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Influence of Some Soil Amendments on Calcareous Soil Properties and its Production of Wheat Under Saline Irrigation Water

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IN ORDER to study the effect of sulphur, organic manure and bitumenous emulsion in single or combined additions on the chemical propertes of calcareous soil and its production of wheat under high saline irrigation water, two field experiments were carried out at Wadi Sudr Experimental Station, south Sinai during 1989-1990 and 1990-1991 seasons. Results showed a sharp decrease in soil pH values as a result of adding soil amendments under investigation and the combined treatment sulphur+organic manure+bitumenous emulsion was the best. Also, adding soil amendments led to reduce soil salinity at root zone relative to the control treatment.

Also, data indicated a sharp decrease in the concentrations of Na^+ and Cl^- ions while the concentrations HCO_3^- and $SO_4^=$ ions in soil solution were increased by adding such amendments.

The addition of amendments increased the percentages of soil organic matter especially in 0-10 cm soil depth and such percentages varied according to the treatment type.

Data indicated a significant increase in both grain and straw yields of wheat in two seasons relative to the control treatments. The combined treatment of sulphur+organic manure + bitumenous emulsion led to highest yield.

It can be recommended that, the application of sulphur+organic manure+bitumenous emulsion is important to control soil salinity, overcome hazard effects of Na^+ and Cl^- and increasing wheat yield under irrigation with high saline water.

Key words : Calcareous soil, Sulphur, Farmyard manure, Bit., Combinations, Saline water, Wheat.

Egypt is semi arid in the north and arid in the south. Under these conditions the problems of soil salinity and alkalinity are widely spread, especially when highlp saline water;is used in irrigation.

Recently, the good management of such soils by using natural or synthetic soil amendments has become one of the most important practices for improving physical and chemical properties of these soils, consequently enhancing its productivity. To achieve this aim many studies were carried out. Application of sulphur to soil resulting in reducing soil pH, EC and SAR values (Khafagi and Abdelhadi (1990).

Also, sulphur application led to a significant increase;of straw and grain yields of wheat plants grown on calcareous soil (Abdalla, 1991).

Adding organic manures to soil decreased its pH and SAR values, meanwhile increased the solubility of its ions (Abou El-Defan, 1990).Also, it increased the yield of wheat (Chen and Wang, 1987).

Several studies showed thal mulching calcareous soil with bitumenous emulsion decreased salt content of soil, Tayel **et al.** (1988) and increased crop yields, El-Shabassy **et al.** (1971) and Hanna (1988).

However, limited informalion was available about the role of soil amendments under highly saline irrigation water

The aim of this work is to study the effect of elemental sulphur, farmyard manure and bitumenous emulsion as well as their combinations on some soil properties and yields of wheat plants grown on calcareous soil under highly saline irrigation water.

Material and Methods

Two field experiments were conducted during 1989/1990 and 1990/1991 growing seasons at Wadi Sudr Agricultural Experimental Station, Desert Research Centre, South Sinai Governorate. The physical and chemical properties of the soil in which the experiments were carried out are shown in Table 1. The soil is highly calcareous, highly saline and of sandy loam texture.

TABLE 1. Some physical and chemical properties of the investigated soil at Ras Sudr.

Soil depth (cm)	Particle size distribution %				Texture class	Bulck density /g/cm³	Field capacity %
	Coarse sand	Fine sand	Silt	Clay			
0-10	39.43	39.70	8.57	12.30	Sandy loam	1.43	13.90
10-20	37.20	43.33	12.20	7.27	Sandy loam	1.51	13.60
20-30	37.30	42.13	12.50	8.07	Sandy loam	1.51	13.60

B- Chemical properties

Soil depth (cm)	EC (dS/m)	Soluble cations (meq/l)			Soluble anions (meq/l)				SAR	$CaCO_3$ %	O.M. %
		Ca^{2+} Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3	SO_4^{2-}	Cl^{-}			
0-10	7.20	12.26	61.67	50.26	1.55	-	2.36	78.78	80.97	10.49	50.70	0.21
10-20	7.30	11.30	51.40	50.52	1.54	-	4.51	37.40	71.00	11.54	51.23	0.14
20-30	7.40	9.40	53.31	36.90	1.13	-	3.25	41.20	47.30	7.15	51.16	0.10

TABLE 2. Chemical composition of the saline well water used for surface irrigation.

Sampling date	EC dS/m	Soluble cations (meq/l)			Soluble anions (meq/l)				SAR
		Ca^{2+} Mg^{2+}	Na^{+}	K^{+}	CO_3^{2-}	HCO_3	SO_4^{2-}	Cl	
Nov. 1989	6.49	30.67	33.91	0.12	-	5.10	29.35	29.17	8.0
Jan. 1990	8.11	44.33	36.27	0.15	-	5.83	34.42	40.86	7.70
Mar. 1990	8.60	46.70	42.04	0.14	-	5.10	35.80	45.75	8.70

The experiments were carried out in a completely randomized block design with four replicates for each treatment The treatments were :

1. Without adding amendments (control treatment).
2. Elemental sutphur (S) at the rate of 0.5 ton/fed.
3. Farmyard fanure (FYM) at the rate of 20 m^3/fed Table 3.
4. Bitumeneous emulsion (Bit.) at at the rate of 0.2 L/m^2.
5. The combined treatment of the same rates of S+FYM.
6. The combined treatment of the same rates of S + Bit.
7. The combined treatment of the same rates of FYM + Bit.
8. The combined treatment of the same rates of S+FYM+Bit

Either S or FYM was mixed with the upper 30 cm depth of the soil before cultivation, whereas Bit. was sprayed on the wet soil surfaie one day after cultivation.

Wheat grains (**Triticum aestivum L.**) Sakha 8 were planted in 10th November of both of the two seasons at the rate of kg/fed. All treatments received the following basis fertilizer dressings :

- Superphosphate at the rate of 30 kg P_2O_5 /fed added be-
- fore cultivation.
- Ammonium nitrate at the rate of 60 kg N/fel added at two doses (40 and 2 kg/fed) applied 2 and 6 weeks after sowing.
- Potassium sulphate at the rate of 50 kg K_2 0/fed divided into two equal doses and added at the same time of adding N fertilizer

Saline irrigation water from a well was added every week and stopped after ear formation till maturity. The chemical analysis of saline irrigation water are shown in Table 3. It is clear

TABLE 3. Chemical composition of the applied farmyard manure amendments.

pH	Organic carbon %	Total nitrogen %	C/N ratio	Total phosphorus %	Total potassium %	Total sulphate %
7.20	19.34	1.45	13.0	0.25	1.40	1.22

that the TC values allover the season had averaged to 7.73 dS/m and the SAR values ranged between 7.7 to 8.7. Consequently such irrigation water is considered as highly saline (FAO, 1990).

The crop was harvested at maturity in April 22th, of both the two seasons and the biological yield as well as grain and straw yields were recorded.

Soil samples were taken at tillering, heading and the end of harvesting stages from equal depths of 0-10, 10-20 and 20-30 cm at the first season. Therefore, prepared for chemical analysis. Soil, water anh FYM analysis were determined according to the mentioned decreased by Page **et al.** (1982).

Results and Discussion

Effect of soil amendments on some soil chemical properties

1 - At tillering stage

Data presented in Table 4 show the effect of soil amendments on some soil chemical properties at tillering stage. With respect to the effect of sulphur, data indicated that the pH and SAR values were decreased slightly meanwhile the EC values, the concentrations of soluble cations and the concentrations of soluble anions (except Cl-) as well as soil organic matter content were increasel as a result of sulphur application. These can be discussed as follows Sulphur can be oxidized by many soil microorganisms to sulphuric acid. Consequently the pH values decreased, meanwhile SO_4^- concentrations increased. Such sulphuric acid reacts with soil $CaCO_3$ resulting in $CaSO_4 + H_2CO_3$. The latter can be ionized to H^+ and HCO_3^- . Therefore, the HCO_3^- concentrations increased. The resulting $CaSO_4$ led to increase both EC values and the concentration of soluble $Ca^{2+} + M.^{2+}$ The latter may be exchanged with K^+ ions in the exchange sites. Consequently the K^+ ions concentrations increased. The favourable effect of sulphur on reducing the concentrations of Cl^- ions may be due to improving the infiltration rate of the soil (Alawi **et al.**, 1980). On the other hand, the effect of sulphur on increasing soil organic matter content may be resulted from increasing root growth.

Concerning the effect of FYM, data in the same table clearly appear that the addition of FYM led to reduce soil pH, EC and SAR values as well as the concentrations of soluble $Ca^{2+} + Mg^{2+}$, Na^+ and Cl^- ions. On the other hand the concentra-

TABLE 4. Effect of adding soil amendments on some soil chemical properties at tillering stage.

Treatments	Depth (cm)	pH	EC (dS/m)	Soluble cations (meq/L)			Soluble anions (meq/L)			SAR	O.M. %
				$Ca^{2+}+Mg^{2+}$	Na^{+}	K^{+}	HCO_3^{-}	SO_4^{2-}	Cl^{-}		
Control	0-10	7.95	12.70	63.33	60.87	1.72	3.25	23.64	99.59	10.82	0.12
	10-20	7.85	16.60	75.00	71.30	1.82	4.18	22.28	139.03	11.64	0.08
	20-30	7.85	16.20	81.34	82.61	1.94	4.56	29.03	128.40	12.95	0.08
S	0-10	7.45	15.10	82.50	67.39	1.87	6.72	54.17	89.63	10.49	0.18
	10-20	7.30	19.30	109.16	74.64	1.95	6.88	74.20	112.46	10.10	0.16
	20-30	7.30	21.50	123.70	87.87	2.15	6.88	91.50	116.78	11.19	0.12
FYM	0-10	7.30	11.64	75.84	43.42	2.20	6.40	27.30	82.17	7.85	0.26
	10-20	7.30	7.00	45.00	23.91	1.95	6.40	23.19	42.00	5.04	0.18
	20-30	7.40	6.80	44.16	23.91	1.95	6.40	29.45	38.32	5.09	0.14
Bit.	0-10	7.45	9.30	63.03	37.61	1.28	4.48	20.23	68.28	6.65	0.20
	10-20	7.40	10.20	63.34	39.13	1.28	5.52	21.71	72.77	6.95	0.14
	20-30	7.50	8.90	50.84	36.09	1.21	5.63	25.18	89.20	7.16	0.14
S+FYM	0-10	7.20	20.80	109.34	86.52	2.15	4.20	110.16	93.60	11.70	0.29
	10-20	7.25	21.20	81.00	86.96	2.15	4.50	98.71	110.73	13.66	0.20
	20-30	7.25	22.60	137.50	95.65	2.15	4.24	98.07	122.40	11.54	0.18
S+Bit.	0-10	7.45	14.60	92.16	53.00	2.00	6.29	29.09	110.62	7.81	0.21
	10-20	7.35	12.70	79.16	42.60	1.62	6.50	29.18	93.22	6.77	0.18
	20-30	7.45	13.10	67.50	56.96	1.23	6.50	38.85	85.81	9.80	0.18
FYM+Bit.	0-10	7.35	12.00	82.00	42.61	1.45	5.63	28.59	85.78	6.65	0.21
	10-20	7.25	10.30	60.84	46.09	1.59	5.63	26.41	73.63	8.36	0.23
	20-30	7.40	9.80	57.50	43.91	1.31	6.25	33.31	66.49	8.19	0.14
S+FYM+Bit.	0-10	7.20	11.10	62.33	46.09	2.20	5.94	38.63	69.38	8.13	0.24
	10-20	7.20	10.12	61.34	41.74	2.08	6.81	41.00	56.79	7.54	0.18
	20-30	7.25	9.00	59.84	37.39	2.08	6.81	39.94	46.50	6.84	0.17

tions of soluble K^+, HCO_3^- and SO^- ions as well as the soil organic matter content were increased in the FYM treated plots. These results can be discussed as follows : The FYM decomposition produces organic and inorganic acids. Accordingly, the pH values were decreased. Also, these organic acids chelate (Ca^{2+} + Mg^{2+}) ions and consequently the concentrations of such ions were decreased. Meanwhile the ionization of H_2CO_3 led to increase the concentrations of (HCO_3^-) ions The reduction in EC values resulting from FYM may be due to improbing the physical properties of calcareous soil as structure permeability and infiltration rate. Consequently more salts can be leached out from the upper 30 cm depth of the soil and moved downward with the movement of the water. The positive effect of FYM application of increasing the concentrations of soluble K^+ and SO_4^- ions as well as the soil organic matter content may be due to the higher initial content of such ions and organic matter in the applied FYM. Table 3.

Regarding the effect of bitumenous emulsion, data in the same table show similar trends which previously mentioned for both S and FYM treatments (except for soluble Ca^{2+} + M^{2+}. and SO_4^- ions). The effect of Bit. on reducing EC values as well as the concentration of soluble Ca^{2+} + Mg^{2+}, Na^+, K^+, SO_4^- and Cl^- ions may be due to reducing the evaporation processes from the soil surface and increasing the moisture content of the soil (Lenvain and De-Boodt, 1976. Accordingly, more soluble salts have the chance to be leached out by the following irrigation.

The positive effect of Bit. on increasing soluble HCO_3^- ions can be explained on the basis of ils effect on increasing soil moisture content and root growth. Such effect produced more soluble CO_2 which was resulting from root respiration. Consequently more HCO_3^- was produced. Also, the positive effect of Bit. on soil organic matter content may be due to its chemically composition which contains a large amount of hydrocarbon chains whereas the soil organic matter was estimated from the determination of soil organic carbon.

The effect of the used soil amendments on the rate of derement of Na was higher than that Ca+Mg. This reflected on decreasing SAR values.

The above mentioned results were confirmed when either two or three amendments were applied together ,i.e., (S+FYM), (S+Bit.), (FYM+Bit.) and (S+FYM+Bit.) treatments.

2 - At heading stage

At heading stage sulphur application had similar trends to those previously mentioned at tillering stage for pH and SAR values as well as the concentrations of soluble anions and soil organic matter content (Table 5). On the other hand, the EC values and the concentrations of soluble cations were decreased at heading stage as compared with those of tillering stage. The favourable effect of sulphur on reducing EC values may be due to sulphur oxidation to sulphuric acid along with increasing the infiltration rate of the soil. The reducing of soluble cations concentrations at heading stage may be due to increasing either plant growth or infiltration rate as a result of increasing the rate of sulphur oxidation with time progressed till 8 weeks period according to Ibrahim (1979). Consequently such cations were lost to the lower soil depths.

Regarding the effect of both FYM and Bit. treatments, data in the same table show similar trends to their effects at tillering stage as previously mentioned.

The above mentioned results were supported when either two or three soil amendments were applied together aspreviously indicated at tillering stage.

3 - At the end of harvesting

Data in Table 6, indicated that, all treatments had similar trends to those previously mentioned at heading stage.

The reduction of the EC values at heading stage over the two other stages may be due to sampling time of heading stage which were taken after heavy rainfall.

Effect of soil amendments on wheat yield

With respect to the effect of sulphur application, data in Table 7 show a significant increase in wheat yields as a result of s application. The magnitude of increase over the control treatment reached 30.5, 48.0 and 37.5% for straw, grain and straw plus grain yields respectively. This is due to its favourable effect on reducing both pH and EC values as previously mentioned.

The magnitude of increase over the control treatment for the FYM treated plots reached 20.9, 38.4 and 27.9% for straw grain and straw plus grain yields respectively. The favourable effect of FYM on increasing the yields of wheat plants may be

TABLE 5. Effect of adding soil amendments on some soil chemical properties at heading stage.

Treatments	Depth (cm)	pH	EC (dS/m)	Soluble cations (meq/L)			Soluble anions (meq/L)			SAR	O.M. %
				$Ca^{2+}+Mg^{2+}$	Na^{+}	K^{+}	HCO_3^-	SO_4^{2-}	Cl^-		
Control	0-10	7.90	9.10	49.30	43.62	1.23	2.33	19.90	70.40	7.09	0.13
	10-20	7.85	12.00	55.30	54.50	1.32	2.51	18.40	98.40	10.36	0.10
	20-30	7.85	14.00	68.90	49.90	1.62	2.70	25.40	112.50	8.50	0.10
S	0-10	7.40	8.20	45.90	36.60	1.03	3.70	30.18	50.50	7.64	0.18
	10-20	7.40	8.90	51.40	34.50	1.03	3.20	34.50	54.90	6.81	0.18
	20-30	7.35	10.10	58.30	45.30	1.03	3.20	37.60	64.50	8.39	0.13
FYM	0-10	7.45	8.90	58.10	33.20	1.70	4.75	20.90	60.90	6.16	0.27
	10-20	7.35	10.20	69.70	34.80	2.10	5.40	25.80	67.20	5.89	0.18
	20-30	7.40	10.80	71.90	40.50	2.70	6.22	32.20	66.10	6.75	0.13
Bit.	0-10	7.45	7.80	27.20	35.50	1.03	3.80	18.20	55.50	6.70	0.22
	10-20	7.40	9.10	53.80	37.30	1.15	4.75	18.30	64.50	6.94	0.16
	20-30	7.50	8.90	53.50	40.50	1.15	4.75	25.00	85.60	7.83	0.14
S+FYM	0-10	7.30	9.30	52.30	40.70	1.03	2.51	40.50	52.50	7.96	0.40
	10-20	7.25	10.30	63.00	44.50	1.03	2.51	38.50	65.50	7.93	0.27
	20-30	7.25	10.90	69.40	45.20	1.03	2.51	49.30	60.20	7.79	0.21
S+Bit.	0-10	7.45	6.70	42.70	26.20	1.03	2.51	22.40	53.80	5.67	0.34
	10-20	7.45	7.70	52.70	25.00	1.03	3.70	19.50	57.40	5.03	0.22
	20-30	7.50	8.70	50.90	37.80	1.03	4.22	26.40	60.50	7.49	0.19
FYM+Bit.	0-10	7.50	7.40	49.10	24.30	1.15	3.70	22.50	56.90	4.81	0.26
	10-20	7.45	7.60	47.90	36.40	1.15	4.22	25.30	56.30	7.44	0.19
	20-30	7.45	8.80	53.70	40.50	1.15	5.50	26.60	60.80	7.82	0.16
S+FYM+Bit.	0-10	7.20	9.40	58.60	37.20	1.80	5.08	36.70	56.50	6.87	0.32
	10-20	7.20	10.60	68.70	45.30	2.10	6.22	49.50	67.60	7.73	0.21
	20-30	7.25	11.50	71.72	46.49	2.10	6.22	54.20	60.50	7.75	0.19

TABLE 6. Effect of adding soil amendments on some soil chemical properties at the end of harvesting.

Treatments	Depth (cm)	pH	EC (dS/m)	Soluble cations (meq/L) $Ca^{2+}+Mg^{2+}$	Na^{+}	K^{+}	Soluble anions (meq/L) HCO_3^{-}	SO_4^{2-}	Cl^{-}	SAR	O.M. %
	0-10	7.85	11.80	64.00	56.50	1.70	3.02	25.80	91.30	9.99	0.15
Control	10-20	7.75	17.20	79.30	78.20	1.90	3.58	26.40	141.00	12.42	0.12
	20-30	7.75	18.90	92.40	93.70	2.10	3.96	34.10	150.80	13.79	0.12
	0-10	7.15	9.80	54.80	43.70	1.24	4.42	34.20	60.40	8.35	0.20
S	10-20	7.25	11.60	67.10	44.97	1.34	4.17	45.00	71.60	7.76	0.20
	20-30	7.30	13.20	76.26	59.20	1.34	4.18	49.00	84.30	9.59	0.13
	0-10	7.30	10.60	60.24	39.54	2.02	5.66	29.90	72.50	6.72	0.20
FYM	10-20	7.30	13.30	85.60	45.30	2.74	7.04	33.60	87.60	6.94	0.22
	20-30	7.35	15.60	103.80	58.50	2.90	8.84	46.50	95.50	8.12	0.13
	0-10	7.40	9.20	63.45	41.87	1.22	4.48	21.47	65.50	7.27	0.25
Bit.	10-20	7.40	10.70	67.94	43.86	1.35	5.59	24.62	75.84	7.52	0.16
	20-30	7.50	11.70	70.34	53.24	1.35	6.24	33.39	112.53	8.98	0.13
	0-10	7.20	8.40	47.34	36.76	1.22	2.27	36.58	47.42	7.56	0.42
S+FYM	10-20	7.20	14.40	88.10	62.21	1.44	3.51	53.83	91.57	9.37	0.23
	20-30	7.20	15.60	96.46	64.69	1.44	3.51	70.56	86.16	9.31	0.19
	0-10	7.20	8.70	55.45	34.00	1.35	3.26	26.10	69.86	6.46	0.40
S+Bit.	10-20	7.25	11.40	78.02	38.20	1.35	5.48	28.87	81.98	6.12	0.22
	20-30	7.35	13.20	77.02	57.35	1.84	6.40	38.54	91.79	9.23	0.19
	0-10	7.25	9.80	67.68	32.18	1.52	4.90	29.20	75.35	5.53	0.32
FYM+Bit.	10-20	7.20	11.90	74.98	56.99	1.84	6.61	36.61	88.15	9.31	0.21
	20-30	7.30	12.60	76.90	57.99	1.84	7.88	39.51	87.10	9.35	0.17
	0-10	7.15	10.20	63.58	40.37	1.90	5.42	39.82	61.31	7.16	0.38
S+FYM+Bit.	10-20	7.20	11.80	76.48	50.43	2.34	6.92	55.10	64.12	8.16	0.23
	20-30	7.25	15.40	96.04	62.14	2.74	8.33	72.58	81.20	8.97	0.19

TABL8 7. Effect of soil amendments on the yield of wheat for two seasons (ton/fed).

Treatments	First season			Second season		
	Straw	Grain	Grain + Straw	Grain	Straw	Grain + Straw
Treatments	2.50 a	3.06 a	5.64 a	2.38 a	2.89 a	5.27 a
Control	2.50 a	3.06 a	5.64 a	2.38 a	2.89 a	5.27 a
S (0.5 ton/fed)	2.08 b	2.28 c	4.36b	2.15 b	2.33 cd	4.47 bc
FYM (20 m3/fed)	2.03 bc	2.25 c	4.27 bc	2.09 b	2.27 cd	4.36 bc
Bit. (0.2 L/m3)	2.00 cd	2.43 b	4.43 b	2.07 b	2.47 bc	4.54 b
S + FYM	1.94 d	2.20 c	4.14 c	1.89 c	2.44 bc	4.33 bc
S + Bit.	1.73 f	2.26 c	3.99 d	1.76 d	2.50 bc	4.26 c
FYM + Bit.	1.85 e	2.44 b	4.29 bc	1.82 cd	2.56 b	4.38 bc
S + FYM + Bit.	1.25 g	1.87 d	3.12 e	1.18 e	1.77 c	2.95 d

The same letter in each column means that there is no any significant differences according to Duncan's multiple range lost at 5% level.

due to one or more of the following reasons; reducing soil pH values, improving soil structure and decreasing soil salinity as mentioned before.

It is also obvious that the yields of wheat plants were significantly increased by Bit. application. The magnitude of increase over the control treatment reached 1.7, 55.2 32.7% for straw grain and straw plus grain yields respectively. This may be due to its influence on increasing soil moisture content, and reducing soil salinity, as a result wheat plants will grown better under such conditions.

The above mentioned results were supported by adding two or three of such soil amendments together and the best treatment was the combined treatment of S+FYM+Bit.

It is worthwhile to note that, the yields of wheat plants had the same trends for the two seasons except that the values of the 1st one were greater by 5-8%.

It can be concluded from this investigation that application of S. FYM and Bit. either alone or together reduced pH and EC values of calcareous soil, meanwhile increased the yields of wheat. Therefore, high saline water can be used for irrigated wheat in the presence of such amendments.

References

Abdalla, A. (1990) Effect of sulphur application to calcareous soil on the statues of some macronutrients under conditions of saline water irtigation. **M.Sc. Thesis,** Fac. of Agric.. Suez Canal Univ.

Abou El-Defan, T. (1990) Effect of organic manure on plant growth and nutrient uptake under saline conditions. **Ph.D. Thesis,** Fac. of Agric., Ain Shams Univ.

Alawi, B.J., Stroehlein, J.L., Hanlon, E.A. and Turner, (1980) Quality of irrigation water and effects of sulphoric acid and gypsum on soil properties and sudan grass yield. **Soil Sci. 129,** 315.

Chen, L.Z. and Wang, J.Y. (1987) Effect of green manure on soil organic matter. **Journal of Soil Sci.,** China, Vol. 18 No. 6, pp : 270-273. **(c.f. Soils and Ferti.,** Vol. 53, No. 3, 2630 (1990).

El Shabassy, A.I., Gohar, A.I., Abdel-Naim, E.M., Abdel-Maklad, F. M.; Farid; A.S. and Dirar R.A. (1971) Effect of asphalt application on a sandy soil in Tahrir province and peanut yield. Agric. **Res. Rev. 49,** No. 2, 1.

F.A.O. (1990) Water, soil and crop management relating to the use of saline water. **Food and Agriculture organization of the United Nations.** Rome (1990).

Hannaa, F.S. (1988) Field experiments on some soil conditioners in Salhia area, Egypt. **International Symposium on the use of soil conditioners for reclamation and farming of desert lands.** 11-13 Oct., 2988, Cairo, Egypt.

Ibrahim, A.S.M. (1979) Sulphur status and its chemical behaviour in some Sharkiya soils. **M.Sc. Thesis,** Fac. of Agric., Zagazig Univ.

Khafagi, M. and Abdelhadi, Y. (1990) Effect of sulphur application on salt distribution in a sodic calcareous soil. **Egypt. J. Soil Sci.,** Vol. **30,** No. 1-2, 199.

Lenvain, J. and De-Boodt, M. (1976) The Effect of small quantities of hydrophobic soil conditioners on the decrease of evaporation and the benefical development of **Vetiveria Zizanoides (L)** Staph in the tropics. **Med. Fac. Landbouww. Rijks Univ. Gent. 41**/1, 159.

Page, A.L., Miller, R.H. and Keeney, D.R. (1982) Methods of Soil Analysis. Part 2, No. 9 (Part 2) in the series agronomy. Am. Soc. of Agron. Madison, Wis., USDA.

Tayel, M., Wahba, M.A. and Ghazy, A. (1988) Effect of drip irrigation system on soil characteristics under different mulching rates. II-Salt distribution pattern. **Egypt. J. Soil Sci.,** Vol. **28, No. 3, 375.**

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تأثير بعض محسنات التربة على خواص التربة الجيرية وانتاجيتها من القمح تحت ظروف الرى بمياه عالية الملوحة

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يهدف هذا البحث الى دراسة تأثير أضافة الكبريت والسماد العضوى ومستحلب البيتومين على صورة منفردة أو مختلطة على خواص التربة الجيرية وانتاجيتها من القمح تحت ظروف الرى بمياه عالية الملوحة .

ولتحقيق هذا الهدف أجريت تجربتين حقليتين فى محطة بحوث رأس سدر بجنوب سيناء خلال موسمى ١٩٨٩/١٩٩٠ ، ١٩٩٠/١٩٩١ .

وقد أوضحت النتائج انخفاضا واضحا فى قيم pH التربة كنتيجة لاضافة محسنات التربة تحت الدراسة . وكانت المعاملة المركبة من (الكبريت + السماد العضوى + البيتومين) هى أفضل المعاملات . كما انخفضت ملوحة التربة فى منطقة الجذور مقارنة بمعاملة الكنترول .

كما أوضحت النتائج أيضا انخفاضا واضحا فى تركيزات أيونات الصوديوم والكلوريد فى حين ازدادت تركيزات أيونات البيكربونات والكبريتات باضافة نفس المحسنات .

انخفضت كذلك نسب المادة العضوية فى التربة خاصة فى عمق صفر ـ ١٠ سم وتباينت هذه النسب تبعا لنوع المعاملة .

كما أوضحت النتائج زيادة معنوية فى كل من محصول الحبوب ومحصول القش لنباتات القمح فى كلا الموسمين بالنسبة لمعاملة الكنترول وأعطت المعاملة المركبة من (الكبريت + السماد العضوى + البيتومين) أعلى محصول.

من النتائج السابقة يمكن التوصية باضافة الكبريت + السماد العضوى + البيتومين للسيطرة على ملوحة التربة والتغلب على التأثيرات الضارة لأيونات الصوديوم والكلوريد بها بالاضافة الى زيادة محصول القمح تحت ظروف الرى بمياه عالية الملوحة .