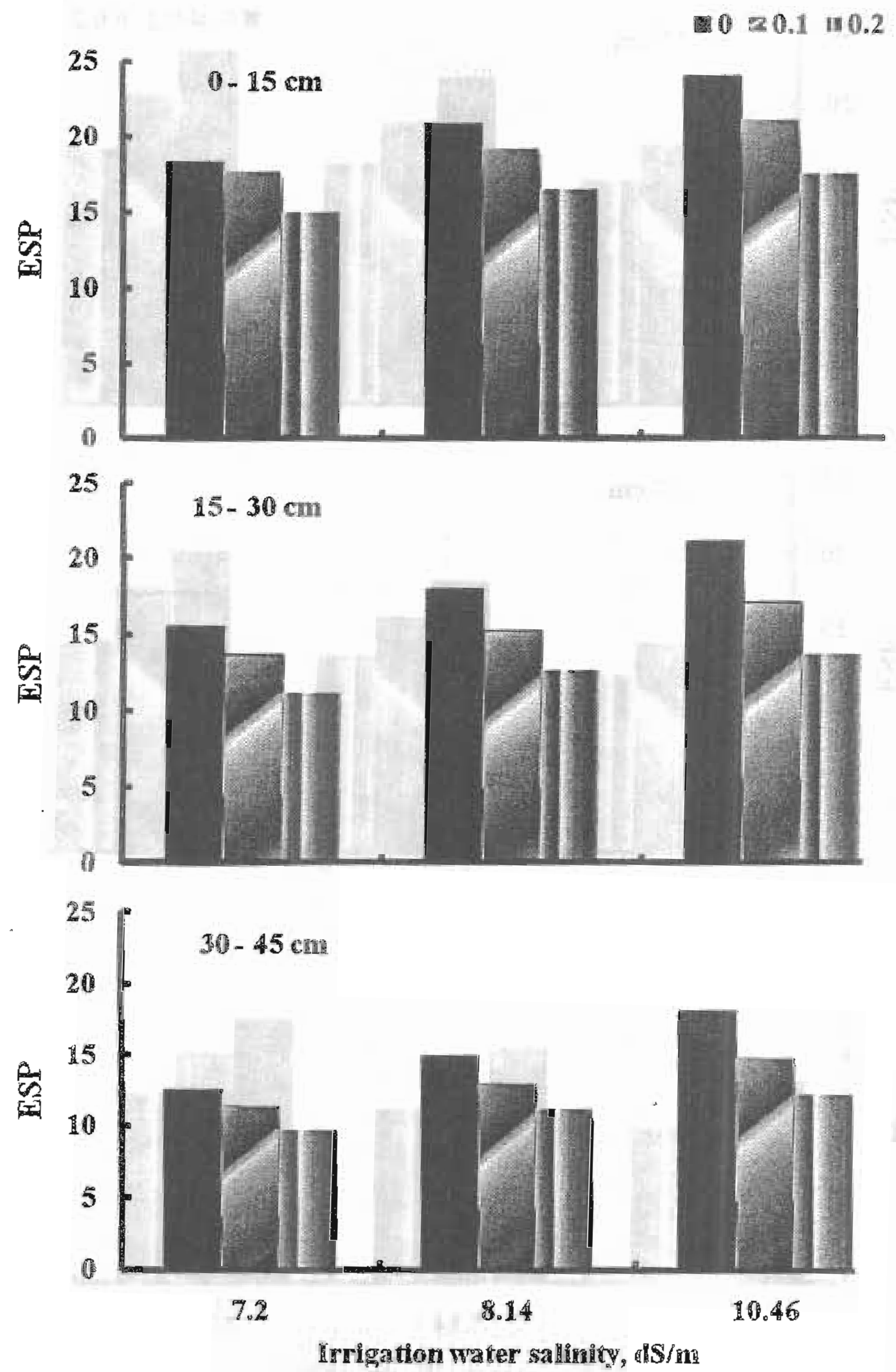

Fig. (4). Exchangeable sodium percentage as affected by irrigation water salinity and leaching requirements (0, .1 and 0.2) at the end of harvesting stage.

The results are illustrated in Table (2&3) and Figure (2) revealed that the increasing leaching requirement levels with saline irrigation water decreased ESP values of the studied soil depths at the end of flowering and harvesting stages. At the end of flowering stage, the decrease percentage of average ESP value at soil depth (0 – 45cm) was 19.5 and 32.2 % relative to without leaching requirement at 7.2 dSm^{-1} irrigation water salinity level with leaching requirement 0.1 and 0.2, respectively. The decrease percentage of average ESP at soil depth (0 – 45cm) was 17.9 and 29.5 %, relative to without leaching requirement, using 8.15 dSm^{-1} irrigation water salinity level with leaching requirement 0.1 and 0.2, respectively. While, the decrease percentage of average ESP at soil depth (0 – 45cm) was 16 and 27.2 % relative to without leaching requirement using 10.46 dSm^{-1} irrigation water salinity level with leaching requirement 0.1 and 0.2, respectively. At the end of harvesting stage, the decrease percentage of average ESP value at soil depth (0 – 45cm) was 20.6 and 34.1 % relative to without leaching requirement at 7.2 dSm^{-1} irrigation water salinity level with leaching requirement 0.1 and 0.2, respectively. The decrease percentage of average ESP at soil depth (0 – 45cm) was 19.0 and 31.2 %, relative to without leaching requirement, at 8.15 dSm^{-1} irrigation water salinity level with leaching requirement 0.1 and 0.2, respectively. While, the decrease percentage of average ESP at soil depth (0 – 45cm) was 16.7 and 27.8 % relative to without leaching requirement using 10.46 dSm^{-1} irrigation water salinity level with leaching requirement 0.1 and 0.2, respectively.

After using the irrigation water salinities with or without leaching requirement, in general the ESP value of soil depth (0 - 15cm) was > 15 with exception using low irrigation water salinity level with 0.2 leaching requirement. Consequently, the soil is saline alkali.

Plant height

Plant height of sunflower, cm, as affected by irrigation water salinity values with or without leaching requirements levels are shown in Table (4). The results revealed that the increasing irrigation water salinity levels significantly decreased plant height. This decrease might be attributed to the increasing salt accumulation in soil of active root zone with increasing irrigation water salinity levels, Table (3). The decrease percentage of plant height at 8.15 and 10.46 dSm^{-1} irrigation water salinity was 13.3 and 23.5 %, relative to low irrigation water salinity, respectively.

The obtained results showed that the increasing leaching requirement levels with studied irrigation water salinities, in general, significantly increased plant height of sunflower, Table (4). This increase might be due to the leaching requirement decrement the soil salinity of active root zone, Table (3). The highest value of sunflower height was found at 7.2 dSm^{-1} irrigation water salinity level with 0.2 leaching requirement, while, the lowest value was found at 10.46 dSm^{-1} irrigation water salinity level without leaching requirement.

Seed yield

Seed yield of sunflower, kg/fed, as affected by irrigation water salinities with or without leaching requirements levels are illustrated in Table (4) and Fig. (5). The results showed that the increasing irrigation water salinity levels significantly reduced seed yield of sunflower. This reduction might be attributed to the increasing soil salinity of active root zone with increasing irrigation water salinity, Table (3). These results are agreement to Gupta (1999) who the salinity is effective on growth and yield of plants thorough increasing osmotic and concentration of specific. The seed yield reduction percentage was 20.9 % at 8.15 dSm^{-1} irrigation water salinity level and was 54.2 % at 10.46 dSm^{-1} irrigation water salinity level relative to low studied irrigation water salinities.

Table (4): Plant height and seed of sunflower as affected by irrigation water salinity levels and leaching requirement levels (LR)

Salinity irrigation water dSm^{-1}	LR	Plant height cm	Seed yield kg/fed
7.2	0.00	140.80	1118.20
	0.10	146.40	1394.10
	0.20	152.60	1512.80
mean		146.60	1341.70
8.15	0.00	117.70	932.60
	0.10	120.00	1067.00
	0.20	143.70	1184.80
mean		127.10	1061.50
10.46	0.00	110.80	487.00
	0.10	111.60	527.80
	0.20	114.00	828.00
mean		112.10	614.20
Total mean		128.60	1005.80
LR mean	0.00	123.10	845.90
	0.10	126.00	996.30
	0.20	136.70	1175.20
LSD	Leaching	4.18	6.59
	salinity	5.84	9.50
	SxL	7.24	11.42

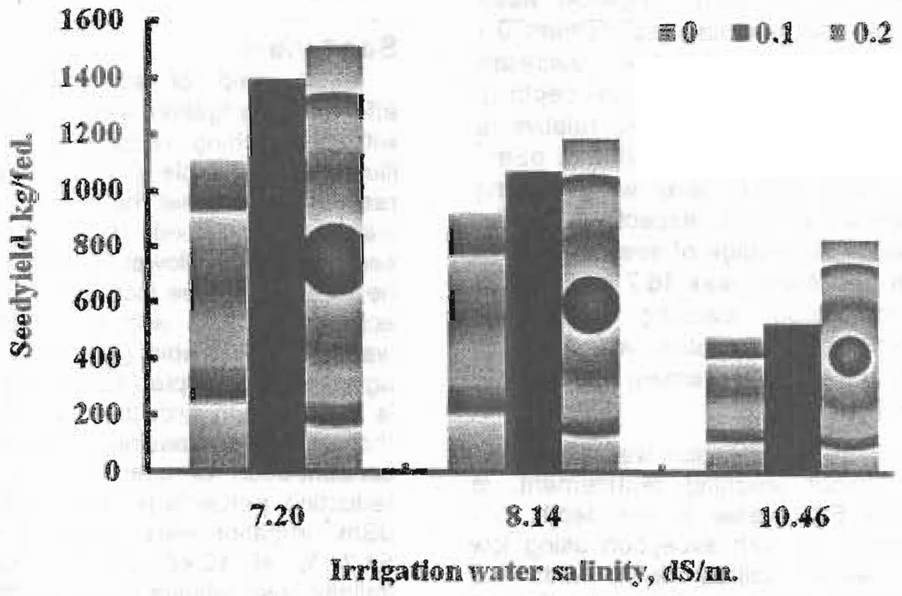

Fig. (5). Seed yield of sunflower as affected by irrigation water salinity and leaching Requirements (0, .1 and 0.2).

The obtained results indicated that increasing leaching requirements levels with studied irrigation water salinities significantly increased seed yield of sunflower, Table (4) and Fig.(5). This increase due to the increasing leaching requirements caused decrement the soil salinity of active root zone. The increase percentage of seed yield was 17.8 % at 0.1 leaching requirement level and was 38.9 % at 0.2 leaching requirement, relative to without leaching requirement. The highest value of sunflower seed yield was found at 7.2 dSm^{-1} irrigation water salinity level with 0.2 leaching requirement, while, the lowest value was found at 10.46 dSm^{-1} irrigation water salinity level without leaching requirement.

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تأثير مستويات ملوحة مختلفة لماء الري ومعدلات الغسيل على بعض الخواص الكيميائية للأرض ومحصول عباد الشمس في منطقة رأس سدر – جنوب سيناء.

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الملخص العربي

أجريت تجربة حقلية على ارض جيرية في محطة بحوث رأس سدر التابعة لمركز بحوث الصحراء- جنوب سيناء لدراسة تأثير مستويات مختلفة من ملوحة ماء الري تحت مستويات مختلفة من الاحتياجات الغسيلية وتأثير ذلك على بعض الخواص الكيميائية مثل pH, EC , ESP وكذلك محصول عباد الشمس وذلك باستخدام ثلاثة مستويات من ملوحة ماء الري وهى (7.20 , 8.14 , 10.46 dSm^{-1}) مع ثلاثة مستويات من الاحتياجات الغسيلية وهى(0.0 ,0.1 , 0.2)على التوالي.

وقد أوضحت النتائج إلى أنة بزيادة مستوى ملوحة ماء الري مع أو بدون إضافة احتياجات غسيليه أدى إلى زيادة ملوحة التربة لطبقات التربة المدروسة وذلك عند نهاية كل من مرحلة التزهير والحصاد ,علاوة على ذلك كانت قيم ملوحة التربة عند عمق 0-15 cm أعلى من الأعماق الأخرى. وكذلك أوضحت النتائج المتحصل عليها أنة بزيادة الإضافة من الاحتياجات الغسيلية عند المستوى المدروس لملوحة ماء الري أدى ذلك إلى انخفاض ملوحة التربة لأعماق نفس المستوى عند نهاية كل من مرحلة التزهير والحصاد.

أظهرت النتائج أيضا أنة بزيادة مستوى ملوحة ماء الري مع أو بدون إضافة احتياجات غسيليه أدى إلى زيادة طفيفة لقيم pH لأعماق نفس المستوى عند نهاية كل من مرحلة التزهير والحصاد.وكذلك أوضحت النتائج أنة بزيادة مستوى ملوحة ماء الري مع أو بدون إضافة احتياجات غسيليه أدى إلى زيادة في قيم ESP لطبقات التربة المدروسة وذلك عند نهاية كل من مرحلة التزهير والحصاد.

أيضا تشير النتائج إلى أنة بزيادة مستوى ملوحة ماء الري أدى ذلك إلى نقص معنوي في طول النبات وبشكل عام أظهرت النتائج إلى أنة بزيادة مستوى إضافة الاحتياجات الغسيلية عند مستوى الملوحة المدروس أدى ذلك إلى زيادة معنوية لكل من طول النبات ومحصول البذور لعباد الشمس في حين نجد أن زيادة مستوى ملوحة ماء الري أدى إلى انخفاض معنوي لمحصول بذور عباد الشمس حيث كانت نسبة الانخفاض ٢٠,٩ % عند مستوى ماء ري 8.15 dSm-1 و ٥٤,٢ % عند مستوى ماء ري 10.46 dSm-1 مقارنة بالمستوى الأقل من ماء الري في حين نجد أن زيادة إضافة الاحتياجات الغسيلية عند مستوى ماء الري المدروس أدى إلى زيادة معنوية كبيرة لمحصول بذرة عباد الشمس وكانت أعلى أنتاج لمحصول بذرة عباد الشمس عند مستوى ملوحة ماء الري 7.2 dSm^{-1} عند إضافة 0.20 من الاحتياجات الغسيلية بينما كانت اقل إنتاجية لمحصول بذرة عباد الشمس عند مستوى ملوحة ماء الري 10.46 dSm^{-1} بدون إضافة احتياجات غسيلية .