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PHYSICAL AND CHEMICAL PROPERTIES OF SOME SOILS ADJACENT TO LAKES AT NORTH WEST AND SOUTH OF EGYPT

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ABSTRACT

This work was carried out to investigate some physical and chemical properties of salt-affected soils adjacent to Qaroun, El Borollus and Edku lakes of Egypt. Three soil profiles were taken at distances of 1.5, 10 and 20 km. from the shoreline of every lake .Undisturbed and disturbed soil samples were taken at depths of 0 – 30, 30 – 60 and 60 – 90 cm .The undisturbed soil samples were used for the determination of soil total porosity, pore size distribution, soil moisture retention curves, hydraulic conductivity and the soil aggregate size distribution. The disturbed soil samples were air-dried, ground to pass through a 2 mm sieve and kept for the chemical determinations. The obtained results indicated that the studied soil samples contain high total soluble salts which tend to decrease with increasing both soil sampling depth and the distance from the shoreline of different lakes under study. The high values of total soluble salts exist in case of soil samples of Qaroun lake followed by those of Borollus and Edku lakes .The values of soil pH in the studied soil samples ranged between 8.00 and 8.60 whereas CEC ranged from 35.21 to 51.21 c mol kg soil^{-1}, and the soil contents of both organic matter and $CaCO_3$ were relatively low and tended to decrease by increasing soil depth. Soil bulk density and soil total porosity values of the studied soil sample were increased by increasing soil depth and distance from the lakes shoreline. The high values of soil total porosity were found in case of Qaroun lake soils. The values of soil hydraulic conductivity (K) were decreased by depth. The distance from the lakes shoreline exerts no clear effect on soil hydraulic conductivity and moisture tension curves .The soil moisture content at field capacity had no clear trend with the soil depth but were gradually decreased with the distance increase from the lakes .The highest values of field capacity were found in the soil samples of Qaroun lake .The soil moisture content at wilting point for all studied areas was higher in the surface soil than the subsurface. The percents of dry stable aggregates increased with increasing the soil depth except large size aggregates which have diameters 10-2 mm. The values of total stable aggregates (T.S.A) increased with the increase of the distance from the lake (especially Qaroun and El-Borollus); this may be due to the decrease of soluble salts with the increase of the distance from the lakes. No clear trend was observed for the effect of soil depth and the distance from the lakes on TSA of different soil under study.
Keywords: Salt affected soils, Salinity, Sodicity, Chemical and physical properties.

INTRODUCTION

One of the most crucial environmental problems affecting developing countries in arid and semi-arid regions is soil salinity. According to certain estimates, approximately 7% of soils all over the world suffer from this phenomenon, (Szabolcs, 1988). Total salt affected area in the world is about 955 million hectares out of which 0.9 million ha exist in Egypt. The majority of salt-affected soils in Egypt are located in the northern-central part of the Nile Delta and on its eastern and western sides. Fifty five percent of the cultivated lands of northern Delta region, twenty percent of the southern Delta and middle Egypt region and twenty five percent of the Upper Egypt regions are salt-affected soils (FAO, 1995).

Assessment of the relationship between soil solution salinity and soil physical properties requires knowledge of the constituents of the dissolved salts, and especially the sodium concentration. For instance, soil dispersion is the primary physical process associated with high sodium concentrations (Bauder and Brock, 2001).

El-Maaz (2005) found that, the cation exchange capacity (CEC) is mainly dependent on clay and organic matter contents. Ghadiri et al., (2007) stated that less values of EC of the clay soil with high ESP led to weakening of its stable aggregates and increased erosion. El-Sheikh (2003) found that, the values of bulk density were affected by soil texture and OM% and stated that, no relation can be mentioned between total soil aggregates and soil texture. Ahmed (2005) stated that, the higher values of total soil porosity are found in soil samples of El- Fayoum area while the lowest ones were obtained in soil samples of Edku area. Kadu et al., (1993) stated that, hydraulic conductivity of the alluvial soils was decreased by increasing soil content of fine particles. Ibrahim (2002) found that, the soil moisture characteristics curves of some alluvial soils were more affected by soil texture. El-Gundy (2005) reported that, the characteristics of soil moisture tension curves were more affected by both soil salinity and salinity types.

Soil dispersion not only reduces the amount of water entering the soil, but also affects hydraulic conductivity of soil which refers to the rate of water flows through soil. For instance, soils with well-defined structure will contain a large number of macro pores, cracks and fissures which allow for relatively rapid flow of water through the soil. When sodium-induced soil dispersion causes loss of soil structure, the hydraulic conductivity is also reduced. If water cannot pass through the soil, then the upper layer can become swollen and water logged. This results in anaerobic soils which can reduce or prevent plant growth and decrease organic matter decomposition rates. The decrease in decomposition causes soils to become infertile, black alkali soils, (Krista E . Pearson and James W .Bauder, 2003) .

This work was carried out to study the effect of salinity on soil physical and chemical properties of salt-affected soils adjacent to the lakes Qaroun, El Borollus and Edku of Egypt.

MATERIALS AND METHODS

Current work was conducted to study the changes on soil physical and chemical properties of salt-affected soils around the lakes of Egypt. For this purpose, three areas were selected around the lakes of Quran, Borollus and Edku, respectively. The location, distance from the lake and cultivated plants are shown in Table [1]. Undisturbed and disturbed soil samples were taken at soil depths of 0 – 30, 30 – 60 and 60 – 90 cm .Total soil porosity, pore size distribution, soil moisture retention curves, hydraulic conductivity and the soil aggregate size distribution were determined in the undisturbed soil samples.

The disturbed soil samples were air-dried, ground to pass through a 2 mm sieve and kept for the chemical determinations.

Table[1] :Location, distance from the lake shoreline and cultivated plants

Lake name	Profile No.	Distance from the lake(Km)	Cultivated plant
Qaroun	1	1.5	Uncultivated
	2	10	Uncultivated
	3	20	Uncultivated
El-Burollus	4	1.5	Cotton
	5	10	Rice
	6	20	Rice
Edku	7	1.5	Maize
	8	10	Cotton
	9	20	Cotton

Soil pH, organic matter and total calcium carbonate were determined according to the methods described by Page et al., (1982).The total soluble salts(EC) were determined in soil paste extract as dSm^{-1}(Jackson, 1973) .Particle size distribution was carried out by the pipette method described by Gee and Bauder(1986).Soil bulk density was determined using the undisturbed soil column and total soil porosity was calculated as percentage from the obtained values of soil real and bulk densities according to Richards (1954). The determination of soil moisture equilibrium values was carried out according to the methods described by Richards and Weaver (1944) and Richards (1947). The moisture retention values were determined by using the pressure cooker under 0.10, 0.33, 0.66 and 1.0 atmospheres and the pressure membrane for pressure 15 atmospheres. Wilting point was determined according to Stakman and Vanderhast (1962), while field capacity was determined as described by Richards (1954).Pore size distribution was calculated according to Deleenheer and De Boodt (1965) and classified to quickly drainable, slowly drainable, water holding and fine capillary pores. Distribution of dry aggregates and hydraulic conductivity were determined according to the methods of Richards (1954). Stability of water stable aggregates was determined using the wet sieving technique described by Yoder (1936) and modified by Ibrahim (1964).

RESULTS AND DISCUSSION

The obtained data will be discussed as follows:

Soil chemical properties:-

Soil electrical conductivity:-

The EC values of the studied soil samples varied widely depending on the studied location, soil depth and the distance from the lake. Total soluble salts decreased with the increase of both soil sampling depth and the distance from the lake, [Tables, 2]. The highest value of EC (36.11 dSm^{-1})

was found in Qaroun area at 1.5 km from the lake and the lowest (8.00 dSm^{-1}) at 20 km compared to Borollus and Edku lakes .These results may be attributed to the long cultivation periods and intensive agriculture rotation in Borollus and Edku areas .These results are in agreement with those of Ahmed (2005).

Table [2]: Some chemical properties of the studied soil profiles

Lake name	Distance from the lake(Km)	Profile No.	Depth Cm	EC dSm^{-1}	pH 1:2.5	O.M %	$CaCO_3$ %	CEC c mol kg^{-1} soil
Qaroun	1.5	1	0-30	36.11	8.11	1.67	3.27	40.11
			30-60	33.01	8.21	0.98	3.18	40.21
			60-90	30.11	8.22	0.98	2.36	40.31
			Mean	33.07	-	1.21	2.94	40.21
	10	2	0-30	25.50	8.02	1.66	3.11	43.22
			30-60	22.61	8.20	0.99	3.01	43.00
			60-90	18.01	8.20	0.99	2.25	41.21
			Mean	22.04	-	1.21	2.79	42.48
	20	3	0-30	13.16	8.00	1.32	2.59	46.51
			30-60	9.81	8.11	0.98	2.31	44.24
			60-90	8.00	8.21	0.86	2.20	38.51
			Mean	10.32	-	1.05	2.37	43.09
El-Burollus	1.5	4	0-30	27.53	8.10	1.33	1.05	51.21
			30-60	15.52	8.22	0.88	1.00	48.48
			60-90	14.53	8.22	0.67	0.83	41.11
			Mean	19.19	-	0.96	0.96	46.93
	10	5	0-30	10.02	8.12	1.23	1.06	50.89
			30-60	9.97	8.23	0.89	0.99	48.88
			60-90	9.97	8.23	0.89	0.65	41.12
			Mean	9.99	-	1.003	0.90	46.96
	20	6	0-30	4.42	8.20	1.08	1.07	50.56
			30-60	2.70	8.20	0.67	0.83	49.32
			60-90	2.11	8.21	0.65	0.58	43.45
			Mean	3.08	-	0.80	0.83	47.78
Edku	1.5	7	0-30	15.54	8.30	1.59	1.25	50.53
			30-60	15.15	8.41	0.98	1.17	42.85
			60-90	7.25	8.60	0.77	1.08	38.73
			Mean	12.65	-	1.11	1.17	44.04
	10	8	0-30	10.64	8.22	1.32	1.00	48.36
			30-60	9.11	8.41	0.79	0.98	41.25
			60-90	5.12	8.40	0.79	0.59	37.22
			Mean	8.29	-	0.97	0.86	42.28
	20	9	0-30	2.11	8.20	1.28	0.67	47.44
			30-60	1.85	8.41	1.08	0.67	41.24
			60-90	1.64	8.41	0.75	0.59	35.96
			Mean	1.87	-	1.04	0.64	41.55

Soil pH:

The pH values of the studied soil samples ranged from 8.00 to 8.60, [Table, 2]. The high pH values were found in Edku soil samples followed by those of Qaroun soil samples. Generally, the differences in the soil pH values of the studied soil samples were small. In all studied soil profiles, pH values tended to increase by increasing soil depth as a result of the high content of soil organic substances in the surface layers,(Mohamed,2002).Moreover, unclear trend was observed between soil pH and the distance from the lakes in the studied areas. Most studied soil samples are saline-alkali (saline-sodic) and have pH values less than 8.5. These results are in agreement with that were found by Ahmed (2005).

Soil organic matter:

The studied soil samples characterized by low content of organic matter, which ranged from 0.65 to 1.67 %,[Table, 2] .According to the soil content of organic matter, the studied areas follow the order of Qaroun > El-Burollus > Edku. The soil content of organic matter tended to decrease with increasing soil depth; however, its content was not related with the distance from the lake shoreline. These findings resulted from the enrichment of the surface layer by organic residues and organic manures during agriculture processes (Anter, 2000 and Mohamed, 2002).

Calcium carbonates $CaCO_3$ % and cation exchange capacity (CEC):

The data showed that, the $CaCO_3$ % content of the soils under study ranged between 0.59 and 3.27 % and followed the order of Qaroun > Edku > El-Burollus according to their content of $CaCO_3$ % [Tables, 2]. The relationship between the content of $CaCO_3$ and both of soil depth and the distance from the lake shoreline had no specific trend. Similar results were found by Anter (2000) and Mohamed (2002) who reported that, most of the studied profiles had fairly to high $CaCO_3$ contents, due to the calcareous lacustrine deposits in the soils of El- Fayoum area. Data in Table [2] show that, cation exchange capacity (CEC) of the studied soil samples as c mol/kg soil ranged from 50.56 to 35.96 c mol kg^{-1} soil. The high values of CEC in all soil profiles exist in the surface and subsurface layers which decrease with the increase in soil depth. These results may be resulted from the high content of both organic matter and clay. Similar results were found by Anter (2000), Ibrahim (2001) and Mohamed (2002). The relationship between CEC and the distance from the lake had no specific trend. The highest values of CEC were found in the samples of Edku soil followed by those of Brollus soils. El-Maaz, (2005) found similar results.

Soil physical properties:

Soil water salinity can affect soil physical properties by causing fine particles to bind together into aggregates. This process is known as flocculation and is beneficial in terms of soil aeration, root penetration, and root growth. Although increasing soil solution salinity has a positive effect on soil aggregation and stabilization, at high levels salinity can have negative and potentially lethal effects on plants. As a result, salinity cannot be increased to maintain soil structure without considering potential impacts on plant health. (Krista E. Pearson and James W. Bauder 2003).

Particle size distribution:-

The values of particle size distribution of the studied soil samples [Table, 3] show that all soils under study have a clay texture at the different soil depths. Data indicated that the content of sand fraction was generally low in all soil profiles. The clay content increased by increasing the soil sampling depth. These results are in agreement with those obtained by Ahmed et al., (2009). Also, it can be noticed from the same data [Table, 3] that the contents of fine particles (clay and silt %) in the studied soil samples often increased with increasing the distance from the lake. It could be concluded that, the relationship between the soil salinity and the soil content of fine particles (clay) was negative. This negative relationship may be resulted from the aggregation effect of high salinity levels in such locations, (El-Gundy, 2005).Thus, it can be concluded that, the distance from the lakes, soil sampling depth and salinity sours i.e. the lakes resulted in the greatest effect on the values of particle size distribution.

Soil bulk density:

The values of soil bulk density of the studied soil samples ranged from 1.09 to 1.39 g cm^{-3} [Table, 3].These values were frequently increased with the increase of both the distance from the lakes and the soil depth, which may be due to the low percentage of different aggregates, coarse fraction and low organic matter content in these soils. These results are in agreement with that found by El-Sheikh (2003) who found that, the values of bulk density were affected by soil texture and OM %

Total soil porosity:

Total soil porosity is an index of the relative volume of pores in the soil. The values of total soil porosity of different soil under study ranged from 47.55 to 58.87 % [Table, 3] .These values were decreased with the increase of the depth and distance from the lakes .This may be due to the fact that, the subsoil layers are more compacted which reduces the total soil porosity. Also, the low soil content of organic matter in the subsoil layers results in poor aggregation. Moreover, the decay of root system in the surface and subsurface layers increased the porosity. These results are in harmony with these of Ahmed (2005).

Soil hydraulic Conductivity:

Data in Table [3] indicate that, the values of soil hydraulic conductivity are low and ranged between 0.005 to 0.072 cm min^{-1}. Also, data revealed that, the values of K decreased by increasing soil sampling depth for all soils under study. The highest K value for the surface layer could be attributed to its relatively high contents of coarse fractions and quickly drainable pores. These results are in agreement with findings of Krista E .Pearson and James W .Bauder, (2003) who found that, the hydraulic conductivity was positively correlated with coarse sand % and quickly drainable pores (>28.8 μ). On the other hand, Kadu et al., (1993) stated that, hydraulic conductivity of the alluvial soils decreased by increasing soil content of fine particles. Regarding the effect of the distance from the lake on the values of (K), it can be stated that, no data illustrated that, the highest values of soil hydraulic conductivity are exist in case of Qaroun area, which could be attributed to its relatively high contents of coarse fraction and total drainable pores (> 8.62 μ),(Ahmed,2005).distinct trend can be observed. On the other hand, the effect of salinity source on the values of hydraulic conductivity (K),

Table [3]: Some physical properties of the studied soil profiles

Lake name	Distance from the lake(Km)	Profile No.	Depth Cm	Particle size distribution			Texture	B.D g cm^{-3}	T.P%	K cm min^{-1}
				Sand %	Silt %	Clay %				
Qaroun	1.5	1	0--30	18.22	30.11	51.67	Clay	1.09	58.87	0.072
			30-60	18.57	30.15	51.28	Clay	1.24	53.21	0.051
			60-90	11.15	35.77	53.08	Clay	1.27	52.08	0.037
			Mean	12.65	32.01	52.01	Clay	1.20	54.72	0.053
	10	2	0--30	16.35	28.11	55.54	Clay	1.22	53.96	0.066
			30-60	15.58	27.19	57.23	Clay	1.23	53.58	0.044
			60-90	10.58	22.77	66.65	Clay	1.27	52.08	0.041
			Mean	14.17	26.02	59.81	Clay	1.24	53.21	0.050
	20	3	0--30	32.10	21.00	46.90	Clay	1.28	51.70	0.062
			30-60	14.15	23.58	62.27	Clay	1.28	51.70	0.042
			60-90	11.01	21.78	67.21	Clay	1.34	49.43	0.040
			Mean	15.75	22.12	58.79	Clay	1.30	50.94	0.048
El-Burollus	1.5	4	0--30	19.45	31.00	49.55	Clay	1.18	55.47	0.031
			30-60	18.00	30.29	51.71	Clay	1.17	55.85	0.022
			60-90	16.00	21.58	62.42	Clay	1.35	49.06	0.015
			Mean	17.82	27.62	54.56	Clay	1.23	53.46	0.023
	10	5	0--30	17.55	22.58	59.87	Clay	1.30	50.94	0.030
			30-60	16.87	20.54	62.59	Clay	1.32	50.19	0.032
			60-90	15.02	20.99	63.99	Clay	1.34	49.43	0.011
			Mean	16.48	21.37	62.15	Clay	1.32	50.04	0.021
	20	6	0--30	19.00	21.58	59.42	Clay	1.32	50.19	0.030
			30-60	17.24	18.27	64.49	Clay	1.36	48.68	0.017
			60-90	11.58	24.89	63.53	Clay	1.39	47.55	0.009
			Mean	15.94	21.58	62.81	Clay	1.36	48.81	0.019
Edku	1.5	7	0--30	25.58	25.11	49.31	Clay	1.26	52.45	0.009
			30-60	18.11	32.58	49.31	Clay	1.28	51.70	0.008
			60-90	9.87	35.01	55.12	Clay	1.32	50.19	0.005
			Mean	17.85	30.90	51.25	Clay	1.29	51.45	0.007
	10	8	0--30	20.54	27.11	52.35	Clay	1.27	52.08	0.022
			30-60	17.00	32.00	51.00	Clay	1.28	51.69	0.015
			60-90	9.57	32.00	58.43	Clay	1.29	51.32	0.008
			Mean	15.70	30.37	53.93	Clay	1.28	51.69	0.015
	20	9	0--30	17.28	31.47	51.25	Clay	1.28	51.70	0.012
			30-60	16.79	34.78	48.42	Clay	1.29	51.32	0.011
			60-90	9.47	28.46	62.07	Clay	1.30	50.94	0.008
			Mean	14.51	31.57	53.91	Clay	1.29	51.32	0.010

BD: Bulk density, RD: Average of real density=2.65 g/cm^3, K: Hydraulic Conductivity, TP: Total porosity.

Moisture retention curves:

Soil moisture contents decreased by increasing the applied pressures and this function is mainly affected by Particle size distribution which affected on the characteristics of moisture tension curves .No clear trend was observed for the effect of the distance from the lakes on the moisture retention curve characteristics, [Table, 4 and fig 1]. These results are in agreement with findings of Ibrahim (2002) who found that, the soil moisture characteristics curves of some alluvial soils were more affected by soil texture. Regarding to the effect of both the distance from the lake and soil salinity source on soil moisture characteristics curves and soil moisture contents for different soils under study, the data showed that, no clear trend exists, which may be attributed to the fact that, soil moisture tension curves mainly depend on both soil texture and structure, (Ibrahim, 2002).On the other hand, El- Gundy(2005) reported that, the characteristics of soil moisture tension curves were more affected by both soil salinity and salinity types.

Table [4]: Moisture contents (volumes %) of the studied soil profiles under different tensions (atm)

Lake name	Distance from the lake(Km)	Profile No.	Depth Cm	Different tensions(atm)					
				0.001	0.1	0.33	0.66	1.0	15.0
Qaroun	1.5	1	0--30	56.60	49.22	43.11	38.45	33.22	27.11
			30-60	55.11	48.17	41.92	37.51	30.12	27.32
			60-90	49.22	43.56	40.14	36.64	32.31	28.72
			Mean	53.46	46.98	41.72	37.53	31.88	27.72
	10	2	0--30	54.00	48.11	41.12	37.89	32.99	27.89
			30-60	50.12	44.78	40.36	37.00	30.09	27.99
			60-90	49.12	43.00	37.00	35.17	30.04	28.11
			Mean	51.08	45.29	39.49	36.69	31.04	27.99
	20	3	0-30	48.25	43.23	39.11	35.01	32.02	28.19
			30-60	48.92	43.54	38.19	36.23	31.04	28.25
			60-90	49.11	42.00	37.00	34.12	30.01	27.14
			Mean	48.76	42.92	38.10	35.12	31.02	27.86
El-Burollus	1.5	4	0--30	51.02	46.15	43.16	39.29	34.01	21.15
			30-60	49.11	44.36	41.15	37.46	32.22	23.11
			60-90	44.06	40.18	38.21	35.11	30.00	27.00
			Mean	48.06	43.56	40.84	37.28	32.08	23.75
	10	5	0--30	47.88	40.15	40.18	35.69	30.12	21.00
			30-60	44.55	39.15	36.89	33.00	30.00	21.28
			60-90	44.00	38.99	33.58	31.00	29.54	24.58
			Mean	45.48	39.43	36.88	33.23	29.87	22.29
	20	6	0--30	41.29	34.21	31.00	28.00	24.04	20.00
			30-60	40.15	33.45	29.61	27.02	25.04	21.22
			60-90	45.22	38.44	36.78	30.19	27.13	23.65
			Mean	42.22	35.37	32.46	28.40	25.40	21.62
Edku	1.5	7	0--30	46.11	40.01	37.81	35.01	31.00	25.33
			30-60	44.20	39.00	37.01	33.18	30.91	25.27
			60-90	43.00	38.22	35.00	31.19	28.82	25.27
			Mean	44.44	39.08	36.61	33.13	30.00	25.29
	10	8	0--30	45.89	39.89	37.55	35.00	31.00	26.00
			30-60	44.18	42.50	39.55	35.11	30.25	25.98
			60-90	45.00	42.00	39.88	33.00	22.99	26.00
			Mean	45.02	41.46	38.99	34.37	28.08	25.99
	20	9	0--30	45.12	39.01	37.58	34.16	,31.00	27.13
			30-60	44.14	41.02	39.61	35.28	30.12	25.81
			60-90	46.51	41.11	39.72	33.31	29.00	26.00
			Mean	45.26	40.38	38.97	34.25	30.04	26.31

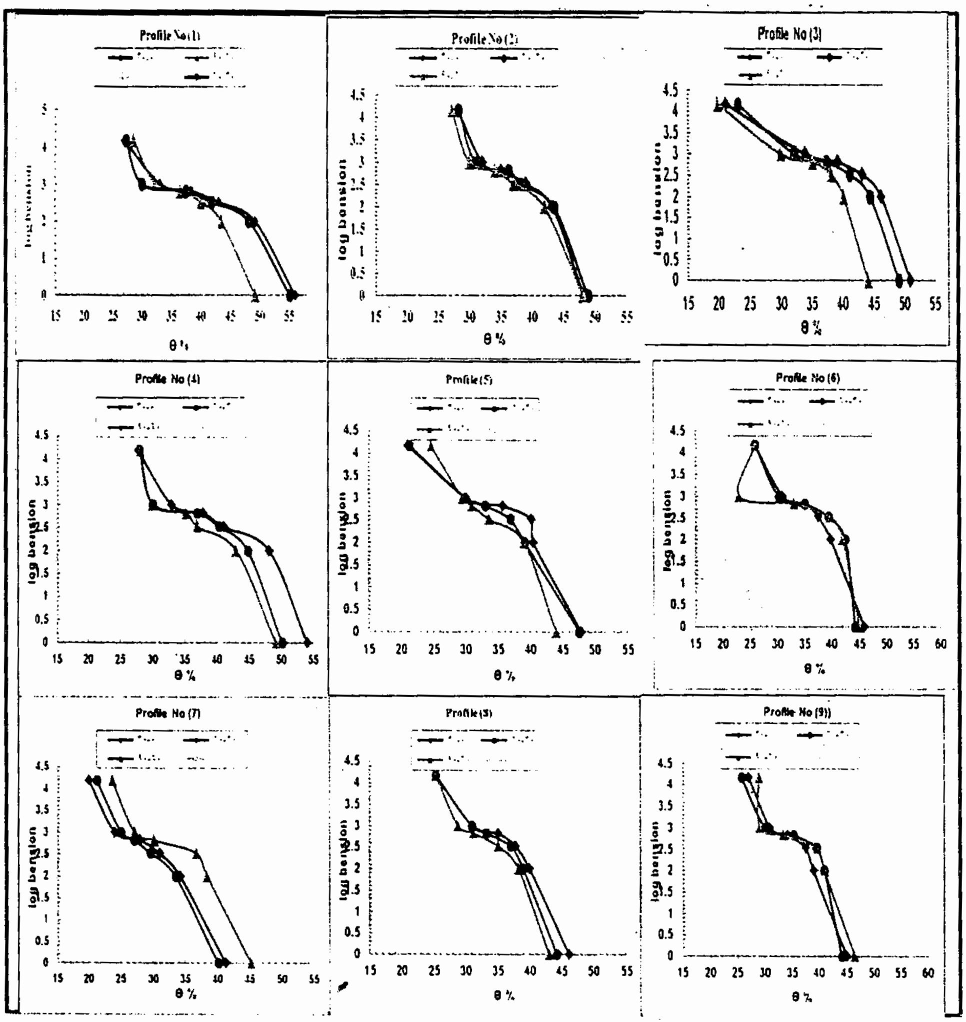

Fig [1]: Moisture retention curves for the investigated soil profiles.

Pore size distribution and Soil moisture constants:

The pore size distribution for different soils under study was calculated as percent from total soil volume [Table, 5]. The data reveal that, the drainable pores frequently decreased with the increase of the distance from the lakes. The values of fine pores were not affected by the increase of the distance from the lakes. The values of total drainable pores frequently decreased with the increase of soil depth. Opposite trend was observed with the fine pores.

Table [5]: Pore size distribution (%) and Soil moisture constants (%) of the studied soil profiles

Lake name	Distance from the lake(Km)	Profile No.	Depth Cm	Pore size distribution %					Soil moisture constants %		
				Q.D.P	S.D.P	D.P	F.C.P	W.H.P	F.C	W.P	A.W
Qaroun	1.5	1	0--30	6.84	6.11	12.95	27.11	16.00	43.11	27.11	16.00
			30-60	6.94	6.25	13.19	27.32	14.6	41.92	27.32	14.60
			60-90	5.66	3.42	9.08	28.72	11.42	40.14	28.72	11.42
			Mean	6.48	5.26	11.74	27.72	14.01	41.72	27.72	14.01
	10	2	0--30	5.89	6.99	12.88	41.12	13.23	41.12	27.89	13.23
			30-60	5.34	4.42	9.76	40.36	12.37	40.36	27.99	12.37
			60-90	6.12	8.00	12.12	37.00	8.89	37.00	28.11	8.89
			Mean	5.78	5.80	11.59	39.49	11.49	39.49	27.99	11.49
	20	3	0--30	5.02	4.12	9.14	28.19	10.92	39.11	28.19	10.92
			30-60	5.38	5.35	10.73	28.25	9.94	38.19	28.25	9.94
			60-90	7.11	5.00	12.11	27.14	9.86	37.00	27.14	9.86
			Mean	5.84	4.82	10.66	27.86	10.24	38.10	27.86	10.24
El-Burollus	1.5	4	0--30	4.87	2.99	7.86	21.15	22.01	43.16	21.15	22.01
			30-60	4.75	3.21	7.96	23.11	17.93	41.15	23.11	17.93
			60-90	3.88	1.97	5.85	27.00	11.21	38.21	27.00	11.21
			Mean	4.50	2.72	7.22	23.75	13.72	40.84	23.75	17.05
	10	5	0--30	7.38	0.32	7.70	21.00	19.18	40.18	21.00	19.18
			30-60	8.40	2.26	10.66	21.28	15.61	36.89	21.28	15.61
			60-90	5.01	5.41	10.42	24.58	9.00	33.56	24.58	9.00
			Mean	6.93	2.66	9.59	22.29	14.59	36.88	22.29	14.59
	20	6	0--30	7.08	3.21	10.29	20.00	11.00	31.00	20.00	11.00
			30-60	6.70	3.84	10.54	21.22	8.39	29.61	21.22	8.39
			60-90	6.78	1.66	8.44	23.85	13.13	36.78	23.65	13.13
			Mean	6.85	2.90	9.78	21.62	10.84	32.46	21.62	10.84
Edku	1.5	7	0--30	6.10	2.20	8.30	25.32	12.46	37.81	25.32	12.48
			30-60	5.20	1.99	7.19	25.27	11.74	37.01	25.27	11.74
			60-90	4.78	3.22	8.00	25.27	9.73	35.00	25.27	9.73
			Mean	5.36	2.47	7.83	25.29	11.32	36.61	25.29	11.32
	10	8	0--30	6.00	2.34	8.24	26.00	11.55	37.55	26.00	11.55
			30-60	2.38	2.95	5.33	25.98	13.57	39.55	25.98	13.57
			60-90	3.00	2.12	542	26.00	13.88	39.88	26.00	13.88
			Mean	3.79	2.47	6.23	25.99	13.00	38.99	25.99	13.00
	20	9	0--30	6.11	1.43	7.54	27.13	10.45	37.58	27.13	10.45
			30-60	3.12	1.41	4.53	25.81	13.8	39.61	25.81	13.80
			60-90	5.40	1.39	6.79	26.00	10.72	36.72	26.00	10.72
			Mean	4.88	1.41	6.29	26.31	11.66	37.97	26.31	11.66

FC = Field Capacity, AW = Available Water, WP = Wilting Point. QDP: (>28.84) Quickly Drainable Pores, SDP: (28.8-8.62u) Slow Drainable Pores, FCP: (<0.19u) Fine Capillary Pores, DP:(8.62u) Drainable Pores. WHP: (8.62-.019) Water Holding Pores,

This may be due to the increase of clay content with depth. In this concern Ibrahim (2002) reported that, wide pores are negatively correlated with clay content, while fine pores are positively correlated with clay content.

Field capacity, wilting point and available water are considered the three mains moisture constants. These constants can be calculated from the soil moisture characteristics curve. Data in Table [5] show that, the soil moisture content at field capacity had no clear relation with soil sampling depth but was gradually decreased with the distance increase from the lakes .The highest values of field capacity were found in the soil samples Qaroun lakes.The soil moisture content at wilting point for all studied areas was higher in the surface soil than the subsurface. This may be due to cultivation effect and plant residues, (El-Maaz,2005).The soil moisture content of available water was low. The low available water in the studied soil could be attributed to the high salt contents. Moreover, the data revealed that, the values of available water percentage were affected by both soil sampling depth and the distance from the lake. The high content of available water was found in the soil samples of El-Burollus lakes .This could be attributed to the variation in pore size distribution, O.M, (clay + silt) contents, total soluble salts and salinity types in the studied soil samples, El-Gundy (2005).

Soil aggregation

Dry sieve aggregates (D.S.A%)

The values of dry sieving aggregates shown in Table [6] reveal that the dry sieving aggregates (D.S.A %) having diameters from 10.0 to 2.0 mm is considered to be the largest size in the different studied areas.

Table [6]: Size distribution fractions (%) of dry- sieve aggregates in the studied soil profiles

Lake name	Distance from the lake(Km)	Profile No.	Depth Cm	Dry aggregates Diameter (mm)						
				10-2	2-1	1- 0.50	0.50-0.25	0.25-0.125	0.125-0.063	<0.063
Qaroun	1.5	1	0-30	54.11	10.28	10.00	12.03	6.00	6.54	1.04
			30-60	56.25	14.25	11.23	9.05	5.50	1.86	1.86
			60-90	72.58	13.89	7.01	2.55	2.08	1.21	0.68
			Mean	60.98	12.81	9.41	7.88	4.53	3.20	1.19
	10	2	0-30	61.00	10.38	9.99	10.25	4.00	4.25	0.13
			30-60	62.52	15.00	10.58	5.88	2.35	1.00	2.67
			60-90	70.34	10.99	8.01	3.55	4.18	1.20	1.73
			Mean	64.62	12.12	9.53	6.56	3.51	2.15	1.51
	20	3	0-30	73.56	12.91	7.25	2.87	2.50	0.04	0.87
			30-60	79.01	10.08	5.69	1.86	1.50	1.08	0.78
			60-90	65.23	15.05	9.41	5.71	2.61	1.09	0.90
			Mean	72.60	12.08	7.45	3.48	2.20	0.74	0.85
El-Burollus	1.5	4	0-30	87.25	7.43	3.06	0.95	0.63	0.27	0.41
			30-60	87.25	5.27	1.67	081	0.66	2.47	1.87
			60-90	86.23	5.87	2.06	1.20	2.81	0.80	1.03
			Mean	86.91	6.19	2.26	0.99	1.37	1.18	1.10
	10	5	0-30	87.23	7.33	2.66	1.00	0.25	1.00	0.53
			30-60	69.00	10.00	5.11	7.00	4.28	2.01	2.60
			60-90	69.23	7.45	5.01	2.35	5.00	1.11	9.85
			Mean	75.15	8.26	4.26	3.45	3.18	1.37	4.33
	20	6	0-30	87.16	7.24	2.43	1.06	1.52	0.12	0.47
			30-60	61.82	10.48	4.91	6.00	9.50	0.29	7.00
			60-90	68.05	8.69	4.51	3.20	9.00	1.53	5.02
			Mean	72.34	8.80	3.95	3.42	6.67	0.65	4.16
Edku	1.5	7	0-30	70.00	17.66	6.63	1.72	1.61	1.48	0.90
			30-60	67.23	14.25	7.42	4.82	1.95	2.97	1.36
			60-90	60.12	18.79	10.16	6.33	2.53	1.36	0.71
			Mean	65.78	16.90	8.07	4.28	2.02	1.94	0.99
	10	8	0-30	69.23	13.00	7.77	1.88	1.99	1.63	2.48
			30-60	70.00	14.02	6.01	2.38	2.04	2.01	3.34
			60-90	63.23	13.32	9.97	3.07	2.00	1.99	0.22
			Mean	68.13	14.83	7.91	3.18	2.01	1.88	2.01
	20	9	0-30	60.25	17.22	11.18	5.71	3.80	1.93	1.91
			30-60	70.26	13.08	6.30	2.78	2.15	4.89	0.54
			60-90	66.89	13.19	8.80	5.62	2.75	1.82	0.92
			Mean	65.80	14.50	8.09	4.70	2.90	2.88	1.12

The percentages of other sizes of dry aggregates decrease as their diameters decrease, especially the aggregates those have diameters less than 0.063 mm. Ahmed (2005) and Ahmed et al., (2009) found that these variations may be related to the management practices and environmental conditions. The percents of dry stable aggregates increased with increasing the soil depth except the large size aggregates which have diameters of 10-2 mm. This may be due to the high content of clay with increasing the soil depth and high content of coarse fraction in the surface soil layers. The highest values of D.S.S% were found in the soil samples of deeper layers. This may be due to the high clay contents, which assist in aggregation process. While the lowest values of D.S.S % were found in the surface layers, due to the high content of coarse fraction. Moreover, data revealed that, the effect of the distance from the different lakes and salinity source on D.S.S% values in the studies soil profiles is not obvious.

Water stable aggregates (W.S.A%):

The values of water stable aggregates (W.S.A%) as well as the distribution of aggregates size fractions in Table [7] indicate that the mean values of aggregates having diameters between 1 to 0.50 mm and 0.50 to 0.25 mm were higher than other aggregates fraction diameters in most soils under study.

Table [7]: Water stable aggregates (%) of the studied soil profiles

Lake name	Distance from the lake(Km)	Profile No.	Depth Cm	Wet aggregates Diameter (mm)						
				10-2	2-1	1- 0.50	0.50-0.25	0.25-0.125	0.125-0.063	Total
Qaroun	1.5	1	0-30	22.11	7.40	4.40	0.66	7.60	0.52	42.69
			30-60	1.86	2.40	9.00	3.32	4.41	0.39	21.38
			60-90	0.68	1.05	2.22	5.81	3.52	0.12	13.40
			Mean	8.22	3.62	5.21	3.26	5.14	0.34	25.65
	10	2	0-30	11.25	8.69	4.11	1.15	6.58	0.99	33.77
			30-60	2.58	2.38	15.69	4.01	9.00	1.57	35.23
			60-90	2.35	1.00	9.22	1.58	7.15	1.22	22.52
			Mean	5.36	4.02	9.67	2.25	7.58	1.26	30.51
	20	3	0-30	0.48	3.04	8.41	8.92	4.36	1.57	26.78
			30-60	1.15	6.30	12.82	6.52	8.75	1.71	37.25
			60-90	4.65	13.2	15.32	2.00	9.52	1.32	46.01
			Mean	2.09	7.51	12.18	5.81	7.54	1.53	36.68
El-Burollus	1.5	4	0-30	21.70	14.80	9.41	4.02	0.42	0.76	51.02
			30-60	0.25	1.32	3.32	7.12	1.65	0.36	14.02
			60-90	4.00	8.65	10.98	4.65	5.98	1.00	35.26
			Mean	8.65	8.26	7.90	5.23	2.68	0.68	33.43
	10	5	0-30	26.11	13.58	7.48	3.00	1.00	1.02	52.19
			30-60	8.24	5.32	5.22	2.58	8.58	1.06	31.00
			60-90	5.02	7.22	11.23	2.58	4.22	1.00	31.27
			Mean	13.12	8.71	7.98	2.72	4.60	1.03	38.15
	20	6	0-30	28.40	4.15	0.25	1.12	1.68	1.42	37.02
			30-60	10.90	14.20	6.30	5.60	10.32	1.14	48.46
			60-90	6.71	7.70	16.45	2.92	6.11	1.11	41.00
			Mean	15.34	8.68	7.67	3.21	6.04	1.22	42.16
Edku	1.5	7	0-30	23.60	20.30	14.23	4.85	3.00	1.25	67.23
			30-60	3.36	2.80	5.02	2.41	5.64	0.79	20.02
			60-90	0.82	1.98	7.85	2.25	1.45	0.73	15.08
			Mean	9.26	8.36	9.03	3.17	3.36	0.92	34.11
	10	8	0-30	23.88	22.00	13.89	1.87	2.59	1.33	65.56
			30-60	15.28	20.11	9.68	3.48	3.66	0.63	52.84
			60-90	11.23	19.25	8.58	3.99	3.58	0.14	46.77
			Mean	16.79	20.45	10.72	3.11	3.28	0.70	55.06
	20	9	0-30	23.70	26.40	13.00	2.31	2.75	1.38	69.54
			30-60	25.45	24.40	11.78	4.56	1.75	0.63	68.57
			60-90	14.62	20.70	11.90	4.52	4.95	0.79	57.48
			Mean	21.26	23.83	12.23	3.80	3.15	0.93	65.20

The values of total stable aggregates (T.S.A) increased with the increasing of the distance from the lake (especially Qaroun and El- Borollus), this may be due to the decrease of soluble salts. No clear trend was observed for the effect of soil depth and the distance from the lakes. This could be attributed to the fact that, the high total soluble salts, ESP and silt fraction content resulted in a decrease of total soil aggregates. These findings are in agreement with those of El-Sheikh (2003).

CONCLUSION

The soils in the three studied areas were salt affected soils characterized by bad chemical and physical properties. Thus, from the obtained data and its discussion we can conclude that, the common reclamation processes applied for these soils must include improvement of soil physical and chemical properties through deep ploughing and addition of different amendments such as organic matter and gypsum which are the most commonly chemical amendment used in Egypt due its low cost and its smoothly application. Use of suitable qualities and requirements of irrigation water in the presence of suitable drainage system.Leaching the excess of soluble salts through continuous or uncontinuous leaching processes using suitable sources of water. The applied drainage system must be design through a good system. Applied agricultural rotation must be more suitable where it's including legume plants. The selected plants to cultivation in these soils must be characterized by high tolerance for soil salinity and alkalinity.

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الخصائص الطبيعية و الكيميائية لبعض الأراضى المتاخمة للبحيرات الشمالية الغربية و الجنوبية في مصر

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ترجع أهمية هذه الدراسة إلى اتساع المساحة التي تشغلها الأراضي المتأثرة بالأملاح في مصر . لذلك أجرى هذا العمل لدراسة بعض الخواص الكيميائية والطبيعية لبعض هذه الأراضي المتأثرة بالأملاح ببعض البحيرات الشمالية الغربية و الجنوبية فى مصر وهي بحيرات أدكو و البرلس وقارون. تم أخذ عدد ٣ قطاع أرضى من كل منطقة يمثل كل قطاع الأبعاد الأتية: ١.٥ و١٠و ٢٠ كم من البحيرات تحت الدراسة حيث أخذت عينات أرضية مثارة وغير مثارة على أعماق ٠-٣٠ و ٣٠-٦٠ و٦٠-٩٠ سم لدراسة الخواص الكيميائية و الطبيعية لهذة الاراضي وكانت النتائج كالتالى:

الخواص الكيميائية:-

– كان أعلى محتوي من تركيز الاملاح الكلية الذائبة موجودة بالقرب من بحيرة قارون يليها البرولس ثم ادكو و تناقص المحتوى من الأملاح الكلية الذائبة بزيادة عمق العينة الأرضية وكذلك بزيادة البعد عن البحيرات أما PH كانت أعلى قيم لها فى الاراضى المتأثرة ببحيرة أدكو أما محتوي الاراضى من المادة العضوية فكانت مرتفعة الي حد ما في الطبقة السطحية وكانت أعلي قيم لها في أدكو وأيضا نسبة $CaCO_3$ كانت أعلي قيم لها في قارون وكان تأثير كل من العمق والبعد غير واضح. وكانت أعلى قيم السعة التبادلية الكاتيونية موجوداً في الطبقات السطحية من القطاع ولم يكن هناك علاقة واضحة فيما بين قيم السعة التبادلية الكاتيونية و البعد عن البحيرة .

الخواص الطبيعة:-

– تميزت عينات الأراضى تحت الدراسة أنها ذات قوام طينى ولوحظ أن أعلى محتوى من الطين وجد فى الأراضى المتاخمة لبحيرة البرلس و تزداد قيم الكثافة الظاهرية بزيادة العمق وأيضا بالبعد عن البحيرات و تقل قيم المسامية بزيادة العمق وأيضا بالبعد عن البحيرات ولوحظ أن أعلى قيم المسامية فى الأراضى المتاخمة لبحيرة قارون أما قيم التوصيل الهيدروليكى فقد انخفضت بزيادة العمق ولم يوجد اتجاة واضح بالبعد عن البحيرات. بالنسبة للتجمعات الثابتة كانت قيم الأقطار من 2-10 عالية بالمقارنة بالتجمعات الأخرى تحت الدراسة ولم يلاحظ اتجاة واضح للعلاقة بين التجمعات الثابتة فى الماء مع البعد عن البحيرات وكذلك العمق. وارتبط محتوى الأرض من الرطوبة بالتوزيع الحجمي للحبيبات والتي تؤثر بدورها على خواص منحنيات الشد الرطوبي . ولا يوجد اتجاه أو تأثير محدد للبعد عن البحيرات على صفات منحنيات الشد الرطوبي .ولم يكن لعمق العينات تأثير واضح على قيم السعة الحقلية بينما تناقصت هذه القيم بزيادة البعد عن البحيرات ولكنها اختلفت اختلافاً بسيطاً مع اختلاف منطقة الدراسة (مصدر الملوحة) حيث كانت أعلى قيم موجودة في العينات المأخوذة من منطقة بحيرة قارون .ولم يتأثر المحتوى من الرطوبة عند نقطة الذبول بالبعد عن البحيرات بينما ازداد بزيادة العمق .وقد انخفض المحتوى من الماء الميسر بزيادة العمق وكذلك بزيادة البعد عن البحيرات . و قد وجد أن أعلى محتوى للماء الميسر موجوداً في العينات الأرضية لمنطقة بحيرة البرلس يليها في ذلك عينات منطقة بحيرة قارون.