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AMELIORATION OF HARDLY RECLAIMABLE SOILS: I: EXISTING OF SALINE SODIC POLLUTED SOILS IN EGYPT

Habib, I. M.; E. A. El Morsy; A. M. A. El Naggar and Noha H.Abd El Kadder
Soil Sci.Dept.,Fac.Agric.,Cairo Univ., Egypt

ABSTRACT

The current investigation was carried out to evaluate the existing of hardly reclaimable soils suffering from salinity, sodicity and heavy metals pollution in Egypt. Thirty scil profiles were studied in five different locations. Such locations have been irrigation for long period with drainage and waste water.

The results come out the limits of salinity (ECe) (9.04 to 21.47 dS/m) and sodicity (ESP) (25.53 to 47.71 %), which mean that the problems of salinity and sodicity are found in these locations. In addition, the soil samples containing high levels of some heavy metals such as Cu, Pb, Cd, Ni, Co and Zn. The determined levels are higher than the permissible limits as reported by linzop (1987). It can be concluded that there are scattered areas all over Egypt suffering from two different problems which make it difficult to be reclaimed.

INTRODUCTION

The scarcity of fresh water for agriculture in the arid zone areas is considered to be the most limiting factor for food production. Countries including Egypt have looked to drainage, municipal and industrial waste waters reuse in order to cover the shortage of high quality waters. Because of the chemical, physical and biological nature of wastewater, there are potential problems associated with its reuse in agriculture. Some of the major concerns are health hazards, salinity build up and toxicity hazards (El-Sokkary and Sharaf, 1996). High content of heavy metals in such water (e.g. Fe, Mn, Zn, Cu, Pb, Cd, Ni, Co and Cr) may accumulate in soils to levels either causing phytotoxic conditions or bio-accumulate in plants at level which adversely affect the health of the consumers (Header, 1987 and Fergusson,1990).

Total and DTPA available Fe, Mn, Zn, and Cu were determined in Abu Hammad county (Tahoun et al, 1999). The data indicated that the salinity is widespread, but sodicity is confined to limited areas. The total Fe, Mn, Zn, and Cu is fairly high and is mostly correlated to the clay content of soils. On the other hand total and available forms of Fe, Zn. Mn, Cu, Pb, Ni, Cd, Co and Cr within the upper 60 cm layer increased by increasing the period of irrigation with sewage water . Accumulation of these elements tended to be more obvious in the surface layers than in the sub-surface Eid (1984), Sadik *et al.*, (1987), Abdel-Sabour *et al.*, (1995) and Mosalem (1997).

Abd El-Ghaffar (1983), Sadek and Sawy (1989) demonstrated that the continuous use of sewage water effluent in irrigation for a long period increased electrical conductivity (ECe) of the soil.

Due to the previous reviewing, there is still lake of information relating the salt affected soil with heavy metals pollution problems in Egypt.

The present work aims to study the existing of saline sodic polluted soil in some locations in Egypt.

MATERIALS AND METHODS

Soil samples were collected from five different deteriorated locations in Egypt (Fig 1) to represent the salt affected soils polluted with heavy metals from industrial waste water. The soil samples were collected from six profile in each location i.e.,(1) Bahr El-Baqar (2) Kafr El-SheeKh (3) El- Khanaka (4) Abu Hamaad (5) Helwan. At each profile, three soil samples were successively taken from the (0-10), (10-20) and (20-30) cm soil depths The chemical analysis were determined according to Jackson (1967).. Some chemical and physical characteristics of these soils are presented in Tables (1 to 3)

The soil samples were analyzed for DTPA extractable Cu, Pb, Cd, Ni, Co and Zn according to (Lindsay and Norvell, 1978). While the total heavy metals were determined according to (Cottenie *et al.*, 1982). Tables (4 to 9)

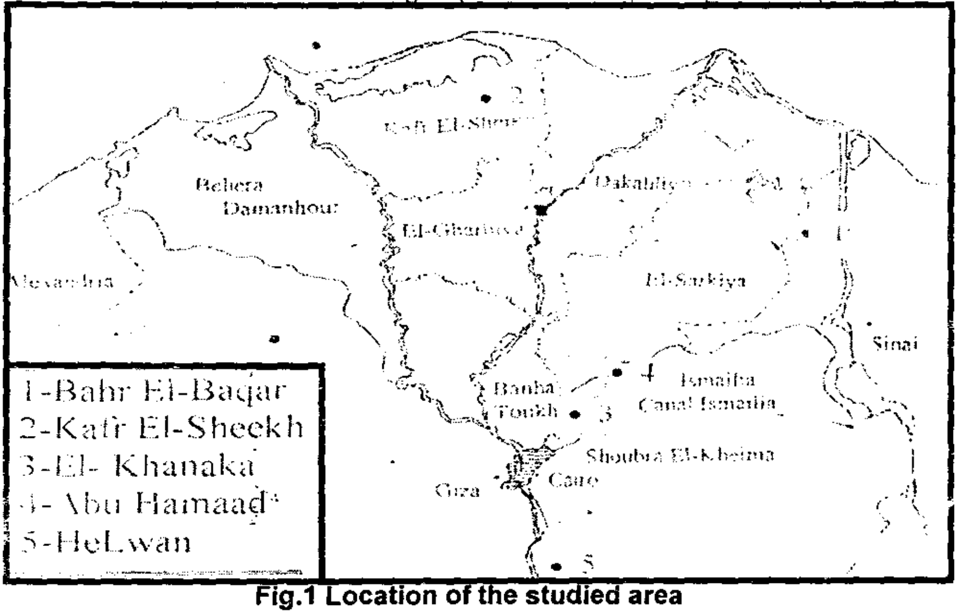

Fig.1 Location of the studied area

RESULTS AND DISCUSSION

Soil physical properties:

Table 1 shows the average of mechanical analysis, soil textural classes, $CaCO_3$ and organic matter % for the three soil depths (0-10), (10-20) and (20-30) cm collected from different locations. It is clear that the most dominant textural classes in the top layers of (0-10) cm depth ranged between silty loam and clay while in subsurface layer of (10-20) cm depth ranged between silty clay loam and clay and the deepest layers of (20-30) cm depth exhibited between silty clay loam and silty clay. Calcium carbonate showed slight changes in their contents among the soil layers of each locations. Organic matter decreased with depth in all locations with the greatest contents in the top layers

Table (1): Average particle size distribution, organic matter % and $CaCO_3$ % for the studied locations

location	depth		Particales size distribution				Texture Class	Organic matter%	CaCO3 %
			Coarse sand%	Fine sand%	Silt%	Clay%			
Bahr El baqar	0-10	Avg.	1.73	19.70	35.84	42.74	Clay loam to clay	2.64	4.43
		Sdv	0.30	1.35	1.33	2.79		0.03	0.06
	10-20	Avg.	3.44	16.01	33.93	46.63	Clay	2.64	4.20
		Sdv	0.59	1.10	2.54	3.86		0.03	0.05
	20-30	Avg.	5.45	11.18	33.70	49.67	Clay loam to clay	2.54	3.99
		Sdv	0.93	0.76	1.25	2.80		0.03	0.05
Kafr el sheekh	0-10	Avg.	1.48	6.65	53.33	38.54	Silty loam to silty clay	2.26	6.01
		Sdv	0.28	0.45	1.98	2.54		0.09	0.08
	10-20	Avg.	1.43	5.40	50.48	42.68	Silty loam to silty clay	2.19	3.68
		Sdv	0.26	0.62	4.03	4.56		0.11	0.92
	20-30	Avg.	1.59	3.77	67.06	27.59	Silty loam to silty clay	2.10	5.40
		Sdv	0.36	0.26	5.52	5.63		0.03	0.07
El Khanaka	0-10	Avg.	2.94	14.36	40.27	42.42	clay to silty clay	2.09	3.54
		Sdv	0.56	0.98	1.49	2.73		0.08	0.04
	10-20	Avg.	2.84	11.67	38.12	47.37	clay to silty clay	2.02	2.17
		Sdv	0.51	1.35	3.04	4.31		0.10	0.54
	20-30	Avg.	3.15	8.15	50.64	38.06	clay to silty clay loam	1.94	3.19
		Sdv	0.72	0.56	4.17	4.45		0.02	0.04
Abu Hamaad	0-10	Avg.	1.85	7.48	46.76	43.91	silty clay	1.03	2.59
		Sdv	0.35	0.51	3.01	2.30		0.04	0.03
	10-20	Avg.	1.79	6.08	52.20	39.93	silty clay	0.99	1.59
		Sdv	0.32	0.70	4.75	4.03		0.05	0.40
	20-30	Avg.	1.98	4.24	41.28	52.49	silty clay	0.95	2.33
		Sdv	0.46	0.29	3.50	3.29		0.01	0.03
Helwan	0-10	Avg.	1.60	11.55	53.43	33.42	silty clay loam	1.96	5.22
		Sdv	0.31	0.79	1.98	2.84		0.08	0.07
	10-20	Avg.	1.55	9.38	50.58	38.49	silty clay loam	1.90	3.19
		Sdv	0.28	1.08	4.04	4.96		0.09	0.80
	20-30	Avg.	1.71	6.55	67.18	24.55	silty clay loam	1.82	4.69
		Sdv	0.39	0.45	5.53	5.76		0.02	0.06

Total soluble salts and exchangeable sodium percent:

The data in Table 2 show the total soluble salts in the studied soil samples. In general soil salinity expressed as ECe values were greater than 9 dS/m, with the maximum ECe is about 21 dS/m. Slight decreased in ECe with soil depth was observed in Bahar El Bakar and Helwan while the ECe values increased with soil depth in Kafr El Sheekh, El-Khanaka an and Abu Hamaad. The distribution of soluble cations shows that the dominant cations is Na^{+} followed by Ca^{++}, Mg^{++} and then K^{+}.

Table 3 shows the CEC values and values of exchangeable cations content as well as ESP. The exchangeable Na^{+} is the dominant cation on the exchange sites of all locations. All soils are sodic where the exchangeable *sodium percentage* (ESP) is higher than 25 % in the three layers. Owing to the preceding results. The soil can be characterized as saline sodic soil.

Table (2): Some chemical characteristics of the studied locations

location	depth		pH range	EC (dS/m)	Soluble cations and anions (meq/l)						
					HCO_3	Cl	SO_4	Ca	Mg	Na	K
Bahr El baqar	0-10	Avg.	7.65 - 7.92	21.02	9.10	180.25	32.75	33.35	22.97	164.40	1.38
		Sdv		6.71	1.63	68.26	13.94	11.66	5.56	62.16	0.24
	10-20	Avg.	7.67 - 7.93	17.59	8.54	151.47	27.79	30.15	16.15	139.97	1.52
		Sdv		6.98	1.45	66.54	10.93	15.17	4.30	59.41	0.25
	20-30	Avg.	7.74 - 7.94	11.06	6.99	89.17	20.95	17.53	9.67	88.73	1.18
		Sdv		5.12	0.98	48.25	9.13	7.14	3.68	43.58	0.31
Kafr el sheekh	0-10	Avg.	8.12 - 8.43	12.79	9.87	76.28	52.88	30.40	22.11	84.99	1.54
		Sdv		4.76	0.98	35.37	19.46	12.29	6.96	39.41	0.25
	10-20	Avg.	8.05 - 8.41	15.96	9.34	115.79	57.97	33.46	18.93	129.00	1.71
		Sdv		6.76	1.61	56.34	28.41	18.19	7.38	62.77	0.28
	20-30	Avg.	7.98 - 8.29	21.47	7.64	165.88	64.65	30.60	21.43	184.81	1.32
		Sdv		9.55	0.85	81.73	31.00	16.78	7.60	91.06	0.32
El Khanaka	0-10	Avg.	7.86 - 8.16	9.04	10.85	28.64	60.64	18.43	15.64	64.58	1.48
		Sdv		2.93	1.10	13.28	27.49	6.07	4.48	25.26	0.33
	10-20	Avg.	7.79 - 8.14	9.58	10.26	43.47	57.34	20.33	13.47	75.55	1.71
		Sdv		1.80	1.67	21.15	29.07	5.03	5.52	24.18	0.20
	20-30	Avg.	7.72 - 8.02	13.05	8.49	62.28	74.16	20.15	16.51	106.41	1.86
		Sdv		3.62	1.08	30.68	44.80	6.94	4.21	33.41	0.29
Abu Hamaad	0-10	Avg.	8.25 - 8.55	13.27	11.80	31.16	96.38	27.46	20.59	89.68	1.60
		Sdv		3.87	1.19	14.45	24.93	16.21	8.61	17.00	0.36
	10-20	Avg.	8.28 - 8.56	16.40	11.89	47.29	114.16	36.19	22.23	113.07	1.86
		Sdv		6.15	1.09	23.01	35.05	27.49	17.44	15.80	0.22
	20-30	Avg.	8.35 - 8.57	21.16	10.36	67.75	146.17	37.69	28.20	156.39	2.02
		Sdv		9.41	0.49	33.38	63.91	30.27	18.40	51.34	0.32
Helwan	0-10	Avg.	7.68 - 7.98	20.76	12.84	162.00	44.26	33.56	24.63	159.67	1.24
		Sdv		6.63	1.30	61.34	16.55	9.76	4.63	57.23	0.21
	10-20	Avg.	7.62 - 7.96	18.06	12.93	136.13	41.21	29.57	17.96	141.37	1.37
		Sdv		5.93	1.19	59.80	16.29	11.03	4.10	46.80	0.22
	20-30	Avg.	7.55 - 7.84	13.52	11.28	80.14	53.18	19.73	12.54	111.27	1.06
		Sdv		3.86	0.53	43.36	20.64	3.66	4.37	44.20	0.28

Heavy metals contents:

The data in Tables (4 to 9) show values of total and DTPA extractable Cu, Pb, Cd, Ni, Co, and Zn in the studied soils. The highest accumulation of heavy metals were found in the surface layers (0-10)cm depth in all locations and lowest in the sub –surface layers (10-20) and (20-30)cm depth. These results are consistent with those of Khalil (1990) and Waffa (1992). This trend could be attributed to the very low mobility of heavy metals due to the strong fixation by organic matter, clay minerals and oxides of Fe, Al and Mn (Adriano, 1986 and Baker, 1974).

Copper:

DTPA extractable Cu (Table 4) in the soil samples ranged from 3.01 to 37.63 ppm with an average 20.32 ppm. Total Cu in the soil samples ranged from 45.14 to 265.79 ppm with an average 155.47 ppm. The soil samples of Kafr El Sheekh, El Khanaka and Helwan possessed the highest level of extractable-Cu. These locations contained total-Cu higher than the permissible limit (50 – 100 ppm) as reported by Linzop (1987). This may be attributed to the impact of irrigation with industrial and sewage water in these locations

Table (3): Cation exchange capacity, exchangeable cations and exchangeable sodium percent for the studied location

location	depth		CEC	Exchangeable Cations (meq/100 gm)				ESP
				Ca^{++}	Mg^{++}	K^{+}	Na^{+}	
Bahr El baqar	0-10	Avg.	37.87	11.17	11.60	0.42	12.13	31.97
		Sdv	2.71	0.98	1.34	0.05	2.77	6.59
	10-20	Avg.	37.90	11.47	11.77	0.42	11.47	30.29
		Sdv	2.75	1.13	1.20	0.03	2.43	6.29
	20-30	Avg.	37.63	12.27	12.43	0.40	9.61	25.53
		Sdv	2.43	1.49	1.56	0.02	2.63	6.75
Kafr el sheekh	0-10	Avg.	48.93	13.35	13.20	0.51	21.47	43.92
		Sdv	3.19	1.52	1.48	0.09	1.86	3.38
	10-20	Avg.	49.09	13.91	13.53	0.50	20.60	41.98
		Sdv	3.37	1.31	1.38	0.06	2.05	3.42
	20-30	Avg.	48.66	14.60	14.57	0.49	18.49	37.92
		Sdv	3.33	1.10	1.32	0.10	2.66	4.15
El Khanaka	0-10	Avg.	38.64	10.54	11.87	0.41	14.80	38.35
		Sdv	2.52	1.20	1.33	0.07	1.28	2.95
	10-20	Avg.	38.76	10.98	12.17	0.40	14.20	36.66
		Sdv	2.66	1.03	1.24	0.05	1.42	2.99
	20-30	Avg.	38.42	11.53	13.10	0.39	12.75	33.11
		Sdv	2.63	0.87	1.19	0.08	1.84	3.62
Abu Hamaad	0-10	Avg.	52.17	12.58	14.77	0.53	23.64	45.34
		Sdv	3.58	1.18	1.78	0.06	2.36	3.69
	10-20	Avg.	51.71	13.21	16.20	0.52	21.22	40.95
		Sdv	3.54	1.00	1.77	0.10	3.05	4.48
	20-30	Avg.	50.97	11.59	14.13	0.52	24.30	47.71
		Sdv	2.51	0.77	1.67	0.07	2.20	4.01
Helwan	0-10	Avg.	32.27	10.02	11.59	0.33	9.44	29.27
		Sdv	2.22	0.94	1.18	0.04	0.94	2.38
	10-20	Avg.	31.98	10.52	12.48	0.32	8.47	26.43
		Sdv	2.19	0.79	1.13	0.06	1.22	2.89
	20-30	Avg.	31.52	9.23	11.25	0.32	9.70	30.79
		Sdv	1.55	0.61	1.41	0.04	0.88	2.59

Table (4): Total and DTPA extractable Cu of three successive layers for the studied location

location	depth	Total Cu (ppm)		DTPA extractable Cu (ppm)	
		Range	Avg ± Sdv	Range	Avg ± Sdv
Bahr El baqar	0-10	99.75 - 119.25	107.54 ± 7.1	19.26 - 21.02	20.04 ± 0.76
	10-20	93.75 -117.00	105.92 ± 8.17	18.28 - 20.32	19.22 ± 0.8
	20-30	92.50 - 109.25	100.29 ± 6.02	16.59 - 19.41	18.32 ± 1.12
Kafr el sheekh	0-10	108.47-128.68	116.95 ± 7.79	9.72 - 11.62	10.47 ± 0.7
	10-20	101.95 - 127.23	115.18 ± 8.89	9.13 - 11.4	10.32 ± 0.8
	20-30	100.59 - 118.80	109.06 ± 6.55	9.01 - 10.64	9.77 ± 0.59
El Khanaka	0-10	131.79 - 157.55	142.09 ± 9.46	11.80 - 14.11	12.73 ± 0.85
	10-20	123.86 - 154.58	139.94 ± 10.80	11.09 - 13.85	12.53 ± 0.97
	20-30	122.21 - 144.34	132.51 ± 7.96	10.95 - 12.93	11.87 ± 0.71
Abu Hamaad	0-10	48.67 - 58.19	52.48 ± 3.49	3.20 - 3.83	3.45 ± 0.23
	10-20	45.75 - 57.09	51.68 ± 3.99	3.01 - 3.76	3.4 ± 0.26
	20-30	45.14 - 53.31	48.94 ± 2.94	2.97 - 3.51	3.22 ± 0.19
Helwan	0-10	222.33 - 265.79	239.70 ± 15.96	31.47 - 37.63	33.93 ± 2.26
	10-20	208.96 - 260.78	236.08 ± 18.22	29.58 - 36.92	33.42 ± 2.58
	20-30	206.17 - 243.51	223.54 ± 13.43	29.19 - 34.47	31.64 ± 1.9

Lead:

The DTPA extractable Pb (Table 5) in the soil samples varied from 0.87 to 28.39 ppm with an average 14.63 ppm while total Pb ranged 9.19 to 542.70 ppm with average 275.95 ppm The highest levels of extractable-Pb in El Khanaka and Helwan where the total-Pb in this locations are higher than the permissible limit (50 – 100 ppm) as reported by Linzop (1987) while 45Bahar El Bakar, Kafr El Sheekh and Abu Hamaad still in the adequate range.

Table (5): Total and DTPA extractable Pb of three successive layers for the studied location

location	depth	Total Pb (ppm)		DTPA extractable Pb (ppm)	
		Range	Avg ± Sdv	Range	Avg ± Sdv
Bahr El baqar	0-10	11.35 - 32.17	24.94 ± 7.29	1.41 - 4.11	3.02 ± 0.91
	10-20	9.59 - 27.60	20.59 ± 7.24	1.2 - 3.01	2.19 ± 0.74
	20-30	9.19 - 20.72	15.98 ± 4.89	0.87 - 2.02	1.61 ± 0.55
Kafr el sheekh	0-10	48.24 - 136.72	105.99 ± 30.96	2.52 - 7.15	5.54 ± 1.62
	10-20	40.76 - 117.30	87.51 ± 30.75	2.13 - 6.14	4.58 ± 1.61
	20-30	39.06 - 88.06	67.89 ± 20.77	2.04 - 4.61	3.55 ± 1.09
El Khanaka	0-10	191.47 - 542.70	420 ± 122.91	10.02 - 28.39	22.01 ± 6.43
	10-20	161.78 - 465.61	347.35 ± 122.06	8.46 - 24.36	18.17 ± 6.39
	20-30	155.03 - 349.54	269.50 ± 82.44	8.11 - 18.29	14.10 ± 4.31
Abu amaad	0-10	41.85 - 118.63	91.96 ± 26.87	2.19 - 6.21	4.81 ± 1.41
	10-20	35.36 - 101.77	75.92 ± 26.68	1.85 - 5.32	3.97 ± 1.4
	20-30	33.89 - 76.40	58.91 ± 18.02	1.77 - 4.00	3.08 ± 0.94
Helwan	0-10	101.81 - 288.56	223.7 ± 65.35	4.04 - 11.44	8.87 ± 2.59
	10-20	86.02 - 247.57	184.69 ± 64.90	3.41 - 9.82	7.32 ± 2.57
	20-30	82.43 - 185.86	143.30 ± 43.84	3.27 - 7.37	5.68 ± 1.74

Cadmium:

DTPA extractable Cd values (Table 6) varied widely among the soils, being from non detected in Bahar El Bakar to 1.28 ppm. The total Cd ranged from non to 11.6 ppm. The soil containing the relatively high levels of extractable Cd are located mainly in Abu Hamaad, El Khanaka and Helwan. The totals Cd in these locations are higher than the permissible limit (5 ppm) according to Linzop (1987).

Nickel:

DTPA extractable Ni (Table 7) in the soil samples ranged from 1.73 to 34.93 ppm with an average 18.35 ppm while total Ni ranged from 10.08 to 148.86 ppm with an average 79.47 ppm. The total-Ni in Bahr El-Baqar, Kafr El Sheekh, El Khanaka and Abu Hamaad. are higher than the permissible limit (30-50 ppm) according to Kabata et al, (1992) and Linzop (1987).

Cobalt:

DTPA extractable Co (Table 8) varied from 0.59 to 10.03 ppm with average 5.315 ppm while total Co ranged from 11.27 to 72.13 ppm with an average 41.7 ppm. The soil samples of Bahr El-Baqar and El Khanaka possessed the highest level of total Co as values of total Co in these locations are higher than the permissible limit (50 ppm) as reported by Linzop (1987), while Kafr El Sheekh, Abu Hamaad and Helwan still in the adequate range.

Table (6): Total and DTPA extractable Cd of three successive layers for the studied location

location	depth	Total Cd (ppm)		DTPA extractable Cd (ppm)	
		Range	Avg ± Sdv	Range	Avg ± Sdv
Bahr El baqar	0-10	nd	nd	nd	nd
	10-20	nd	nd	nd	nd
	20-30	nd	nd	nd	nd
Kafr el sheekh	0-10	0.73 - 1.01	0.90 ± 0.10	0.08 - 0.11	0.10 ± 0.01
	10-20	0.73 - 0.95	0.86 ± 0.08	0.08 - 0.10	0.09 ± 0.01
	20-30	0.73 - 0.96	0.84 ± 0.08	0.08 - 0.10	0.09 ± 0.01
El Khanaka	0-10	6.72 -9.24	8.19 ± 0.89	0.73 - 1.01	0.89 ± 0.10
	10-20	6.72 - 8.69	7.87 ± 0.72	0.73 - 0.95	0.86 ± 0.08
	20-30	6.72 -8.67	7.69 ± 0.74	0.73 - 0.95	0.84 ± 0.08
Abu Hamaad	0-10	5.06 - 6.96	6.17 ± 0.67	0.55 - 0.76	0.67 ± 0.07
	10-20	5.06 - 6.55	5.93 ± 0.55	0.55 - 0.72	0.65 ± 0.06
	20-30	5.06 - 6.53	5.79 ± 0.56	0.55 - 0.71	0.63 ± 0.06
Helwan	0-10	8.43 -11.60	10.27 ± 1.12	0.93 - 1.28	1.14 ± 0.12
	10-20	8.43 - 10.90	9.87 ± 0.91	0.93 - 1.21	1.09 ± 0.10
	20-30	8.43 - 10.88	9.64 ± 0.93	0.93 - 1.2	1.07 ± 0.10

Zinc:

Values of DTPA extractable Zn (Table 9) in the soil samples varied from 3.08 to 29.93 ppm with an average 16.51 ppm. Total Zn varies from 72.33 to 896.54 ppm with an average 484.4 ppm. The total Zn content of soils is increased with increasing their clay content and organic matter. This may be explained by the presence of Zn as a structural constituent of some minerals or its presence as an exchangeable cation on clays and organic matter (Tahoun *et al.*, 1999). The highest levels of total-Zn are found in Kafr El Sheekh and Helwan. The levels of total-Zn in these locations are higher than the permissible limit (150-300 ppm) according to Kabata et al, (1992) and Linzop (1987).

Table (7): Total and DTPA extractable Ni of three successive layers for the studied location

location	depth	Total Ni (ppm)		DTPA extractable Ni (ppm)	
		Range	Avg ± Sdv	Range	Avg ± Sdv
Bahr El baqar	0-10	95.32 - 138.09	114.49 ± 17.70	24.25 - 34.93	27.26 ± 3.87
	10-20	82.24 - 129.80	105.02 ± 18.40	21.98 - 34.57	25.78 ± 4.45
	20-30	80.31 - 104.37	93.5 ± 8.56	19.21 - 33.09	24.21 ± 4.9
Kafr el sheekh	0-10	102.75 - 148.86	123.42 ± 19.08	15.65 - 22.67	18.8 ± 2.91
	10-20	88.65 - 139.92	113.22 ± 19.84	13.5 - 21.31	17.24 ± 3.02
	20-30	86.57 - 112.51	100.8 ± 9.23	13.19 - 17.14	15.35 ± 1.41
El Khanaka	0-10	83.58 - 121.09	100.39 ± 15.52	12.73 - 18.44	15.29 ± 2.36
	10-20	72.11 - 113.82	92.09 ± 16.14	10.98 - 17.34	14.03 ± 2.46
	20-30	70.42 - 91.52	81.99 ± 7.51	10.73 - 13.94	12.49 ± 1.14
Abu Hamaad	0-10	78.65 - 113.94	94.47 ± 14.60	11.98 -17.35	14.39 ± 2.22
	10-20	67.86 - 107.10	86.66 ± 15.19	10.34 - 16.31	13.2 ± 2.31
	20-30	66.27 - 86.12	77.15 ± 7.06	10.09 - 13.12	11.75 ± 1.08
Helwan	0-10	11.97 - 17.34	14.38 ± 2.22	2.05 - 2.97	2.47 ± 0.38
	10-20	10.33 - 16.30	13.19 ± 2.31	1.77 - 2.8	2.26 ± 0.4
	20-30	10.08 - 13.10	11.74 ± 1.08	1.73 -2.25	2.01 ± 0.18

Table (8): Total and DTPA extractable Co of three successive layers for the studied location

location	depth	Total Co (ppm)		DTPA extractable Co (ppm)	
		Range	Avg ± Sdv	Range	Avg ± Sdv
Bahr El baqar	0-10	57.23 - 72.13	64.14 ± 5.72	7.91 - 10.03	9.09 ± 0.87
	10-20	53.67 - 66.19	59.99 ± 4.6	7.82 - 10.00	8.87 ± 0.89
	20-30	52.78 - 63.72	59.15 ± 4.34	7.93 - 9.52	8.51 ± 0.67
Kafr el sheekh	0-10	12.22 - 15.40	13.69 ± 1.22	0.64 - 0.81	0.72 ± 0.06
	10-20	11.46 - 14.13	12.81 ± 0.98	0.6 - 0.74	0.67 ± 0.05
	20-30	11.27 - 13.60	12.[illegible] ± 0.93	0.59 - 0.71	0.66 ± 0.05
El Khanaka	0-10	50.18 - 63.25	56.24 ± 5.02	2.63 - 3.31	2.94 ± 0.26
	10-20	47.06 - 58.04	52.51 ± 4.03	2.46 - 3.04	2.75 ± 0.21
	20-30	46.28 - 55.87	51.86 ± 3.8	2.42 - 2.92	2.71 ± 0.2
Abu Hamaad	0-10	13.06 - 16.46	14.63 ± 1.31	0.68 - 0.86	0.77 ± 0.07
	10-20	12.25 - 15.10	13.69 ± 1.05	0.64 - 0.79	0.72 ± 0.05
	20-30	12.04 - 14.54	13.50 ± 0.99	0.63 - 0.76	0.71 ± 0.05
Helwan	0-10	41.98 - 52.90	47.04 ± 4.20	0.91 - 1.14	1.02 ± 0.09
	10-20	39.36 - 48.55	44.0 ± 3.370	0.85 - 1.05	0.95 ± 0.07
	20-30	38.71 - 46.74	43.38 ± 3.18	0.84 - 1.01	0.94 ± 0.07

Table (9): Total and DTPA extractable Zn of three successive layers for the studied location

location	depth	Total Zn (ppm)		DTPA extractable Zn(ppm)	
		Range	Avg ± Sdv	Range	Avg ± Sdv
Bahr El baqar	0-10	114.87 - 144.22	127.74 ± 11.69	10.19 - 19.21	16.46 ± 3.35
	10-20	112.2 - 134.03	121.14 ± 8.26	10.09 - 18.47	16.04 ± 3.23
	20-30	102.34 - 131.17	112.96 ± 11.63	10.02 - 17.14	14.39 ± 2.77
Kafr el sheekh	0-10	330.30 - 414.69	367.32 ± 33.63	14.06 -17.66	15.64 ± 1.43
	10-20	322.62 - 385.39	348.32 ± 23.75	13.74 - 16.41	14.83 ± 1.01
	20-30	294.27 - 377.17	324.82 ± 33.46	12.53 - 16.06	13.83 ± 1.42
El Khanaka	0-10	81.19 -101.93	90.29 ± 8.27	3.46 - 4.34	3.84 ± 0.35
	10-20	79.30 - 94.73	85.62 ± 5.84	3.38 - 4.03	3.65 ± 0.25
	20-30	72.33 - 92.71	79.84 ± 8.22	3.08 - 3.95	3.4 ± 0.35
Abu Hamaad	0-10	150.22 -188.6	167.05 ± 15.29	6.40 - 8.03	7.11 ± 0.65
	10-20	146.73 - 175.27	158.41 ± 10.8	6.25 - 7.46	6.74 ± 0.46
	20-30	133.83 - 171.53	147.72 ± 15.22	5.7 - 7.3	6.29 ± 0.65
Helwan	0-10	714.08 - 896.54	794.08 ± 72.69	23.84 - 29.93	26.51 ± 2.43
	10-20	697.49 - 833.19	753.05 ± 51.34	23.28 - 27.81	25.14 ± 1.71
	20-30	636.19 - 815.41	702.23 ± 72.33	21.24 - 27.22	23.44 ± 2.41

CONCLUSION

From the above-mentioned results, it can be concluded that there are scattered areas all-over Egypt suffering from salinity, sodicity and pollution with some heavy metals to different degrees, due to use of poor quality water for irrigation and inadequate drainage. Such soil needs special amelioration techniques to over come the two complex problems. Proposed method for reclamation will be dealt with in the next paper.

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تحسين الأراضى صعبه الأصلاح

١- تواجد الأراضى الملحية الصوديه الملوثة فى مصر

ابراهيم محمد حبيب ، السعيد احمد المرسى ، على محمد النجار، نهى حمدى عبد القادر
قسم الأراضى - كليه الزراعة - جامعة القاهرة -الجيزه - مصر

تمت الدراسه بهدف تقييم مدى تواجد و انتشار مشكلتى الأراضى الملحيـه الصوديه و الملوثه معا فى مصر من خلال أخذ عينات من ثلاثين قطاع من خمس مناطق مختلفه فى مصر و التى تروى بمياه الصرف او المياه العادمه.

وأظهرت النتائج ان حدود الملوحه درجه ا لتوصيل ا لكهربى كانـت (٩,٠٤- ٢١,٤٧ ديسى‌سيمنز/ متر) و الصوديه (نسبه الصوديوم المتبادل (٢٥,٥٣ - ٤٧,٧١ %) وهذا يعنى تواجد مشكلتي الملوحه و الصوديه في هذه المواقع ، في ذات الوقت كانت تحتوى هذه الأراضـى علـى مستويات مرتفعه من بعض العناصر الثقيله مثل النحـاس والرصـاص والكـادميوم و النيكـل و الكوبلت و الزنك. وكانت هذه الحدود أعلى من الحدود المسموح بها فى الأراضي.

من ذلك نستخلص انه توجد بعض الأراضى فى مصر تعانى من مشكلتى الملوحـه و الصوديه بجانب التلوث بالعناصر الثقيله مما يصعب من عمليه الأصلاح .