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LAND RESOURCES EVALUATION OF THE SOILS OF EL-SALHYIA,PROJECT, EASTERN DELTA, EGYPT

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ABSTRACT

Six soil profiles were selected to represent the soils of El-Salhiya project which located in the eastern side of the Nile Delta in order to evaluate their physical and chemical properties of the soils in this project to be classified , land capability for cultivation as well as land suitability for growing crops were carried out.

The obtained results reveal that the soils are clay loam or sandy clay loam in the surface layers, sandy loam in the deepest layers. Field capacity (FC); wilting point (WP) and available water (AW) varied from 9.2 to 20%, 4.0 to 9.98% and 2.62 to 15.19%, respectively, while hydraulic conductivity ranged from 6.8 to 15.2 cm/hr.

Frequency distribution of pores: (QDP) 1.0 to 12.1; (SDP) 1.2 to 13.21, (WHP):2.5 to 24.9% and (FCP):6.5 to 13.8%, respectively.

Chemical properties of the studied area reveal that the soil reaction ranged from 7.2 to 7.9. Soil salinity fluctuates between non saline to slightly saline where EC values ranged from 0.45 to 3.7 dSm^{-1}. Soluble cations are in the order $Na^{+}>Ca^{++}>Mg^{++}>K^{+}$, while soluble anions following the order $Cl^{-}>SO_4^{=}>HCO_3^{-}$. Cation exchange capacity of the soils under consideration is in the range of 3.71 to 29.55 $Cmol_c\ kg^{-1}$. Exchangeable cations follow the order $Ca^{++}>Na^{+}=Mg^{++}>K^{+}$.

The soils are classified into one order, namely; *Entisoils* down to the family level.

Order: Entisols
Suborder: Orthents
Great group: Torriorthents
Sub group: TypicTorriorthents

Application of the capability index reveal that the studied soil profiles are placed between (II) and (III) grades

The studied soil profiles are evaluated to determine its suitability for growing 22 crops. Results reveal that the studied soils include suitability class (S2, S3 and N).

INTRODUCTION

Particularly from 1952 on wards, the Egyptian government devoted a considerable effort for land reclamation to accelerate horizontal expansion to crop with the over-increasing population. Most of the reclaimed lands are desert soils and salt affected soils having different properties which would change after reclamation practices,

El-Salhiya project is considered one of the important project of horizontal expansion in the Eastern Desert. It is located in the Eastern part of the Nile Delta with latitudes of 30˚ 35′ to 30˚ 45′ North and longitudes of 31˚ 39′ to 32˚ 04′ East (Fig1). The study area is acreaged some 23000 feddans. The metrological records of Ismailia station (means of 10 years 1992-2002) show that

- The total mean rainfall is 4800ml/year
- The mean relative humidity is 56.0%
- Evaporation values range from 4.3ml/day in January to 19.1 ml/day in July
- Main monthly temperature range between 12.6 ˚C in January and 27.3 ˚C in July.

According to Egyptian Meteorological Authority (2005) and the American Soil Taxonomy (USDA, 2006), the soil temperature regime of the study area is *thermic* and the soil moisture regime is *Torric*.

Geology of the region East of Nile Delta

From the geological point of view, El-Salhiya area is located in this region ; occupied by different rocks belonging to the Tertiory and Quatemory periods.

According to Said (1990) the succession of the formation of El-Salhyiya area was described from the oldest to the youngest i.e. Tertiory (Eocene and Oligocene) and Quaternary (Pleistocene and Holocene). Eocene rocks is mainly composed of dolomitic, sandy, marly and chalky limestones with some clay and sand beds in the

upper positions. The oligocene formations are mainly sand and gravel deposits.

The surface deposits of the Pleistocene and Holocene epochs cover a large area of the region. They comprise a Variety of continental and epi-contineutal deposits including the following:

1) Aeolian deposits, mainly of losse quartz sand in form of sand dunes, hummocks and sheets.
2) Old deltaic deposits; mainly losse of quartzitic sand and flinty pebbles.

The objectives of this study are to evaluating soil characteristic of such area after reclamation, is essential to assess their capability, characteristics including physical and chemical aspects, soil classification, as well as land suitability for growing crops were carried out.

MATERIALS AND METHODS

Field work

Six soil profiles were selected to represent the soils of El-Salhyia project which is located in the East of the Nile Delta. The location of the soil profiles are shown in Fig.(1). Soil profiles were dug deep to 150cm unless hindered by a rock or water table. Each profile was morphologically described and sampled. Eighteen soil samples representing profile layers and horizons were collected through a 2 mm sive , dried crashed sieved and the fine earth particles (less than 2mm) were kept for analysis.

Laboratory analyses

Laboratory analyses were carried out for particle size distribution, using the pipette methods (piper 1950); calcium carbonate content using calcimeter (Black et al, 1965); gypsum content by precipitation with acetone, and soil pH in the soil paste using pH meter (USDA2004); salinity as electrical conductivity (EC) in the soil paste extract was assessed in the 1:1 soil water extract for salic horizon identification; cation exchange capacity(CEC) and exchangeable cations were determined according to Tucker (1954).

For determination of moisture retention curve, bulk density, real density and hydraulic conductivity, undisturbed soil cores(2.5, 5 and

15cm hight and 5cm diameter) were collected in the representative soil horizons.

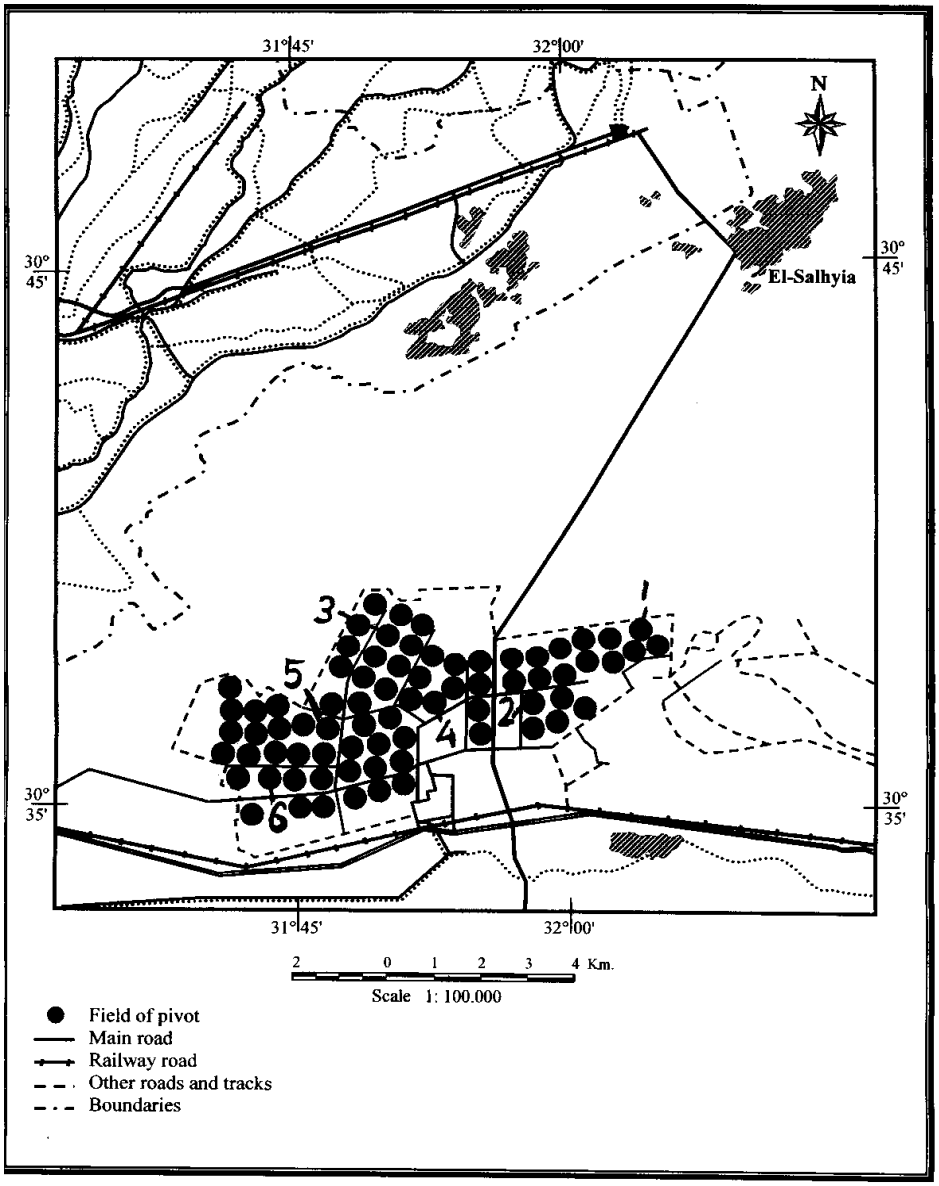

Fig. ( ) : Location of the studied soil profiles .

- Soil particles density (real density) was determined using Kerosene as a displacing liquid according to Abd El-Aal(1971).
- Soil bulk density was determined according to Black et al.(1965).
- Soil moisture retention curves were determined using a pressure membrane apparatus (Stakman 1966).
- Pore size distribution was determined according to De-Lecnher and De-Boodt, 1965).
- Saturated hydraulic conductivity was determined using the method reported by Richards (1954).
- Soils were categorized to the level of soil family using the Keys to Soil Taxonomy (USDA,2006), Land suitability classification was carried according to Sys et al.(1991)
- Soil under study were classified according to their suitability for certain crops using a numerical system undertaken by Sys et al (1993) which is a program developed through matching soil properties together with crop requirements. The main soil parameters used in this system are climate, soil depth, soil texture, gravel percentage, $CaCO_3$ percentage, gypsum percentage, salinity (EC_e), alkalinity (ESP), slop pattern and drainage conditions. A suitability index of 22 crops for studied soils was done according to this program.

RESULTS AND DISCUSSION

General view on the representative soil profiles

The field study reveal that the topography of the land scope is almost flat, topped in some parts by Oolitic sand sheets. Soil texture is clay loam or sandy clay loam in the upper most surface layers, but sandy loam in the deepest layers. Soil structure is massive in the top layeres of soil profiles whereas in the deepest layer it is single grains. Soil consistence is sticky and moderately plastic.

Data in Tables 1 and 2 reveal that the soils have $CaCO_3$ content of 1.0 to 1.7% with a relative decrease with depth. Organic matter content is very low being in the range of 0.1 to 0.8%. Gypsum content is extremely low not exceeding 0.22%. Soils are neutral to moderately alkaline where pH values ranged from 7.2 to 7.9. The EC_e values range from 0.45 to 3.7 dSm^{-1} indicating that the soils are non saline to slightly saline. The cationic composition of the soil saturation extract followed a pattern characterized by the dominance of Na^+

followed by Ca^{++}, Mg^{++} and K^{+}. Anionic composition also follows a consistent pattern where anions are dominated by Cl^{-} followed by $SO_4^{=}$, HCO_3^{-}, while $CO_3^{=}$ is absent.

Cation exchange properties of the soils

The values of CEC as well as exchangeable cations of the investigated soils are shown in Table (3). It is noticed that CEC values varied considerably from one soil sample to another. Such variability is mainly attributed to the differences in soil quality.

CEC values of the soils of El-Salhiya project which are represented by profiles 1 to 6 ranged from 3.71 to 29.55 C mol_e kg^{-1}. The lowest value is that recorded for the deepest layer of profile 4, while the highest value is that of the surface layer of profile 1. The textural variation reflects differences in clay contents between the soil profiles and their layers.

Table (1): Particle size distribution, texture class, calcium carbonate, organic matter and gypsum content of El-Salhiya soil profiles.

Profile No.	Depth (cm)	Particle size distribution %				Textural class	$CaCO_3$ %	OM %	Gypsum %
		Coarse sand	Fine sand	silt	clay				
1	**0-30**	11.60	48.40	25.00	15.00	CL	1.00	0.56	0.18
	30-80	5.90	66.10	11.00	17.00	SCL	1.30	0.13	0.10
	80-120	9.50	66.70	8.50	15.30	SCL	1.15	0.10	0.12
2	**0-30**	3.80	57.90	20.80	17.50	CL	1.15	0.45	0.12
	30-70	7.40	67.05	9.05	16.50	SCL	1.30	0.16	0.14
	70-120	7.30	53.90	20.00	18.80	CL	1.20	0.10	0.10
3	**0-30**	4.30	56.20	21.00	18.50	CL	1.65	0.44	0.10
	30-65	6.20	76.80	10.00	7.00	SL	1.00	0.20	0.10
	65-110	7.30	64.70	15.00	13.00	SL	1.00	0.15	0.14
4	**0-25**	3.50	48.80	28.20	19.50	CL	1.70	0.80	0.16
	25-75	8.40	66.60	11.70	13.30	SL	1.70	0.50	0.10
	75-120	10.00	71.20	10.50	8.30	SL	1.45	0.15	0.22
5	**0-30**	3.00	57.10	20.70	19.20	CL	1.60	0.75	0.10
	30-65	3.00	77.20	10.20	9.50	SL	1.25	0.18	0.15
	65-115	7.60	71.85	8.25	12.30	SL	1.10	0.11	0.13
6	**0-35**	3.50	62.50	17.70	16.30	SCL	1.30	0.45	0.10
	35-85	3.80	77.40	10.30	8.50	SL	1.25	0.21	0.10
	85-120	3.50	74.70	13.30	8.50	SL	1.45	0.20	0.12

CL: clay Loam SL: Sandy Loam SCL: Sandy clay loam

Table (2) : Chemical composition of the soil saturation extract of El-Salhiya soil profiles

Profile No.	Depth (cm)	pH	EC (dS/m)	Cations m mol/L				Anions m mole/L			
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3	$CO_3^{=}$	Cl^{-}	$SO_4^{=}$
	0-30	7.20	3.70	11.45	9.40	19.00	1.15	0.00	2.40	22.0	16.60
1	**30-80**	7.60	0.72	2.05	1.56	3.25	0.53	0.00	1.60	4.0	1.79
	80-120	7.90	0.84	2.20	1.43	4.65	0.28	0.00	1.40	5.0	2.16
	0-30	7.80	0.55	1.31	1.25	2.80	0.24	0.00	1.20	3.0	1.40
2	**30-70**	7.60	0.69	1.47	1.21	4.20	0.25	0.00	1.40	4.0	1.73
	70-120	7.30	1.24	6.33	2.47	5.00	0.34	0.00	1.40	6.0	6.74
	0-30	7.20	1.09	2.74	1.35	7.60	0.28	0.00	1.60	7.0	3.37
3	**30-65**	7.60	0.54	1.13	0.85	3.50	0.14	0.00	1.00	3.0	1.62
	65-110	7.70	0.46	1.31	0.75	2.50	0.12	0.00	1.20	2.0	1.48
	0-25	7.90	0.56	1.43	0.92	3.30	0.22	0.00	1.00	3.0	1.87
4	**25-75**	7.70	0.55	2.55	1.03	2.00	0.16	0.00	1.20	2.0	2.54
	75-120	7.60	0.49	1.16	0.85	3.00	0.18	0.00	1.20	2.0	1.99
	0-30	7.40	0.96	2.47	1.63	5.20	0.35	0.00	2.00	6.0	1.65
5	**30-65**	7.50	0.70	1.13	1.00	5.00	0.25	0.00	1.20	4.0	2.18
	65-115	7.20	1.06	2.35	1.15	6.60	0.34	0.00	1.60	7.0	2.84
	0-35	7.60	0.45	1.26	1.03	2.50	0.18	0.00	1.00	2.0	1.97
6	**35-85**	7.40	0.56	1.60	1.00	3.20	0.22	0.00	1.20	3.0	1.82
	85-120	7.30	0.50	1.39	1.15	2.60	0.14	0.00	1.20	2.0	2.09

Table (3) : Cation exchange capacity CEC; exchangeable cations and exchangeable sodium percent(ESP) of the soil profiles of some reclaimad soils in El-Salhiya area.

Profile No.	Depth (cm)	CEC Cmole kg^{-1}	Exchangeable cations cmolc kg^{-1}				ESP
			Ca^{++}	Mg^{++}	K^{+}	Na^{+}	
	0-30	29.55	15.02	7.60	2.87	4.06	14
1	**30-80**	5.12	1.96	1.17	0.83	1.16	23
	80-120	5.28	2.06	1.36	0.56	1.30	25
	0-30	23.05	11.15	6.76	2.30	2.84	12
2	**30-70**	13.72	7.20	4.00	0.56	1.96	14
	70-120	5.69	2.31	2.05	0.18	1.15	20
	0-30	26.70	12.56	8.10	2.74	3.30	12.
3	**30-65**	5.39	2.00	1.85	0.64	0.90	17
	65-110	4.06	1.85	1.16	0.30	0.75	18
	0-25	24.47	13.00	6.10	2.22	3.15	13
4	**25-75**	4.20	1.85	1.00	0.35	1.00	24
	75-120	3.70	1.30	1.05	0.40	0.90	24
	0-30	24.30	12.80	6.30	2.25	2.95	12
5	**30-65**	4.15	1.70	1.10	0.35	1.00	25
	65-115	4.45	1.95	1.16	0.40	1.04	23
	0-35	14.54	6.75	4.19	1.45	2.15	15
6	**35-85**	4.50	1.95	1.00	0.25	1.30	29
	85-120	3.91	1.46	1.15	0.30	1.00	23

Considering exchangeable cations, data indicate that they display a trend of Ca^{++}> Mg^{++}> Na^{+}>K^{+}. However, in the surface layers of profiles 2 and 4 and subsurface layers profile 6, the order is Ca^{++}>Na^{+}>Mg^{++}>K^{+}.

Physical properties:

Data in Table (4) show that field capacity (FC) ranges from 9.2 to 20.80%. The highest values are in the surface layers which are generally heavy textured and the low values are with light texture soils. In most profiles (FC) coinciedes in most cases with increased content of clay and silt. Wilting point (WP) varied from 4.2 to 9.98%. High values are associated with high contents of clay in soils. Available water (AW) varies from 2.62 to 15.19%. High values are associated with high content of clay, while the low values are found in the surface layers which have low contents of clay.

The statistical analysis exhibits a significant positive correlation between FC and clay (r=0.584**); and a negative one with each of sand (r=-0.565*) and ESP (r=-0.589**). Correlation with AW shows a positive value with clay (r=0.590**).

There is a positive correlation between wilting point and organic matter (r=0.460*).

With regard to the particle density (P.D), data in Table (5) show a little variation in particle density where ranged from 2.77 to 2.65 g/cm^3. The highest value is detected in the surface layer of profile 5, while the lowest value is in the deepest layer of profile 5.

Bulk density (BD) ranges from 1.73 to 1.53 g/cm^3 with the highest value in the surface layer of profile 3, while the lowest value is detected in the subsurface layer of profile 1. Abdel Razik (2002) reported that soil bulk density is affected by soil texture, CEC and organic matter contents. Values of bulk density increased by depth reflecting the lower content of organic matter with depth as well as the weight of the upper soil layers(Higgy, 1983).

Data in Table (4) show that hydraulic conductivity (HC) varied from 6.8 to 15.2 cm/hr with an increase in the coarse textured soils. High values which are shown in the coarse textured soils contrast the low values shown in the fine textured ones. These results aggrement with those obtained by Talha et al.(1979).

The statistical analysis shows that there are significant negative correlations between HC and each of CEC (r=-0.595**) and silt (r=-0.544*).

Regarding to soil moisture characteristic curves, data in Table (5) reveal that the soils of El-Salhiya project are characterized by low moisture contents at any of the applied suctions. This behavior is due to the absence of finer fraction which if present they are mostly active in relating water.

In the soils of El-Salhiya project, the total porosity values (Table 6) range between 31.1 to 54.7% with a general mean of 40.7%. The effect of soil depth on total soil porosity is very obvious, a gradual decrease is shown as the soil depth increases.

The statistical analysis exhibits significant positive correlation between total porosity and each of EC (r=0.603**) and organic matter (r=0.519*).

With regard to the pore size distribution, data in Table (6) reveal that the range of quickly drainable pores (QDP), slowly drainable pores (SDP), water holding pores (WHP) and fine capillary pores(FCP) are 1.0 to 12.1; 1.2 to 13.2; 7.2 to 24.9 and 6.5 to 13.8%, respectively. The trend of pores size distribution follow the order

WHP>SDP>FCP>QDP

The statistical analysis exhibits a significant positive correlation between fine capillary pores and each of $CaCO_3$ (r=0.503*) and organic matter content (r=0.500*).

Table (4): Soil moisture content, hydraulic conductivity (HC), real density (RD), bulk density (BD) for the studied soil profiles

Profile No.	Depth (cm)	RD g/cm^3	BD g/cm^3	HC Cm/h	Soil moisture content parameters. (W/W %)		
					FC	WP	AW
1	0-30	2.66	1.62	6.80	20.20	5.84	14.4
	30-80	2.70	1.53	9.40	17.82	4.93	12.9
	80-120	2.72	1.56	10.30	18.85	4.50	14.4
2	0-30	2.75	1.70	7.60	19.70	5.00	14.7
	30-70	2.75	1.60	10.20	18.70	4.50	14.2
	70-120	2.68	1.55	9.80	19.80	4.20	15.6
3	0-30	2.65	1.73	7.60	19.60	4.41	15.2
	30-65	2.65	1.55	10.80	9.20	4.40	4.8
	65-110	2.71	1.65	11.40	10.60	6.98	3.6
4	0-25	2.73	1.71	7.30	18.80	7.98	10.8
	25-75	2.74	1.55	15.20	20.80	9.98	10.8
	75-120	2.76	1.55	7.90	20.80	9.80	11.0
5	0-30	2.77	1.70	6.80	18.50	7.97	10.5
	30-65	2.68	1.61	10.10	12.80	5.67	7.1
	65-115	2.63	1.65	11.30	17.50	5.00	12.5
6	0-35	2.65	1.55	8.10	16.40	6.72	9.7
	35-85	2.64	1.60	7.40	11.80	5.67	6.1
	85-120	2.69	1.65	7.60	16.30	4.00	12.1

Table (5): Soil moisture (%by weight) determined at different levels of moisture tension of the soil profiles

Profile No.	Depth (cm)	Moisture tension (MPa)						
		0.01	0.033	0.10	0.20	0.30	1.00	1.50
1	0-30	28.30	20.20	7.48	6.62	6.34	6.11	5.84
	30-80	23.90	17.82	5.85	5.35	5.18	5.05	4.93
	80-120	24.00	18.85	6.74	6.30	5.20	5.00	4.50
2	0-30	25.10	19.70	7.06	6.21	5.36	5.18	5.00
	30-70	22.50	18.70	7.51	5.16	5.00	4.90	4.50
	70-120	20.30	19.80	9.62	7.16	5.40	4.90	4.20
3	0-30	24.50	19.60	6.45	5.56	5.19	4.85	4.41
	30-65	14.80	9.20	6.61	5.63	5.35	4.80	4.40
	65-110	19.70	10.60	13.73	11.78	10.70	9.62	6.98
4	0-25	29.80	18.80	13.63	11.67	10.71	9.68	7.98
	25-75	27.90	20.80	16.20	13.86	12.97	10.65	9.98
	75-120	27.90	20.80	16.30	15.40	12.30	10.65	9.80
5	0-30	25.60	18.50	13.70	11.64	10.64	8.49	7.97
	30-65	18.60	12.80	8.90	7.10	6.46	6.24	5.67
	65-115	23.90	17.50	12.80	9.50	6.30	5.16	5.00
6	0-35	23.60	16.40	11.99	9.99	9.06	7.16	6.72
	35-85	18.90	11.80	8.53	7.10	6.86	5.84	5.67
	85-120	20.30	16.30	10.73	5.53	5.30	4.50	4.00

Table (6): Total porosity and pore size distribution of the studied soil profiles

Profile No.	Depth (cm)	Total porosity v/v%	Pore size distribution (V/V%)			
			QDP	SDP	WHP	FCP
1	**0-30**	38.90	8.60	9.50	11.30	9.50
	30-80	35.80	7.60	9.30	11.40	7.50
	80-120	34.30	9.20	8.10	10.00	7.00
2	**0-30**	54.70	12.10	9.18	24.90	8.50
	30-70	37.00	1.00	6.10	22.70	7.20
	70-120	38.80	7.20	1.20	23.90	6.50
3	**0-30**	32.90	7.60	8.50	9.20	7.60
	30-65	31.00	6.80	8.80	8.60	6.80
	65-110	36.80	6.50	13.30	7.50	9.50
4	**0-25**	47.60	6.80	12.20	17.50	11.10
	25-75	46.50	4.90	11.10	16.70	13.80
	75-120	46.50	3.70	11.10	16.50	15.20
5	**0-30**	49.50	6.00	12.00	17.90	13.60
	30-65	37.20	7.20	9.40	11.50	9.10
	65-115	46.20	6.80	10.50	20.60	8.30
6	**0-35**	42.30	5.70	11.20	15.00	10.40
	35-85	37.10	6.90	11.20	9.90	9.10
	85-120	39.60	6.10	6.60	20.30	6.60
Mean		40.70	6.70	9.40	15.30	9.30

Soil Taxonomy

The USDA soil Taxonomy (2006) was applied in this work to identify soil taxonomy of the studied soil profiles.

According to the climatic data of the Meteorological Authority of Egypt (2005), the moisture regime of the study area is "torric" and the temperature regime is "thermic". Soil characteristic of the study area (Tables 1 and 2) were classified is one order of *Entisols* to the soil family level. Their taxonomic classes are squintly described according to their descending development order as follows.

Order Entisols

Entisols soils are of recent development that only have an ochric, albic or histic epipedon, usually they are characterized by low contents of calcium carbonate. Their clays are of siliceous nature (Table 7)

Entisols of the current study include one suborder i.e. Orthents, which is tern includes one great group i.e.Torriorthents. this great group include one sub group i.e. Typic Torriorthents.

According to the wide variation in particle size classes and mineralogy of these soils, two families were distignished in this subgroup as follows.

1- *Typic* , *Torriorthents*, coarse loamy, mixed, thermic(profiles 1,2, 3,4 and 5)
2- *Typic Torriorthents*, sandy, mixed, thermic (profile 6).

Table (7): Soil classification categories of the studied soil profiles according to USDA Soil Taxonomy (2006)

Order	Suborder	Great group	Sub group	Family	Soil profiles
Entisols	*Orthents*	*Torriorthents*	*Typic Torriorthents*	*Coarse loamy, Mixed, Thermic* *sandy, Mixed, Thermic*	1,2,3,4 and 5 6

Land capability and land suitability classification of soils

Soils of the studied area is considered arable evaluating the capability and suitability of lands is essential for their practical use. The system of Sys et al. (1991) was applied. The land capability was done by rating the land characteristics of slope, drainage condition, soil texture, stoniness (gravel contents), soil depth, fertility (CEC), $CaCO_3$ status and gypsum status. The ratings were matched with certain crop requirements, that proposed by Sys et al (1993), resulting in suitability indices. The intensity of limitations were used for specifying land suitability as the order suitable [highly suitable "S_1", moderately suitable "S_2" and marginally suitable "S_3"] and not suitable [currently not suitable "N_1" and potentially not suitable "N_2"].

Land capability

The results of applying the system of Sys et al (1991) to the soils of the current study on the basis of irrigated agriculture are shown in Table (8). The results reveal that the soils are between grades 2 and 3 regarding and capability.

1-Grade II (S_2) moderately suitable

These relate to three soil profiles (1, 2 and 4), the limitations are slight and are mainly relate to soil texture

Table (8): Land capability grades of the studied soil profiles according to Sys et al. (1991).

Profile No.	Limitation rates							Capability index	class
	t	W	S_1	S_2	S_3	S_4	N		
1	100	90	100	70	90	90	90	51	S_2
2	100	90	100	70	90	90	90	51	S_2
3	100	90	100	65	100	90	90	47	S_3
4	100	90	100	70	100	90	90	51	S_2
.5	100	90	100	65	100	90	90	47	S_3
6	100	90	100	65	100	90	90	47	S_3

t :topography
W: wetness
s_1: depth
s_2 :texture
s_3 : $CaCO_3$
s_4: Gypsum
n: salinity and alkalinity
S_2 : moderately suitable
S_3: marginally suitable

3- Land of grade (III) marginally suitable

These relate to three soil profiles (3, 5 and 6). The limitation are moderate and different in their kind and degree. The main limitations are texture, salinity and sodicity and wetness.

It could be concluded that the soils of the current study would be utilized efficiently management and conversation practices are applied in a proper

Land suitability classification

By using the parametric approach of land index as mentioned by Sys et al.(1993), the obtained data through matching soil properties together with crop requirements. Table (9) leds to the current suitability indices for each of the studied crops.

Moderately suitable (S_2)

They are moderately suitable (S_2) for growing cotton, anion and cabbage.

Marginally suitable (S_3) for growing wheat, maize, barley, rice, groundnuts, soybean, sunflower, sesame, alfalfa, sugger cane, grean papper, potato, watermelon, olives guava and mango

Not suitable (N_1) for growing beans and citrus.

Table (9): Suitability index (SI) and suitability class (Sc) of the studied soils (Sys et al.1993)

Crops	SI	Sc
Wheat	38.1	S_3
Maize	34.4	S_3
Barley	44.0	S_3
Rice	32.3	S_3
Groundnuts	34.7	S_3
Soya	24.1	S_3
Sun flower	29.5	S_3
Sesame	43.5	S_3
Cotton	55.6	S_2
Alfalfa	37.9	S_3
Suger cane	34.1	S_3
Green papper	44.7	S_3
Potato	45.2	S_3
Tomato	35.5	S_3
Cabbage	48.4	S_2
Beans	10.6	N_1
Onion	48.2	S_2
Water melon	29.2	S_3
Olives	44.6	S_3
Guva	26.9	S_3
Mango	31.2	S_3
citrus	16.2	N_1

SI: sutability index
Sc: sutability clss

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تقييم الموارد الارضية لاراضى مشروع الصالحية بالصحراء الشرقية ـ مصر

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اختير عدد 6 قطاعات أرضية ممثلة لاراضى مشروع الصالحية والواقعة فى الجزء الشرقى لدلتا نهر النيل بغرض تقييم الخواص الطبيعية والكيميائية اهذه الاراضى وكذلك تقسيم وتحديد القدرة الانتاجية لهذه الاراضى بالاضافة الى تقدير درجات الصلاحية لزراعة المحاصيل المختلفة.

وتشير نتائج الدراسة الى أن قوام التربة يتراوح ما بين الطمى الطينى أو الطمى الرملى الطينى فى الطبقات السطحية بينما الطمى الرملى فى الطبقات التحت سطحية. وقد تراوحت قيم السعة الحقلية (FC) ونقطة الذبول(WP) والماء الميسر (AW) ما بين 9.2-20%، 4.0-9.98%، 2.62-15.19% على الترتيب بينما تراوحت قيم التوصيل الهيدروليكى (HC) لهذه الاراضى ما بين 6.8 الى 15.2 سم/ساعه. وقد تراوحت قيم المسام السريعة الصرف (QDP) ، مسام بطيئة الصرف (SDP) ، المسام الخاصه بمسك الكمية الغظمى من الماء (WHP)، والمسام الشعرية (FCP) ما بين 1.0-12.3%، 1.2-13.21% ، 2.5-24.9%، 6.5-13.8% على الترتيب.،

تشير نتائج التحليل الكيمائى لعينات التربة الى أن تفاعل التربة (pH) تراوحت ما بين 7.2 الى 7.9 والملوحة فى هذه الاراضى تراوحت ما بين عديمة الملوحة الى ملوحة خفيفه وقد تميزت الكاتيونات الذائبة بالترتيب التالى

$Na^{+}>Ca^{++}>Mg^{++}> K^{+}$ بينما الانيونات الذائبة أخذت الترتيب التالى

$Cl^{-} >SO_4^{=}>HCO_3^{-}$

وقد تراوحت قيم السعة التبادلية الكاتيونية (CEC) من 3.71 الى 29.55 سنتيمول/كجم وتميزت الكاتيونات المتبادلة عموما بسيادة كاتيون الكالسيوم يليه الصوديوم أو الماغنسيوم ثم البوتاسيوم

وبتطبيق نظام التقسيم الامريكى (2006) تبين أن هذه الاراضى تقع تحت رتبة الاراضى الحديثة Entisols وقد اجريت عملية التقسيم حتى مستوى العائلات

وباستخدام الCapability index لتقييم القدرة الانتاجية لهذه الاراضى وجد انها تقع ما بين الدرجة الثانية والثالثة

وقد قيمت هذه الاراضى لتحديد مدى ملائمتها لزراعة 22 محصول طبقا للمحددات الارضية الهامة والتى تؤثر على مدى ملائمتها لزراعة هذه المحاصيل وقد وجدت الدرجات المختلفة للصلاحية لهذة المحاصيلفى منطقة الدراسة وهى:

1-متوسطة الصلاحية (S_2)
2-هامشية الصلاحية (S_3)
3-عديمة الصلاحية (N)

لمحاصيل الخضر والحقل والفاكهه.