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EFFECT OF DIFFERENT WATER QUALITIES ON SOIL PROPERTIES AND PLANT GROWTH UNDER NATURAL CONDITION

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ABSTRACT

A pot experiments were conducted at the farm of Faculty of Agric. Al-Azhar University, Nasr City, Cairo, Egypt to study the effect of irrigation by water differed in their qualities (EC, SAR and RSC parameters) on soil characteristics (both physical and chemical) and plant growth. The concentrations of the above three parameter were prepared by making a series of dilutions of Qarun Lake water samples. Where these concentrations were 1, 2, 3, and 4 dS m^{-1} for EC, 6, 12, 18 and 24 meq l^{-1} for SAR and 1, 1.75, 2.5 and 3.25 for RSC. Some winter crops, wheat (*Triticum asitivum*), broad bean (*Vicia faba*) and Kidney bean (*Phaseolus vulgaris*)) and summer crops, coriander (*Coriandrum saivum*), sunflower (*Helianthus annus*) and sesame (*Sesamum indicum*)) were selected as indicator plants.

The results could be summarized as follows:-

- The low quality of irrigation water had a significant hazard effect on the plant growth. This was true for all parameters (EC, SAR and RSC). Where, a significant decrease in the growth of all crops (winter and summer) was observed by increasing the levels of irrigation water parameters.
- The increase in the concentrations of water parameters (EC, SAR and RSC) led to an increase in EC, pH and the concentration of soluble ions (both anions and cations), exception was found in case of soluble K, where there is no effect of water quality on the K concentration. The effect of water parameters can be arranged in the following order; SAR > EC > RSC. This was true for all crops.
- The increase of irrigation water salinity (EC) gave a marked increase in E %, HC and MWD. On the other hand, the increase of irrigation water sodicity (SAR and RSC) gave a marked decrease for E %, HC and MWD. Exception was found in a low level RSC where a slight increase of total porosity (E %) was obtained.

Keywords: water quality, soil salinity, aggregate stability, plant growth

INTRODUCTION

It is well known that water is a basic necessity for sustaining life in the universe. In plants, functions of water are manifold, such as maintenance of turgidity, opening and closing of leaf stomata, uptake and translocation of nutrients and metabolites, synthesis of proteins and other related products, sequestration of excessive salts and toxic material into vacuoles or out of tissue and serving as medium for all biochemical and bio-energy reactions (Salisbury and Ross, 2005). Soil salinity is a major environmental factor that limits the productivity of agricultural lands. Soil salinity also causes land degradation and affects food production (Sharma and Rao, 1998). Limiting good quality of water resources are farcing growers to use water with relatively high salt concentration for crop irrigation (Rasiah *et al.*, 1992). Saline irrigation water contains dissolved substances known as salts. In much arid and semi arid regions, most of the salts present in irrigation water are chlorides, sulfates, carbonates, and bicarbonates of calcium, magnesium, sodium and potassium. While salinity can improve soil structure, it can also negatively affect plant growth and crop yields. Sodicity refers specifically to the amount of sodium present in the irrigation water. Irrigation with water that has excess amounts of sodium can adversely impact soil structure making it difficult for plant growth. High saline and sodic water qualities can cause problems for irrigation, depending on the type and amount of salts present, the soil type being irrigated, the specific plant species and growth stage, and the amount of water that is able to pass through the root zone. Behrouz *et al.* (2007) stated that the increase in irrigation water salinity had no effect on the soil acidity, but it decreased water holding capacity. Emdad *et al.* (2006) found that the application of either low or high SAR water led to reduce aggregate stability, increase the bulk density of both the surface crust and underlying soil. Both of these results indicate the impact of high SAR on the collapse of soil structure and soil dispersion. Under field conditions, irrigated soils are exposed to sequential periods of rapid wetting followed by drying. Soils which are subjected to these wetting and drying cycles have been found to exhibit low aggregate stability (Caron *et al.*, 1992) resulting in the release of colloidal material and the collapse of soil pores, Levy and Miller (1997). However, the quality of irrigation water applied will also affect the soil chemical properties which influence soil dispersion and aggregate breakdown, surface sealing and crust formation, Shainberg and Letey (1984). Hence, few workers have been able to distinguish the physico-chemical impacts associated with the quality of water applied (e.g. dispersion) from the physical impacts associated with wetting and consolidation (i.e. slumping, hydraulic sealing). Furrow irrigation water quality affected soil cohesively by altering clay dispersion, Malik *et al.* (1992) and Shainberg *et al.* (1992) and aggregate stability characteristics, Smith *et al.* (1992). Hence the objective of the work is to evaluate the effect of irrigation water quality (salinity and sodicity) on the soil properties (both chemical and physical) under field conditions. The effect of water quality on growth parameters of some crops (winter and summer crops) was also taken into consideration.

MATERIALS AND METHODS

A pot experiments were conducted at the farm of Faculty Agric. Al-Azhar University, Nasr City, Cairo, Egypt to study the effect of irrigation by water differed in their qualities (EC, SAR and RSC parameters) on soil characteristics (both physical and chemical) and plant growth. The concentrations of the above three parameter were prepared by making a series of dilutions of Qarun Lake water samples. Where these concentrations were 1, 2, 3, and 4 dS m^{-1} for EC, 6, 12, 18 and 24meq l^{-1} for SAR and 1, 1.75, 2.5 and 3.25 for RSC. Some winter crops, wheat (*Triticum asitivum*), broad bean (*Vicia faba*) and Kidney bean (*Phaseolus vulgaris*)) and summer crops, coriander (*Coriandrum saivum*), sunflower (*Helianthus annus*) and sesame (*Sesamum indicum*)) were selected as indicator plants. A pot of 20 cm diameter and 30 cm depth was filled by 8 Kg of sandy loam soil. Wheat, broad bean and Kidney bean crops were planted at rates of 10, 5and 5 grains for each pot respectively, while summer crops were planted at rates of 10, 5and 10grains for coriander, sunflower and sesame, respectively, The moisture content of soil was kept at field capacity by using the abovementioned waters which differed in their qualities for irrigation. The NPK fertilizers were applied as according to the recommended rates for each crops. The experiments were arranged according to complete randomized design (Snedecor and Cochran, 1972). At the end of experiments the plants were harvested and prepared for analysis. The characteristics of the investigated soil and water weres determined according to Klute; (1986) and Page *et al.*, (1982). The results of soil and water analysis before experimenting are presented in Tables 1&2. In this respect the analysis of plants was also determined after (Page *et al.*, 1982)

Table1: Some physical and chemical properties of the investigated soil

Soil Properties		Particle size distribution %				Textural class	O.M. %	$CaCO_3$ %	pH	EC dS m^{-1}
		Coarse Sand	Fine sand	Silt	Clay					
		54.23	22.53	10.91	12.33	Sandy loam	1.14	1.23	7.62	1.13
Soluble ions in 1:2.5 soil water extract (meq L^{-1})							BD, g/ cm^3	E %	MWD Mm	HC, cm/h
Ca^{++}	Mg^{++}	Na^{++}	K^+	SO_4^{--}	Cl^-	HCO_3^-				
2.45	1.55	5.53	0.54	2.27	5.85	1.95	1.38	46.92	0.335	9.25

BD = bulk density, E= total porosity, MWD = mean weight diameter, HC = hydraulic conductivity

Table2: Some chemical analysis of Qarun Lake water.

Irrigation water properties	pH	EC dS m^{-1}	Soluble ions (meq L^{-1})					SAR	RSC meq l^{-1}
			Ca^{++}	Mg^{++}	Na^{++}	CO_3	HCO_3		
	8.12	43.6	20.00	82.00	274.0	0.66	2.85	34.59	-96.54

RESULTS AND DISCUSSION

Effect of water qualities on the growth of both winter and summer crops.

With regard to the effect of water quality on growth of different crops (either winter or summer crops) expressed as the mean of dry matter weight, the results are presented in Table 3. It seen that the low quality of irrigation water had a significant hazard effect on the plant growth. This was true for all parameters (EC, SAR and RSC). Where, a significant decrease in the growth of all crops (winter and summer) was observed by increasing the levels of irrigation water parameters. Generally, the relative decrease for winter crops due to total salinity (EC) can be arranged as follow: kidney bean > broad bean > wheat. The same arrangement was also obtained with other parameters (either SAR OR RSC).But the hazard effect of both SAR and RSC on the growth was hither than EC. On the other hands, the relative decrease for summer crops due to total salinity (EC) can be arranged as follow: sesame > sunflower > coriander. The same hand was observed in the case of RSC parameters. While the arrangement of the due SAR coriander > sunflower > sesame. This result partially agreed with those of Mousavil *et al.* (2009); who found that saline irrigation water treatments significantly reduced fresh yield, number of fruits, fruit weight per plant and water use efficiency.

Table 3: Effect of water qualities on the growth of both winter and summer crops.

Treatments		Winter crops					
		Wheat		Broad bean		Kidney bean	
		Dry weight, g. pot^{-1}	Relative decrease of growth%	Dry weight, g. pot^{-1}	Relative decrease of growth %	Dry weight, g. pot^{-1}	Relative decrease of growth %
Control		**11.67**	**0.00**	**18.14**	**0.00**	**13.22**	**0.00**
EC dS m^{-1}	1	10.67	8.57	16.12	11.14	10.55	21.20
	2	9.29	21.40	13.96	22.87	9.43	28.67
	3	7.91	32.22	10.90	39.92	8.33	36.99
	4	7.66	34.37	10.12	44.22	7.23	45.32
SAR	6	10.32	11.57	16.14	11.03	10.66	19.37
	12	9.65	17.31	14.18	21.84	10.32	21.94
	18	8.43	27.77	13.32	26.58	9.31	29.58
	24	8.33	28.63	11.18	38.37	7.30	44.79
RSC meq l^{-1}	1	10.45	10.46	14.74	18.74	10.63	19.60
	1.75	10.43	10.63	13.25	26.96	10.34	21.79
	2.5	9.42	19.93	12.64	30.32	9.22	30.26
	3.25	8.34	28.54	11.63	35.89	7.22	45.39
Treatments		**Summer crops**					
		Coriander		**Sunflower**		**Sesame**	
		Dry weight, g. pot^{-1}	**Relative decrease of growth%**	**Dry weight, g. pot^{-1}**	**Relative decrease of growth %**	**Dry weight, g. pot^{-1}**	**Relative decrease of growth %**
Control		**5.16**	**0.00**	**6.21**	**0.00**	**5.16**	**6.80**
EC dS m^{-1}	1	4.76	7.26	5.37	13.53	6.12	10.00
	2	4.56	11.63	5.31	14.50	5.63	17.20
	3	4.37	15.31	4.13	33.39	5.13	24.56
	4	3.87	25.00	3.60	42.03	4.64	31.77
SAR	6	5.00	3.11	5.73	7.73	6.42	5.59
	12	4.66	9.69	5.10	17.87	5.60	17.65
	18	4.55	11.83	4.00	35.58	5.11	24.86
	24	3.62	29.85	3.72	40.10	4.10	39.71
RSC meq l^{-1}	1	5.00	3.11	5.10	17.87	5.62	17.36
	1.75	4.74	8.14	4.21	32.20	5.42	20.30
	2.5	4.57	11.44	4.63	25.45	5.00	26.48
	3.25	4.43	33.53	3.45	44.45	4.11	39.56

Effect of water qualities on soil characteristics.

Effect on soil chemical properties.

The results of Tables 4 and 5 showed that the use of water differed in their qualities had a significant effect on some soil chemical properties. Where, it is interesting to say that the increase in the concentrations of water parameters (EC, SAR and RSC) led to an increase in EC, pH and the concentration of soluble ions (both anions and cations). Exception was found in case of soluble K, where there is no effect of water quality on the K concentration. The highest concentration of ion was markedly observed in case of both Na and Cl, Also, it is noticed that RSC parameter was superior to other parameters on its effect on the concentration of HCO_3, where the highest values of HCO_3 was obtained with RSC. In this respect, the results of organic matter seem to be equal indicating that water quality had no effect on the content of soil organic matter. However, the results of Table 4 indicated that the water quality had a little effect on either EC or pH values, where a little increase of both EC and pH was observed due to the irrigation by low water quality. In contrary, a high increase of ESP was observed with increasing the concentration of water parameters. The effect of water parameters can be arranged in the following order; SAR > EC > RSC. This was true for all crops. As regard to Tables 4 and 5, it is noticed that concentration of soluble ions (cations and anions) of the cultivated soil depend on the quality of irrigation water (either salinity or sodicity) and the specific plant species (winter and summer crops). This reflects the differentiation of such crop to absorb ions from growth media. These results are in a good harmony with those obtained by many authors such as Rodolfo *et al.* (2007), they noticed an increase in ESP, EC and pH due to irrigation of soil with marginal water quality.

Table 4: Soil chemical properties as affected by treatments after winter season

crops	Treatment		pH soil past	EC, dS m^{-1}	O.M %	Cation mg/L				Anions mg/L				ESP %
						Ca	Mg	Na	K	SO_4	CO_3	HCO_3	Cl	
Wheat	**Control**		**7.51**	**1.42**	**1.16**	**2.28**	**2.69**	**5.14**	**1.10**	**4.76**	**0.0**	**1.61**	**5.34**	**3.16**
	EC dS m^{-1}	1	7.52	1.40	1.15	2.60	2.50	7.13	1.10	5.96	0.0	1.14	4.48	5.00
		2	7.53	1.46	1.14	2.61	2.40	7.20	1.10	5.46	0.0	1.50	4.55	5.09
		3	7.60	1.55	1.14	2.61	1.60	7.92	1.13	5.27	0.0	1.49	5.91	6.83
		4	7.62	1.69	1.13	2.62	1.51	8.73	1.14	4.98	0.0	2.91	6.51	7.51
	SAR	6	7.55	1.40	1.15	2.45	2.40	7.11	1.11	4.46	0.0	2.11	4.58	5.18
		12	7.56	1.42	1.15	2.50	2.48	8.31	1.10	5.72	0.0	2.12	5.29	6.00
		18	7.58	1.50	1.13	1.70	2.11	8.59	1.13	4.18	0.0	2.20	6.22	7.19
		24	7.62	1.60	1.13	1.72	2.00	10.11	1.13	4.63	0.0	3.12	7.43	8.66
	RSC meq l^{-1}	1	7.53	1.39	1.15	3.63	3.10	6.51	1.10	3.11	0.0	6.10	3.55	3.74
		1.75	7.61	1.49	1.15	3.72	3.40	6.50	1.11	4.49	0.0	6.12	3.45	3.59
		2.5	7.63	1.52	1.13	4.73	3.42	6.72	1.11	3.31	0.0	7.13	3.55	3.74
		3.25	7.70	1.58	1.13	3.82	3.61	7.20	1.30	4.10	0.0	7.33	3.76	4.05
Broad bean	**Control**		**7.51**	**1.42**	**1.16**	**2.28**	**2.69**	**5.14**	**1.10**	**4.76**	**0.0**	**1.61**	**5.34**	**3.16**
	EC dS m^{-1}	1	7.52	1.45	1.15	2.55	2.50	8.10	1.09	6.18	0.0	1.15	6.91	5.83
		2	7.55	1.50	1.13	2.60	2.39	8.15	1.10	5.67	0.0	1.59	6.98	5.91
		3	7.59	1.60	1.13	2.59	1.45	8.90	1.13	4.97	0.0	1.60	7.50	6.33
		4	7.61	1.70	1.13	2.60	2.50	10.13	1.13	5.65	0.0	3.10	7.61	9.09
	SAR	6	7.55	1.40	1.14	2.49	2.45	8.12	1.00	4.49	0.0	2.10	7.47	5.88
		12	7.56	1.45	1.14	2.50	2.46	9.15	1.03	5.54	0.0	2.10	7.50	6.72
		18	7.69	1.61	1.13	1.60	1.61	10.13	1.13	4.74	0.0	2.12	7.61	9.37
		24	7.70	1.69	1.13	1.62	1.63	10.20	1.13	4.84	0.0	3.11	7.63	10.29
	RSC meq l^{-1}	1	7.59	1.40	1.14	3.72	3.11	6.60	1.10	2.71	0.0	6.11	5.71	3.80
		1.75	7.60	1.50	1.13	3.90	3.39	6.50	1.11	3.87	0.0	7.12	3.91	3.56
		2.5	7.60	1.55	1.13	4.72	3.41	6.70	1.11	3.61	0.0	7.13	3.93	3.75
		3.25	7.66	1.68	1.13	3.93	3.70	7.14	1.43	3.16	0.0	7.33	4.92	3.89
Kidney bean	**Control**		**7.51**	**1.42**	**1.16**	**2.28**	**2.69**	**5.14**	**1.10**	**4.76**	**0.0**	**1.61**	**5.34**	**3.16**
	EC dS m^{-1}	1	7.53	1.50	1.14	2.60	2.50	8.20	1.10	5.80	0.0	1.20	7.40	5.87
		2	7.55	1.52	1.14	2.65	2.41	8.25	1.11	5.78	0.0	1.60	7.44	5.91
		3	7.60	1.68	1.13	2.60	1.55	9.30	1.30	5.15	0.0	1.63	7.61	7.50
		4	7.63	1.94	1.13	2.63	2.56	12.41	1.43	7.29	0.0	3.10	8.64	9.01
	SAR	6	7.56	1.45	1.14	2.51	2.56	9.13	1.10	5.73	0.0	2.10	7.47	6.60
		12	7.57	1.50	1.14	2.53	1.57	10.10	1.10	5.75	0.0	2.11	7.49	8.24
		18	7.70	1.61	1.13	1.67	1.60	11.15	1.20	5.86	0.0	2.10	7.66	10.23
		24	7.72	1.93	1.13	1.70	1.65	14.21	2.30	8.04	0.0	3.13	8.70	12.80
	RSC meq l^{-1}	1	7.60	1.46	1.14	3.52	3.60	6.75	1.10	3.16	0.0	7.11	4.70	3.80
		1.75	7.61	1.51	1.14	3.67	3.62	6.80	1.11	3.25	0.0	8.13	3.82	3.75
		2.5	7.61	1.60	1.13	3.73	3.66	6.81	1.11	3.33	0.0	8.15	3.83	3.76
		3.25	7.65	1.92	1.13	4.80	4.71	7.85	2.12	5.40	0.0	9.18	4.90	3.82

Table 5: Soil chemical properties as affected by treatments after summer season.

Crops	Treatment		pH soil past	EC dS m^{-1}	O.M %	Cation mg/L				Anions mg/L				ESP %
						Ca	Mg	Na	K	SO_4	CO_3	HCO_3	Cl	
Coriander	**Control**		**7.51**	**1.42**	**1.16**	**2.28**	**2.69**	**5.14**	**1.10**	**4.76**	**0.0**	**1.61**	**5.34**	**3.16**
	EC dS m^{-1}	1	7.53	1.41	1.15	2.61	2.50	7.14	1.11	5.94	0.0	1.13	6.24	5.00
		2	7.53	1.45	1.15	2.60	2.41	7.21	1.10	5.57	0.0	1.40	6.34	5.09
		3	7.61	1.54	1.14	2.61	1.60	7.91	1.12	5.26	0.0	1.48	6.49	6.83
		4	7.63	1.70	1.14	2.62	1.52	8.72	1.13	4.99	0.0	2.92	7.12	7.51
	SAR	6	7.54	1.40	1.15	2.46	2.39	7.12	1.11	4.47	0.0	2.11	6.51	5.18
		12	7.57	1.42	1.15	2.51	2.47	8.31	1.10	5.71	0.0	2.13	6.56	6.00
		18	7.58	1.51	1.14	1.71	2.10	8.60	1.12	4.20	0.0	2.20	7.16	7.19
		24	7.62	1.60	1.14	1.73	1.99	10.12	1.13	4.62	0.0	3.12	7.20	8.66
	RSC meq l^{-1}	1	7.54	1.40	1.15	3.62	3.11	6.52	1.10	3.11	0.0	6.10	5.12	3.74
		1.75	7.62	1.50	1.15	3.71	3.41	6.51	1.11	4.50	0.0	6.13	4.11	3.59
		2.5	7.64	1.53	1.15	4.70	3.45	6.73	1.11	3.31	0.0	7.12	4.12	3.74
		3.25	7.71	1.58	1.14	3.80	3.63	7.20	1.30	4.10	0.0	7.31	4.52	4.05
Sunflower	**Control**		**7.51**	**1.42**	**1.16**	**2.28**	**2.69**	**5.14**	**1.10**	**4.76**	**0.0**	**1.60**	**5.34**	**3.16**
	EC dS m^{-1}	1	7.53	1.44	1.15	2.28	2.49	8.10	1.10	6.17	0.0	1.13	6.71	5.83
		2	7.55	1.49	1.15	2.59	2.40	8.16	1.12	5.65	0.0	1.60	6.81	5.91
		3	7.60	1.59	1.14	2.60	1.44	8.89	1.12	4.96	0.0	1.61	7.33	5.33
		4	7.62	1.68	1.14	2.59	2.51	10.12	1.12	5.65	0.0	3.11	7.59	9.03
	SAR	6	7.54	1.41	1.15	2.50	2.44	8.11	1.10	4.48	0.0	2.11	7.50	5.88
		12	7.55	1.46	1.15	2.51	2.45	9.14	1.09	5.53	0.0	2.11	7.61	6.72
		18	7.68	1.62	1.14	1.61	1.60	10.11	1.11	4.74	0.0	2.12	7.62	9.37
		24	7.71	1.70	1.14	1.62	1.63	11.20	1.12	4.83	0.0	3.13	7.62	10.29
	RSC meq l^{-1}	1	7.60	1.40	1.14	3.73	3.10	6.59	1.10	2.70	0.0	6.13	5.73	3.80
		1.75	7.62	1.52	1.14	3.91	3.38	6.49	1.12	3.87	0.0	7.12	3.92	3.56
		2.5	7.65	1.56	1.14	3.72	3.41	6.70	1.12	3.60	0.0	7.39	3.92	3.75
		4	7.72	1.09	1.14	3.92	3.71	7.15	1.33	3.15	0.0	8.13	4.93	3.89
Sesame	**Control**		**7.55**	**1.42**	**1.16**	**2.79**	**2.70**	**5.15**	**1.10**	**4.77**	**0.0**	**1.62**	**5.35**	**3.10**
	EC dS m^{-1}	1	7.58	1.52	1.14	2.62	2.61	8.30	1.12	5.58	0.0	1.62	7.35	5.83
		2	7.59	1.53	1.14	2.70	2.65	8.35	1.13	5.73	0.0	1.63	7.47	5.70
		3	7.65	1.69	1.13	2.75	1.70	9.50	1.14	5.82	0.0	1.72	7.55	7.35
		4	7.68	1.97	1.13	2.80	1.75	11.70	1.18	6.78	0.0	3.85	8.80	9.04
	SAR	6	7.61	1.46	1.14	2.56	2.59	9.14	1.11	5.79	0.0	2.11	7.50	6.56
		12	7.63	1.53	1.14	1.70	1.60	11.19	1.14	0.99	0.0	2.13	7.51	10.20
		18	7.68	1.62	1.14	1.72	1.65	12.22	1.20	6.89	0.0	1.20	7.70	11.04
		24	7.81	1.95	1.13	1.80	1.65	14.23	1.22	7.85	0.0	2.25	8.80	12.61
	RSC meq l^{-1}	1	7.64	1.47	1.15	3.57	3.55	7.15	1.13	2.76	0.0	7.13	5.51	4.28
		1.75	7.65	1.52	1.15	3.71	3.62	7.20	1.15	2.04	0.0	8.11	5.53	4.01
		2.5	7.77	1.61	1.13	3.73	3.67	7.30	1.17	2.12	0.0	8.23	5.60	4.09
		3.25	7.80	1.96	1.14	4.81	4.68	8.32	1.22	2.06	0.0	9.26	7.71	4.12

They also reported that irrigation by high sodicity water increased the sodium content in soil without increasing the total salt content. This is a modification of the proportion of exchangeable cations, rather than an increase in total salts content.

Effect on soil physical properties.

The results of Table 6 indicated that soil physical properties were significantly affected by the quality of irrigation water. However, this effect on these soil properties markedly varied according to the type of water parameters as well as its concentration. As regard to Ttable 6, it is noticed that increasing water salinity caused a little decrease of soil bulk density

(BD). An opposite trend was observed in case of total porosity (E %), hydraulic conductivity (HC cm h^{-1}) and the mean weight diameter (MWD) as indicator of aggregate stability. Where, the increase of irrigation water salinity (EC) gave a marked increase of E %, HC and MWD. On the other hand, the increase of irrigation water sodicity (SAR and RSC) gave a marked decrease of E %, HC and MWD. Exception was found at low level of RSC which has a slight increase of total porosity (E %) was obtained. In contrary, the increase of water sodicity (SAR and RSC) caused a little increase in soil bulk density (BD). Both of these results indicate the impact of high SAR on the collapse of soil structure and soil dispersion.

Table 6: Some physical properties of soil as affected by different treatments after winter and summer season.

plant	Treatment		BD, g cm^{-3}	E %	MWD, Mm	HC, cm h-1	plant	BD, g cm^{-3}	E %	MWD Mm	HC, cm h-1
Wheat	**Control**		**1.38**	**46.92**	**0.335**	**12.25**	Coriander	**1.38**	**46.92**	**0.335**	**9.25**
	EC dS m^{-1}	1	1.36	47.92	0.338	12.70		1.35	48.07	0.339	9.55
		2	1.35	48.07	0.341	13.30		1.33	48.84	0.339	9.75
		3	1.35	48.07	0.345	14.50		1.32	49.23	0.341	9.90
		4	1.32	49.23	0.351	15.20		1.30	50.00	0.345	9.50
	SAR	6	1.38	46.92	0.330	12.30		1.39	46.53	0.325	9.20
		12	1.39	46.53	0.325	11.50		1.41	45.76	0.325	9.15
		18	1.41	45.76	0.315	11.20		1.41	45.76	0.321	8.65
		24	1.43	45.00	0.309	10.90		1.42	45.38	0.320	8.42
	RSC meq l^{-1}	1	1.35	48.07	0.333	12.50		1.37	47.30	0.332	9.21
		1.75	1.39	46.53	0.330	12.70		1.38	46.92	0.332	9.11
		2.5	1.40	46.15	0.325	11.80		1.38	46.92	0.334	9.10
		3.25	1.42	45.38	0.312	10.80		1.40	46.15	0.332	9.00
Broad bean	**Control**		**1.38**	**46.92**	**0.335**	**12.25**	Sunflower	**1.38**	**46.92**	**0.335**	**9.25**
	EC dS m^{-1}	1	1.34	48.46	0.336	12.60		1.33	48.84	0.336	9.40
		2	1.32	49.23	0.339	12.90		1.33	48.84	0.338	9.55
		3	1.32	49.23	0.339	13.60		1.32	49.23	0.339	9.80
		4	1.29	50.38	0.348	14.50		1.30	50.00	0.342	10.85
	SAR	6	1.37	47.30	0.330	12.30		1.40	46.15	0.326	9.15
		12	1.39	46.53	0.330	12.10		1.40	46.15	0.325	9.00
		18	1.40	46.15	0.325	11.60		1.42	45.38	0.324	8.75
		24	1.40	46.15	0.314	11.30		1.43	45.00	0.322	8.75
	RSC meq l^{-1}	1	1.40	46.15	0.331	12.40		1.36	47.92	0.331	9.35
		1.75	1.41	45.76	0.330	12.60		1.36	47.92	0.332	9.25
		2.5	1.41	45.76	0.322	12.80		1.39	46.53	0.332	9.15
		3.25	1.42	45.38	0.310	12.90		1.39	46.53	0.332	9.35
Kidney bean	**Control**		**1.38**	**46.92**	**0.335**	**12.25**	Sesame	**1.38**	**46.92**	**0.335**	**9.25**
	EC dS m^{-1}	1	1.35	48.07	0.338	12.50		1.30	50.00	0.339	9.45
		2	1.35	48.07	0.339	12.90		1.28	50.76	0.339	9.65
		3	1.33	48.84	0.346	13.75		1.28	50.76	0.345	9.80
		4	1.32	49.23	0.360	14.60		1.25	51.92	0.345	10.20
	SAR	6	1.39	46.53	0.328	11.90		1.39	46.53	0.330	9.00
		12	1.39	46.53	0.321	11.30		1.41	45.76	0.329	8.55
		18	1.41	45.76	0.315	10.65		1.41	45.76	0.325	8.35
		24	1.43	45.00	0.295	10.00		1.44	44.61	0.322	8.20
	RSC meq l^{-1}	1	1.36	47.92	0.326	12.10		1.38	46.92	0.331	9.00
		1.75	1.38	46.92	0.325	11.80		1.39	46.53	0.331	9.10
		2.5	1.39	46.53	0.324	11.50		1.40	46.15	0.332	9.25
		3.25	1.42	45.38	0.315	11.30		1.41	45.76	0.335	9.25

This may be attributed to the high sodium levels which can reduce soil permeability through the swelling and dispersion of clays and the slaking of the aggregates. These results are in harmony with those obtained by Murtaza *et al.* (2006); who reported that infiltration rate tended to increase with freshwater as well as with saline-sodic water when used with amendments, but drastically decrease when saline-sodic water was used alone. Bulk density remained the highest with saline-sodic water at the 0.10–0.15 and 0.20– 0.25 m soil depths. This evidence suggests that low infiltration rate with high SAR water irrigation could cause some dispersion of clays, which caused an increase in bulk density that may become a big problem with continued saline-sodic irrigation water in the absence of an appropriate amendments.

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تأثيرالرى بمياه مختلفة الصلاحية على بعض خواص التربة والنبات تحت الظروف الطبيعية

عمـــاد ســـعيد الســـيد عبـــد الهـــادى ، خالـــد محمـــد عبـــد الحلـــيم العشـــرى و على محمد عبد الوهاب مشهور

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أقيمت تجربة أصص فى مزرعة كلية الزراعة – جامعة الأزهر – مدينة نصر بالقاهرة لدراسة تأثيرنوعيات مختلفة من مياه الرى على بعض خواص التربة ونمو بعض المحاصيل الشتوية (القمح ، الفول البلدى والفاصوليا) والصيفية (الكسبرة، دوار الشمس والسمسم). وقد اشتملت المعاملات على أربع مستويات من مقاييس جودة المياه EC (١، ٢، ٣ و ٤ ديسيسيمنزمتر$^{-1}$) ، SAR (٦، ١٢، ١٨و٢٤) ، RSC (١ ، ١.٧٥، ٢.٥و ٣.٢٥ ملليمكافئ لتر$^{-1}$) وذلك باستخدام سلسله من التخفيفات لعينة مياة من بحيرة قارون بمحافظة الفيوم للوصول الى النسب السابقة.

وقد أوضحت النتائج ما يلى :-

- يتأثر نمو النبات تأثيرا ملحوظا بإجراء عملية الرى بمياه منخفضة الصلاحيه حيث ظهر بوضوح نقص فى وزن الماده الجافه لجميع المحاصيل التى أتخذت كدليل للمعاملات سواء كانت هذه المحاصيل شتويه أو صيفيه.
- أدى استخدام مياه ذات مستويات مختلفة من مقاييس الصلاحية تحت الدراسة (EC SAR RSC) إلى زيادة تركيز كلا من الكاتيونات والأنيونات فيما عدا البوتاسيوم فى الأراضى المنزرعة خاصة الصوديوم والكلوريد فى معاملتى EC, SAR والبيكربونات فى معاملة RSC بينما زادت النسبة المئوية للصوديوم المتبادل ورقم الحموضة لمعاملتى SAR, RSC وقد وجد أن التأثير الأكبر للتركيزات على التربة كان يتبع الترتيب التالى نسبة ادمصاص الصوديوم > التوصيل الكهربى > كربونات الصوديوم المتبقية.
- كما أدى ارتفاع ملوحة مياه الرى إلى انخفاض كثافة التربة الظاهريه بينما زاد متوسط القطر الموزون (كدالة على ثبات التجمعات) والمسامية الكلية والتوصيل الهيدروليكى. ومن ناحية أخرى أنخفض متوسط القطر الموزون والمسامية الكلية والتوصيل الهيدروليكى وزادت الكثافة الظاهرية نتيجة لزيادة مستويات مقاييس الصلاحية SAR, RSC مقارنة بمعاملة الكنترول.

قام بتحكيم البحث

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