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LAND CLASSIFICATION, EVALUATION AND USE OF SOME SOILS IN ATMUR EL-NUQRA VALLEY, KOM OMBO, ASWAN, EGYPT.

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Abstract: The studied area is located at Utmur El-Nuqra Valley, about 70 Km east of Kom Ombo city, Aswan governorate. It is a part of the eastern desert plateau of Egypt. Fourteen soil profiles, representing 4000 feddans, were selected for this study to identify soil taxonomic units of this area with a special reference to their capability for agricultural purposes and suitability for some main crops.

Based on the physical and chemical soil properties, the studied soil profiles were classified down to the family level, according to soil taxonomy as a) sandy, mixed (calcareous), hyperthermic or sandy-skeletal, mixed (calcareous), hyperthermic or sandy siliceous (calcareous), hyperthermic, Typic Torripsamments, b) siliceous (calcareous), hyperthermic, Typic Quartzipsamments, c) coarse loamy, mixed (calcareous), hyperthermic, Typic Torriorthents, d) fine loamy, mixed (calcareous), hyperthermic, Sodic Torriorthents, and e) coarse loamy, mixed (calcareous), hyperthermic or , loamy-skeletal, mixed (calcareous), hyperthermic, Typic Natrargids.

Data obtained from the study reveal that the soils under consideration are suitable for irrigation, except some profiles that show severe or very severe limitations and are, in turn, not suitable for irrigation. Due to their very coarse texture, alkaline (sodic) and/ or saline nature, these locations are useful for pasture.

Results concerning the evaluation of soil suitability for major filed crops vegetable and fruit trees (24 crops), reveal that most of the studied soils are placed into S2 and S3 classes. Data obtained indicate that date palm is the most suitable crop (S2-S3) followed by alfalfa, sorghum, olives, barley and sunflower, then maize, sugarcane and onions. Soybean, sesame, beans, banana and pineapple are considered unsuitable crops (N1and N2).

Key words: Soil characteristics, Soil classification, Taxonomic units, Land evaluation, Arid and semiarid areas.

Introduction

In Aswan governorate, the cultivated area is mainly located in a very narrow strip (up to 5 Km in width) of alluvial soils that extends along the Nile river on both sides. The eastern desert plateau, with its rigid topography, encloses several wadies that occur along the eastern side of the alluvial soils of the Nile

valley. Some of these wadies, especially Kharit and El-Nuqra, represent areas of high agricultural potentiality due to their large extent, smooth topography, deep lands, and, in some areas, sufficient groundwater resources (AUSS Staff 1996).

Atmur El-Nuqra is a wide area that extends deeply in the eastern desert plateau. It is considered as one of the most promising areas for agricultural expansion. It is characterized by certain geomorphic units and certain soil types that are being developed. The studied area is located between latitudes 24° 30` and 24° 35`N and longitudes 33° 5` and 33° 15`E.

The general view of geology and geomorphology of Atmur El-Nuqra plain constitutes the floor of the vast depression that lies at Kom Ombo cultivated plain in the west and is separated from it by flat-topped disconnected hills. It is surrounded from the south, east and north by ever-broadening Nubian and post-Nubian sandstone of low table lands. The later is dissected by many dry wadies which continue to the Nile Valley. Wadi Kharit has been the main supply of sediments to Atmur El-Nuqra plain since the Quaternary time (AUGD Staff 1995 and 1996).

The soil characteristics, classification and land evaluation of some parts in the eastern desert of Egypt have been studied at regional stages by Hamdi *et al.*, (1973), Fathi *et al.*, (1975). Deregne (1976), Noman and Khalil (1980), Erain (1982), Fanous (1984), Khatter and Magd (1986), Mussttafa *et al.*, (1986), Ahmed and Khatter (1990), Zarhan and Wills (1992), Ibrahim *et al.*, (1994), Awad (1996), Amira *et al.*, (1997), Abd El-Aziz (1998), Mousa *et al.*, (2000) and Faragallah (2001). This study aims to identify the soil taxonomic units of Atmur El-Nuqra area with connection to their capability for agricultural purposes and their suitability for some main crops, vegetable and fruit trees.

Materials And Methods

The area under study is located at Atmur El-Nuqra valley, that is about 70 Km east Kom Ombo city, Aswan governorate, Egypt. It is a part of eastern desert plateau that extends along the eastern side of the Nile valley. It lies between latitudes 24° 30 ¯ and 24° 35 ¯ N and between longitudes 33° 5 ¯ and 33° 15 ¯ E (Figure 1and 2). The total area covers 4000 feddans.

Geologic and topographic maps and recent aerial photographs of the studied area as well as field observations, were used to select various locations of soil profiles. Fourteen soil profiles representing the area under investigation were selected. Each profile was dug to the suitable depth according to the type and nature of the soil material. All soil profiles were prepared and

described according to the standard procedures and terminology (Soil Survey Staff, 1975; Fanning and Fanning 1989; FAO, 1990; Soil Survey Staff, 1998). Soil samples were collected from profile layers according to the vertical morphological variations.

Soil samples were air dried, crushed, passed through a 2 mm sieve and kept for different physical and chemical analyses.. Gravel percentage was measured by volume for each soil layer. The physical and chemical analyses were performed using the methods of Richards (1969), Page et al.(1982) and Page et al.(1986). The soils were classified up to the family level according to Soil Taxonomy (Soil Survey Staff, 1998). Land evaluation was done according to Sys and Verheye (1978) and FAO (1979). Soil suitability classes for certain crops were identified according to Sys *et al.* (1993).

Results And Discussion

A-Morphological Characteristics

Morphological investigation of representative soil profiles is given in Table (1). The results reveal that the soil surface is covered with desert pavement with an elevation of < 150 m below sea level and, in most locations, has gentle slope and, in some parts, is almost flat. The area is virgin without any natural vegetation. Soil profiles are deep and rather uniform in texture.

According to the meteorological information of Kom Ombo Sugar Factory Station (Table 2), the prevailing climate of Atmur El-Nuqra valley is extremely arid. The average daily temperature ranges from 14.6 to 17.3 °C in winter and from 31.4 to 33.2 °C in summer. The relative humidity in the studied area shows a wide range of 64% in December to 29% in May. In most years, the rainfall in the area is nil, except some torrents take place in few years, indicating a very severely arid climate (Erian, 1989; Faragallah, 2001). So, the dominant soil moisture regime in the studied area is aridic (torric) with a hyperthermic soil temperature regime.

B-Soil Properties

The Physical and chemical analyses (Table 3 and 4) show that the investigated soils are generally deep, well to excessively well drained with coarse to medium texture grades. Soil surface is sandy, loamy sand and sandy loam, in most cases, with more fine texture in the subsurface layers. Total carbonate ($CaCO_3$) content is rather low to moderate (0.42 and 13.63 %). Gypsum is very low (0.17 and 0.70 %). Soil reaction is mildly alkaline, as it is indicated by pH values, which range between 7.36 and 8.48. Total soluble salts are slight to moderate in most of soil samples, except few soil samples that have high contents of soluble salts near

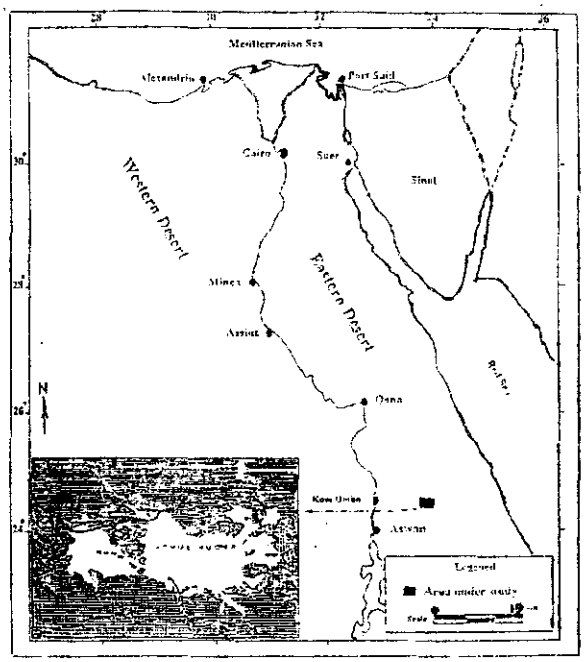

Figure (1): Location map of the study area.

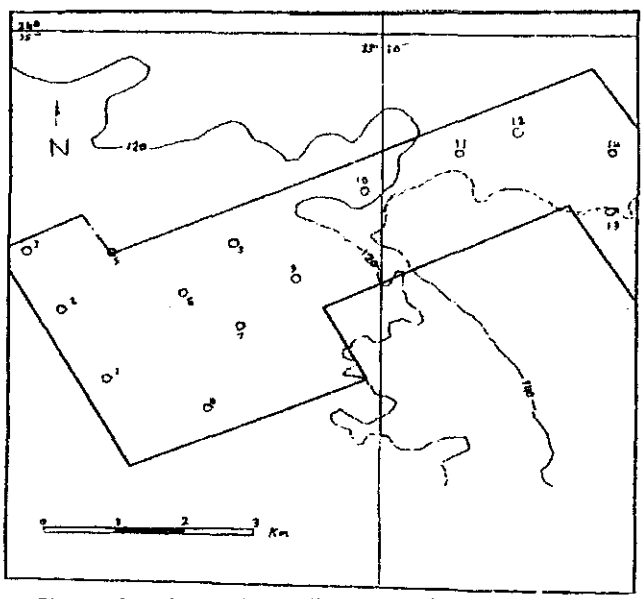

Figure (2): Map of the studied area and soil profile sites.

Table (1) : Morphological description of the studied soil profiles.

Prof. No	Elevation A.S.L (m)	Slope	Drainage	Water table (Cm)	Horizons & depth (Cm)	Color (I) Dry	Color (I) Moist	Gravel	Texture (II)	Structure (III)	Consistence (IV) Dry	Consistence (IV) Moist	Boundary (V)
1	115	Slight	Well drained	> 150	C1 0-30	P(7.5YR 7/4)	b(7.5YR 5/4)	-	SL	1 f pl	so	friable	as
					2C2 30-80	pg(7.5YR6/2)	b(7.5YR5/4)	many	L	2 m sbk	h	firm	as
					3C3 80-110	sb(7.5YR 5/6)	db(7.5YR 4/4)	many	LS	2 m sbk	h	v. friable	-
2	113	Slight	Well drained	> 150	C1 0-5	sb(7.5YR 5/6)	db(7.5YR 4/4)	many	SL	1 f pl	so	friable	as
					2C2 5-90	lb(7.5YR6/4)	sb(7.5YR5/6)	common	S	sl	h	v. friable	-
3	117	Slight	Well drained	> 150	C1 0-30	lb(7.5YR 6/4)	sb(7.5YR 5/6)	-	LS	1 f pl	sl h	v. friable	as
					2C2 30-100	lrb(5YR6/4)	rb(5YR4/3)	common	S	1 f pl	sl h	v. friable	-
4	116	Gentle	Well drained	> 150	C1 0-40	lrb(5YR 6/3)	rb(5YR 4/3)	-	L	1 f sbk	sl h	firm	as
					2C2 40-100	rb(5YR5/3)	rb(5YR4/4)	common	Si L	2m sbk	h	firm	-
5	117	Slight	Well drained	> 150	C1 0-20	yr(5YR 5/6)	yr(5YR 4/6)	-	S	sl	sl h	v. friable	as
					C2 20-70	ry(5YR6/6)	rb(5YR5/4)	-	S	sl	h	v. friable	as
					C3 70-100	rb(5YR 5/4)	rb(5YR 4/4)	common	S	sl	v h	v. friable	-
6	118	Slight	Well drained	> 150	C1 0-10	sb(7.5YR 5/6)	db(7.5YR 4/4)	-	LS	1 f pl	so	v. friable	as
					2C2 10-40	b(7.5YR5/4)	db(7.5YR4/4)	-	SL	2 m sbk	sl h	firm	-
					3C3 40-100	yb(10YR 5/4)	db(10YR 3/3)	-	Si L	2 m pl	h	firm	-
7	118	Gentle	Well drained	> 150	C1 0-20	sb(7.5YR 5/6)	db(7.5YR 4/4)	-	SL	1 f pl	so	friable	as
					2C2 20-90	sb(7.5YR5/6)	db(7.5YR4/4)	-	LS	1f sbk	sl h	v. friable	as
					3C3 90-110	sb(7.5YR 5/6)	db(7.5YR 4/4)	-	LS	2 f sbk	v h	v. friable	-
8	119	Gentle	Well drained	> 150	C1 0-10	b(7.5YR 5/4)	db(7.5YR 4/4)	-	LS	1 f pl	so	v. friable	as
					2C2 10-30	ry(7.5YR6/6)	b(7.5YR5/4)	many	S	sl	lo	loose	as
					3C3 30-40	sb(7.5YR 5/6)	db(7.5YR 4/4)	common	S	sl	so	v. friable	as
					2C4 40-110	b(7.5YR 5/4)	db(7.5YR 4/4)	many	S	sl	so	v. friable	-
9	118	Gentle	Well drained	> 150	C1 0-40	yr(5YR 4/6)	yr(5YR 4/8)	-	SL	1 f pl	so	friable	as
					2C2 40-110	b(7.5YR5/4)	db(7.5YR4/4)	-	L	s m sbk	h	frm	-
10	120	Gentle	Well drained	> 150	C1 0-35	b(7.5YR 5/4)	db(7.5YR 4/4)	-	S	sl	so	v. friable	as
					C2 35-100	b(7.5YR5/4)	db(7.5YR4/4)	common	S	sl	so	v. friable	-
11	120	Gentle	Well drained	> 150	C1 0-20	b(7.5YR 5/4)	db(7.5YR 4/4)	many	LS	1 f pl	so	v. friable	as
					2C2 20-120	sb(7.5YR5/6)	db(7.5YR4/4)	many	S	sl	st h	v. friable	-
12	125	Gentle	Well drained	> 150	C1 0-25	b(7.5YR 5/4)	db(7.5YR 4/4)	many	S	sl	so	v. friable	as
					C2 25-100	sb(7.5YR5/8)	db(7.5YR4/4)	-	S	sl	so	v. friable	-
13	140	Gentle	Well drained	> 150	C1 0-10	lrb(5YR 6/4)	yr(5YR 5/6)	-	LS	1 f pl	so	v. friable	as
					2C2 10-110	ry(5YR6/6)	yr(5YR4/6)	common	S	sl	sl h	v. friable	-
14	140	Gentle	Well drained	> 150	C1 0-20	rb(5YR 5/4)	yr(5YR 4/6)	-	S	1 f pl	so	v. friable	as
					C2 20-100	ry(5YR6/6)	yr(5YR4/6)	-	S	1 f pl	so	v. friable	-

Abbreviations: Colour (I) P= Pink, pg = pinkish gray, b= brown, sb = strong brown, db = dark brown, lb = light brown, rb= reddish brown, lrb = light reddish brown, ry = reddish yellow, yr = yellowish red and yb = yellowish brown.

Texture (II) S= Sand, LS= Loamy Sand , SL= Sandy Loam, L = Loam and Sil = Silt loam .

Structure (III) 1 = weak, 2 = moderate, f = fine, m= medium, sl= structurless, pl= platy and sbk= subangular blocky.

Consistence (IV) lo = loose , so = soft, slh= slightly hard , h = hard, and vh= very hard .

Boundary (V) as = abrupt smooth .

the surface. This could be attributed to the barren nature of the soil as well as it reflects the ineffective role of rarely occurring torrents and infrequent showers in flushing soluble salts out of the soil surface. Values of the electrical conductivity of soil past extract (EC_e) range between 0.43 and 44.10 dS/m. These soils show no sodicity as they are indicated by exchangeable sodium percentage (ESP) values of < 15 % and sodium adsorption ratio (SAR) of < 13, except in profiles 1,4 and 9; where ESP and SAR are higher than 15 % and 13, respectively. The cation exchange capacity (CEC) ranges between 2.62 and 21.40 cmol(+)/ Kg. It well corresponds with the clay content in each layer. The organic matter is extremely low (< 0.3 %) due to the prevailing arid climate. Soil hydraulic conductivity is found, in general, to be closely correlated with soil texture and are relatively high in various layers of soil profiles, due to the relatively coarse texture of the soil material.

Table (2): Some meteorological data (average/year) of the studied area (Station of Kom Ombo Sugar Factory).

Year	Temperature °C			Evaporation	Relative	Wind velocity	Rainfall
	Max.	Min.	Mean	mm/day	Humidity %	Km/h	Mm
90-98	34.2	14.9	24.6	8.6	46	1.06	0.6
1998	34.9	15.9	25.4	9.4	43	1.17	0.2

C-Soil Classification

Classification of soils understudy was based on field observations and laboratory data. Soil taxa present were formulated and arranged according to the U. S. Soil Taxonomy (Soil Survey Staff, 1998). In lights of relevant soil properties, the studied soils are classified into two orders: Entisols and Aridisols.

1-Entisols

This order included soils that have little or no evidence of horizon differentiation. This may be ascribed to the continual addition of soil materials or to the nature of the prevailing dry climate. Tow suborders are recognized: Psamments and Orthents. At the great group level, three great groups could be distinguished; namely, Torripsamments, Quartzipsamments and Torriorthents. Under these great groups, the identified subgroups are Typic Torripsamments, Typic Quartzipsamments, Typic Torriorthents and Sodic Torriorthents. Data in Table (5) reveal that the soils of the different taxonomic units are characterized by the following:-

Table (3). Some physical properties and constituents of studied soil profiles.

Profile No	Depth of Layer (Cm)	SP %	H.C Cm/hr	G% by V.	Particle size distribution				Soil Texture Grade	CaCO3 %	Gypsum %	O.M %
					C.S% >100 u	V.F.S% 50-100 u	Silt %	Clay %				
1	0-30	33.6	1.37	4.11	40.09	17.14	27.96	14.81	SL	3.85	0.60	0.10
	30-80	36.8	1.19	45.87	25.30	16.95	40.72	17.03	SK.L	6.69	0.25	0.12
	80-110	32.8	5.26	37.00	59.29	17.46	16.70	6.55	SK.LS	4.43	0.19	0.08
	W.Mean	34.8	2.35	32.06	38.60	17.14	30.94	13.56	SL	5.30	0.33	0.10
2	0-5	30.4	3.90	42.59	23.11	35.14	34.84	6.91	Sk.SL	8.03	0.27	0.16
	5-90	23.6	15.29	6.66	93.4	1.39	2.97	2.24	S	1.51	0.21	0.16
	W.Mean	23.9	14.65	8.66	89.49	3.26	4.75	2.50	S	1.87	0.21	0.16
3	0-30	26.0	4.97	-	66.39	18.10	8.16	7.35	LS	3.68	0.36	0.06
	30-100	24.8	13.56	7.50	80.03	11.75	5.51	2.71	S	2.93	0.25	0.01
	W.Mean	25.2	10.98	5.25	75.94	13.65	6.30	4.11	S	3.15	0.28	0.02
4	0-40	38.0	0.49	2.24	24.77	13.56	35.60	26.07	L	5.52	0.70	0.21
	40-100	57.2	0.82	7.14	13.46	10.00	53.39	23.15	SiL	5.10	0.21	0.20
	W.Mean	49.5	0.69	5.18	17.98	11.42	46.27	24.32	L	5.27	0.41	0.20
5	0-20	18.4	11.32	-	89.49	1.97	5.28	3.26	S	2.42	0.30	0.16
	20-70	17.6	9.28	2.7	82.50	6.30	6.94	4.26	S	3.60	0.34	0.08
	70-100	19.6	12.04	11.9	91.61	0.92	4.04	3.43	S	1.09	0.19	0.03
	W.Mean	18.4	10.52	4.92	86.63	3.82	5.74	3.81	S	2.61	0.29	0.08
6	0-10	30.4	3.96	-	62.23	16.57	13.40	7.80	LS	3.18	0.36	0.09
	10-40	27.2	3.16	-	64.87	5.13	20.92	9.08	SL	3.68	0.39	0.09
	40-10	38.0	3.32	-	9.28	11.73	69.68	9.31	SiL	13.63	0.27	0.08
	W.Mean	34.0	3.34	-	31.25	10.23	49.42	9.09	SiL	9.60	0.31	0.08
7	0-20	31.0	3.20	-	38.47	33.62	18.75	9.16	SL	4.35	0.51	0.09
	20-90	30.8	7.29	-	61.19	24.57	9.27	4.97	LS	2.01	0.19	0.09
	90-110	32.4	7.26	-	40.42	38.09	16.90	4.59	LS	6.69	0.20	0.08
	W.Mean	31.1	6.54	-	53.28	28.67	12.38	5.66	LS	3.29	0.25	0.09
8	0-10	26.8	8.25	3.12	66.75	17.90	11.73	3.62	LS	3.85	0.25	0.02
	10-30	18.8	9.52	45.00	86.86	3.84	5.51	3.79	SK.S	2.51	0.25	0.07
	30-40	24.8	7.75	5.00	81.84	7.47	5.83	4.86	S	0.92	0.27	0.01
	40-110	22.0	15.29	38.50	89.36	4.76	3.43	2.45	SK.S	3.01	0.31	0.05
	W.Mean	22.1	12.91	33.42	86.17	6.03	4.78	3.02	S	2.80	0.29	0.05
9	0-40	32.0	2.31	2.60	42.76	18.89	26.89	11.46	SL	3.43	0.24	0.11
	40-110	41.2	1.15	2.50	32.01	14.60	35.82	17.57	L	3.09	0.40	0.15
	W.Mean	37.8	1.57	2.54	35.92	16.16	32.57	15.35	L	1.25	0.34	0.13
10	0-35	20.8	12.83	-	89.56	4.09	3.68	2.67	S	0.92	0.62	0.22
	35-100	21.6	13.26	20.00	93.65	2.03	1.49	2.83	S	0.67	0.40	0.22
	W.Mean	21.3	13.11	13.0	92.22	2.75	2.26	2.77	S	0.76	0.48	0.22
11	0-20	31.2	7.11	32.00	31.45	45.36	18.85	4.34	LS	8.03	0.17	0.11
	20-120	21.6	7.91	38.00	86.22	4.57	4.56	4.65	SK.S	1.92	0.21	0.11
	W.Mean	23.2	7.78	37.00	77.09	11.37	6.94	4.60	SK.S	1.34	0.20	0.11
12	0-25	24.8	13.05	41.00	85.54	4.05	8.26	2.15	SK.S	2.51	0.35	0.11
	25-100	25.2	9.52	-	82.23	7.85	5.60	4.32	S	1.42	0.37	0.13
	W.Mean	25.1	10.40	10.25	83.06	6.90	6.26	3.78	S	1.69	0.36	0.12
13	0-10	24.8	2.97	-	76.63	7.54	6.20	9.63	LS	2.01	0.56	0.23
	10-110	21.0	12.83	7.14	88.26	5.95	2.37	3.42	S	1.00	0.31	0.14
	W.Mean	21.3	11.93	6.49	87.20	6.09	2.72	3.98	S	1.09	0.33	0.15
14	0-20	20.0	8.08	-	87.43	4.31	3.62	4.64	S	0.50	0.21	0.27
	20-100	18.6	13.26	1.39	91.64	4.19	1.51	2.66	S	0.42	0.27	0.16
	W.Mean	18.9	12.22	1.11	90.80	4.21	1.93	3.06	S	0.44	0.26	0.18

Where: Sp = Saturation percentage H.C= Hydraulic conductivity

G% = Gravel by volume S= Sand LS= Loamy Sand

SL= Sandy Loam L= Loam SiL= Silt Loam

SK. S = Skeletal Sand Sk.LS= Skeletal Loamy Sand

SK.SL= Skeletal Sandy Loam SK.L = Skeletal Loam

C.S = Coarse Sand V.F.S = Very fine sand O.M= Organic matter

Table (4) : Some chemical properties of studied soil profiles .

Prof No.	Depth of Layer (Cm)	pH 1:1	EC (1:1) dSm^{-1}	EC$_e$ DSm^{-1}	Soluble anions (meq/l)				Soluble anions (meq/l)			CEC cmol (+)/kg	ESP	SAR
					Na^+	K^+	Ca^{++}	Mg^{++}	$CO_3^=$	Cl^-	$SO_4^=$			
	0-30	8.17	5.11	9.02	68.26	1.85	19.16	4.76	2.34	64.24	7.08	11.48	22.64	19.74
	30-80	7.38	15.64	44.10	160.9	0.61	239.8	64.50	1.43	435.8	5.75	15.20	18.62	13.04
1	80-110	7.65	6.78	14.88	71.30	0.54	64.96	22.62	1.56	150.6	3.12	7.7	8.05	10.77
	W.Mean	7.67	10.35	26.56	-	-	-	-	-	-	-	12.14	16.83	14.25
	0-5	8.08	0.64	1.28	4.4	0.46	5.19	4.56	2.73	7.23	5.12	8.10	1.60	1.99
2	5-90	8.33	0.21	0.58	1.7.	0.20	4.58	1.02	2.08	2.84	1.87	3.27	1.22	1.01
	W.Mean	8.31	0.23	0.62	-	-	-	-	-	-	-	3.54	1.24	1.06
	0-30	7.97	1.18	2.85	6.2	0.90	12.34	8.12	2.34	11.75	7.46	8.19	3.48	1.94
3	30-100	8.05	0.33	0.76	3.04	0.23	4.13	2.53	1.94	4.07	2.29	2.98	1.68	1.66
	W.Mean	8.03	0.58	1.39	-	-	-	-	-	-	-	4.54	2.20	1.74
	0-40	7.90	10.32	22.80	210.4	0.79	20.58	13.45	1.95	230.2	7.50	21.40	24.34	51.01
4	40-100	7.86	10.93	19.11	165.4	0.67	27.42	11.77	2.34	166.9	6.71	17.20	16.51	37.36
	W.Mean	7.88	10.69	20.59	-	-	-	-	-	-	-	18.88	19.64	42.82
	0-20	7.84	0.25	0.59	1.52	0.26	4.61	2.03	2.34	2.94	1.79	4.50	1.11	0.83
	20-70	7.95	0.26	0.68	2.60	0.26	3.92	1.90	2.64	2.94	1.92	5.20	1.35	1.52
5	70-100	7.94	0.27	0.80	3.20	0.33	3.62	1.04	2.61	4.97	1.87	4.70	0.85	2.10
	W.Mean	7.92	0.26	0.70	-	-	-	-	-	-	-	4.91	1.15	1.56
	0-10	8.04	0.93	1.86	6.70	0.77	9.25	5.71	2.86	7.68	7.42	8.40	1.90	2.45
	10-40	7.80	7.71	18.26	73.90	0.85	78.00	24.93	3.61	172.9	4.50	9 83	10.58	10.30
6	40-10	8.00	2.87	7.74	24.80	0.61	30.25	15.83	1.82	64.97	3.29	10.12	5.24	5.17
	W.Mean	7.94	4.13	10.31	-	-	-	-	-	-	-	9.86	6.51	6.44
	0-20	7.36	2.30	5.12	16.60	1.54	25.64	11.54	1.95	42.59	7.12	10.10	4.55	3.85
	20-90	7.54	4.33	8.78	22.80	0.72	43.60	27.20	1.56	84.30	2.58	5.72	2.72	3.83
7	90-110	7.37	6.75	14.51	34.80	0.72	89.27	26.39	1.94	148.1	4.17	5.36	6.72	4.58
	W.Mean	7.48	4.40	9.16	-	-	-	-	-	-	-	6.45	3.83	3.97
	0-10	8.37	0.33	0.87	2.70	0.43	5.24	3.06	2 34	4.97	1.75	4.90	2.24	1.32
	10-30	7.91	0.97	3.21	4.30	0.79	21.96	7.20	1.82	25.59	5.54	4.10	2.19	1.14
8	30-40	8.48	0.21	0.43	1.50	0.23	3.06	1.02	2.08	1.36	1.28	5.53	1.63	1.05
	40-110	8.11	0.25	0.79	2.60	0.26	5.42	2.05	1.56	6.33	2.62	3.25	1.85	1.34
	W.Mean	8.13	0.38	1.20	-	-	-	-	-	-	-	3.76	1.93	1.27
	0-40	8.20	4.20	12.46	99.60	1.08	21.40	7.87	2.08	118.5	6.25	10.89	18.82	26.03
9	40-110	7.70	12.42	25.30	178.6	0.41	69.14	15.36	1.56	258.1	5.83	15.68	22.70	27.48
	W.Mean	7.88	9.43	20.63	-	-	-	-	-	-	-	13.94	21.29	26.95
	0-35	7.66	1.41	4..8	18.60	0.90	16.14	10.66	1.82	30.96	6.25	3.30	3.03	5.08
10	35-100	7.93	0.45	1.36	4.70	0.46	6.71	3.06	1.56	7.91	2.67	3.51	1.42	2.13
	W.Mean	7.83	0.80	2.42	-	-	-	-	-	-	-	3.44	1.98	3.16
	0-20	7.67	1.02	2.03	3.70	0.61	12.99	4.11	1.82	13.23	3.83	5.79	1.04	1.26
11	20-120	8.04	0.45	0.98	3.30	0.36	5.17	2.08	1.82	4.07	5.62	4.89	2.66	1.73
	W.Mean	7.98	0.54	1.15	-	-	-	-	-	-	-	5.04	2.39	1.65
	0-25	7.75	1.51	4.61	15.60	1.08	18.75	7.52	2.08	32.20	6.25	2.62	4.20	4.30
12	25-100	8.31	0.20	0.53	1.90	0.31	3.08	1.01	1.95	2.26	2.50	3.90	1.27	1.33
	W.Mean	8.17	0.53	1.55	-	-	-	-	-	-	-	3.58	2.00	2.07
	0-10	7.94	1.21	3.77	12.40	2.05	15.75	7.79	1.95	29.49	6.33	10.33	2.61	3.61
13	10-110	7.84	0.84	2.36	5.20	0.61	12.32	4.95	1.69	16.37	2.62	4.42	1.81	1.77
	W.Mean	7.85	0.87	2.49	-	-	-	-	-	-	-	4.96	1.88	1.94
	0-20	8.10	0.66	2.03	5.40	1.02	13.30	5.02	1.95	12.46	3.75	4.87	2.87	1.78
14	20-100	8.24	0.32	0.82	3.50	0.43	5.58	1.02	2.08	5.33	1.67	3.37	1.19	1.93
	W.Mean	8.21	0.39	1.06	-	-	-	-	-	-	-	3.67	1.53	1.90

a. Typic Torripsamments

The studied soils that are represented by profiles 3, 5, 7, 8, 11,12 and 13 (Table 5) are coarse in texture with three categories i. e., a) loamy sand in the surface layer followed by sandy texture in subsoil layers, b) sandy texture in all soil layers, and c) sandy loam in the surface and loamy sand in the subsurface layers. Some layers show sandy skeletal texture (profile 8, 11, and 12). Soil surface has nearly flat level to gentle slope; water table is deeper than 1.5 m; soil profiles are deep (> 90 cm). Total soluble salts (EC_e) range between 0.43 and 14.51 dS/m, indicating that these soils are free to slightly saline (profiles 3, 5, 8, 11, and 12) or slightly to moderately saline (profile 7). The cation exchange capacity ranged between 2.98 and 10.33 cmol (+)/ Kg; ESP is 0.85 to 6.72 %; $CaCO_3$ content ranges between 0.92 and 8.03 %; gypsum content is between 0.17 and 0.56 %. The organic matter content is very low (< 0.3 %). So, the taxonomic units of this subgroup lie within three families, i. e. namely sandy-skeletal, mixed (calcareous), hyperthermic, sandy, mixed (calcareous), hyperthermic and sandy-siliceous (calcareous), hyperthermic (Figure 3).

b. Typic Quartzipsamments

The taxonomic unit of this subgroup is characterized by very coarse texture, mainly sand (> 92 % in average), and is represented by profiles 2, 10, and 14. Total soluble salts that are indicated by ECe values range between 0.58 and 4.38 dS/m, indicating none saline conditions, in most cases. The cation exchange capacity (CEC) ranges between 3.27 and 4.87 cmol (+)/ Kg. Its value for the surface layer of profile 2 is relatively high (8.10 cmol (+)/Kg) and well corresponds with silt and clay content in this layer. The soils are none alkaline, as the exchangeable sodium percentage (ESP) is less than 15%; calcium carbonate content ranges between 0.42 and 8.03 %; gypsum content is very low (0.21 and 0.62%). Organic matter is very low (<0.3%). The taxonomic unit has one family for this subgroup; namely, siliceous (calcareous), hyperthermic (Figure 3).

c. Typic Torriorthents

The analytical data (Tables 3 and 4) show that this subgroup (profile 6) has a nearly flat level, with deep profile and its water table is deeper than 1.5 m. Soil texture is loamy sand in the surface layer, followed by sandy loam and silt loam in deeper layers. Total soluble salts that are represented by EC_e values range between 1.86 and 7.74 dS/m, indicating that these soils are none to slightly saline. Cation exchange capacity (CEC) values range between 8.40 and 10.12 cmol (+)/ Kg. Values of ESP are between 1.90 and 5.24 %; $CaCO_3$ content ranges between 3.18 and 13.63 % with an

increase in the deepest layer; gypsum content is from 0.27 to 0.39 %; organic matter content is very low (0.1 to 0.13 %). This subgroup has one family, namly, coarse loamy, mixed (calcareous), hyperthermic (Figure 3).

d. Sodic Torriorthents

This subgroup represents the Torriortents that have an exchangeable sodium percentage (ESP) of > 15% and SAR of more than 13 in all layers. These soils have gentle slope, with a loamy surface layer followed by silt loam one. The soil profile is deep and water table is deeper than 1.5 m. These soils are moderately to strongly saline (EC_e ranges between 19.11 and 22.80 dS/m). The CEC values are 17.20 to 21.40 cmol (+)/Kg, due to their relatively high clay and silt contents. Gypsum and organic matter contents are very low and ranges between 0.21 to 0.70 % and between 0.20 to 0.21%, respectively. This subgroup has one family, namely, fine loamy, mixed (calcareous),hyperthermic(Figure 3).

2-Aridisols

Generally, these soils are characterized by the presence of some diagnostic horizons, namely, argillic and natric (profiles 1 and 9). The soils are nearly flat to gentle slope; soil profiles are deep; water table is deeper than 1.5 m. Soil texture is sandy loam in the surface layer followed by loamy and loamy sand in the deeper layers. The control section contains >35% coarse fragments (profile 1). The clay content ranges between 6.55 to 17.57 % with more remarkable increases in the subsurface layer than the surface layer, suggesting the presence of an argillic horizon. The EC_e values range between 9.02 and 44.10 dS/m indicating moderate to very strong salinity levels. The CEC ranges between 7.7 and 15.68 cmol (+)/kg, with an increase with depth that coincides with increasing the clay content with depth. The soils are alkaline, as ESP values are > 15 % and SAR are > 13 (natric horizon). Calcium carbonate content ranges between 3.09 and 6.69 %; gypsum content is 0.19 to 0.60 %; organic matter is very low and ranges between 0.08 to 0.15 %. Accordingly, these soils are placed in the suborder of Argids, the great group of Natrargids and the subgroup of Typic Natrargids (Soil Survey Staff, 1994). At the family level, they are defined as a) loamy-skeletal, mixed (calcareous), hyperthermic (profile 1) and b) coarse loamy, mixed (calcareous), hyperthermic (profile 9) (Figure 3).

D-Land Evaluation

Quantitative estimation of soil characteristics, namely, slope, soil profile depth, drainage, texture, $CaCO_3$, gypsum, salinity and alkalinity (sodicity) were used for the numerical land evaluation. Based on the soil properties (Table 3 and 4)

Table (5): Taxonomic classes of the studied soil profiles.

Order	Suborder	Great group	Subgroup	Family
Aridisols	Argids	Natrargids	Typic Natrargids	Loamy-skeletal,mixed (calcareous), hyperthermic
Entisols	Psamments	Quartzipsamments	Typic Quartzipsamments	Siliceous (calcareous),hyperthermic
Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy,mixed (calcareous)hyperthermic
Entisols	Orthents	Torriorthents	Sodic Torriorthents	Fine loamy,mixed (calcareous), hyperthermic
Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy-siliceous (calcareous), hyperthermic
Entisols	Orthents	Torriorthents	Typic Torriorthents	Coarse - loamy,mixed (calecreous), hyperthermic
Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy,mixed (calecreous), hyperthermic
Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy-siliceous (calecreous), hyperthermic
Aridisols	Argids	Natrargids	Typic Natrargids	Coarse -loamy,mixed (calecreous), hyperthermic
Entisols	Psamments	Quartzipsamments	Typic Quartzipsamments	Siliceous (calecreous), hyperthermic
Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy-skeletal,mixed (calecreous), hyperthermic
Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy-skeletal,mixed (calecreous), hyperthermic
Entisols	Psamments	Torripsamments	Typic Torripsamments	Sandy-siliceous (calecreous), hyperthermic
Entisols	Psamments	Quartzipsamments	Typic Quartzipsamments	Siliceous (calecreous), hyperthermic

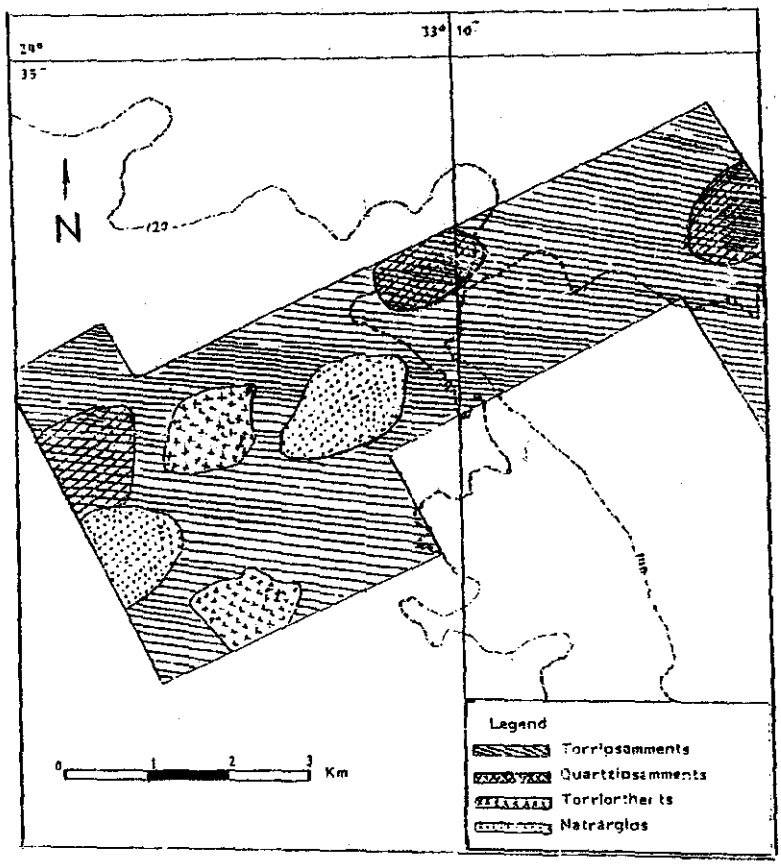

Figure (3): soil map (great group level) of the studied area.

and according to Sys and Verheye (1978) and USBR (1951), Table (6) and Figure (4) show that soils represented by profiles 1, 2, 3, 4, 5, 6, 7, 9, 11 and 13 are suitable for irrigation (order: S). Soils represented by profiles 4, 6, and 9 are moderately suitable (class: S2) with slight to moderate limitations, where their suitability index for irrigation (Ci) ranges between 51.31 and 63.82. Soils belonging to profiles 1, 2, 3, 5, 7, 11, and 13 are marginally suitable (class: S3) with moderate to severe limitations that do not exclude the use of lands for irrigation; as their rates of (Ci) range between 25.22 and 46.2.

On the other hand, soils of profiles 8, 10, 12 and 14 are not suitable for irrigation (order: N). These soil profiles belong to class N1 with severe or very severe limitations that can be corrected, as their Ci values range between 21.52 and 24.97.

Under the best conditions of water availability for agricultural purposes, soils suitable for irrigation (classes S2 and S3) could safely be used for agriculture in addition to the none suitable ones (class N1) after correcting their severe or very severe limitations.

E-Evaluation of soil suitability for some crops.

Soils understudy were evaluated to determine their suitability for twenty-four field crops, vegetables and fruit trees. Identification of suitable crops for each soil profiles under consideration is an important aim for agriculture purposes. According to the system of Sys *et al.* (1993), data of Ci values (Table 7 and 8) reveal that date palm is the best suitable crop for these soils with S2 and S3 soil classes, except profile 2. Alfalfa, sorghum, olives, barley and sunflower followed by maize, sugarcane and onion are suitable crops for most of the studied soils. Data in Tables 7 and 8 show that soils represented by profiles 6, 7, 11 and 13 are moderately suitable (S2) for growing date palm, olives, alfalfa and sorghum and marginally suitable (S3) for growing sunflower and sugarcane. Also, soils of profiles 11 and 13 are suitable (S2-S3) for growing all studied crops, except soybean, sesame, banana and pineapple. Alfalfa, sorghum, maize, sunflower, potato, carrots, onion, green pepper, water melon, date palm, olives, citrus, guava and mango are suitable crops (S2-S3) to be grown in soils of represented by profile 3. Soils represented by profile 5 are suitable (S2-S3) for growing all studied crops, except soybean, sesame, tomato, beans, banana and pineapple. Barley and date palm are only the suitable crops (S2-S3) for soils of profile 4. Soils represented by profile 2 are marginally suitable (S3) for growing alfalfa, maize, sorghum, and sunflower.

Table (6): Evaluation of the studied soils according to land suitability for irrigation (Sys and Verheye 1978).

Prof. No.	Rating of limiting properties							Suitability			
	Slope (t)	Wetness (W)	Texture (S1)	Depth (Cm) (S2)	$CaCO_3$ % (S3)	Gypsum % (S4)	Salinity and alkalinity (n)	Ci	Order	Class	Sub-class
1	95	100	75.00	90	95	90	76	41.70	S	S3	S3 s1,n
2	95	100	40.0	90	95	90	100	29.20	S	S3	S3 s1
3	95	100	48.25	90	95	90	100	35.27	S	S3	S3 s1
4	100	100	103.50	90	95	90	75	59.70	S	S2	S2n
5	95	100	34.50	90	95	90	100	25.22	S	S3	S3 s1
6	95	100	93.00	90	98	90	91	63.82	S	S2	S2n
7	100	100	66.00	90	95	90	91	46.20	S	S3	S3s1
8	100	100	32.80	90	94	90	100	24.97	N	N1-S3	N1s1
9	100	100	86.60	90	95	90	77	51.31	S	S2	S2 s1,n
10	100	100	31.90	90	85	90	98	21.52	N	N1-S3	N1s1
11	100	100	33.30	90	95	90	100	25.62	S	S3	S3 s1, s3
12	100	100	32.10	90	95	90	99	24.45	N	N1-S3	N1 s1
13	100	100	36.60	90	95	90	100	28.16	S	S3	S3 s1
14	100	100	34.50	90	85	90	100	23.75	N	N1-S3	N1 s1, s3

Where:

Ci : A suitability index for irrigation.

S1 : Suitable land for irrigation (Ci > 75).

S2 : Land units with more than 3/4 slight limitations and no more than 2/3 moderate limitations (Ci 50 to 75).

S3 : Land units with more than 2/3 moderate limitations and / or one severe limitation that does not exclude the use of the land for irrigation (Ci 25 to 50) .

N : Not suitable (C: < 25) .

N1: land units with severe or very severe limitations that can be corrected .

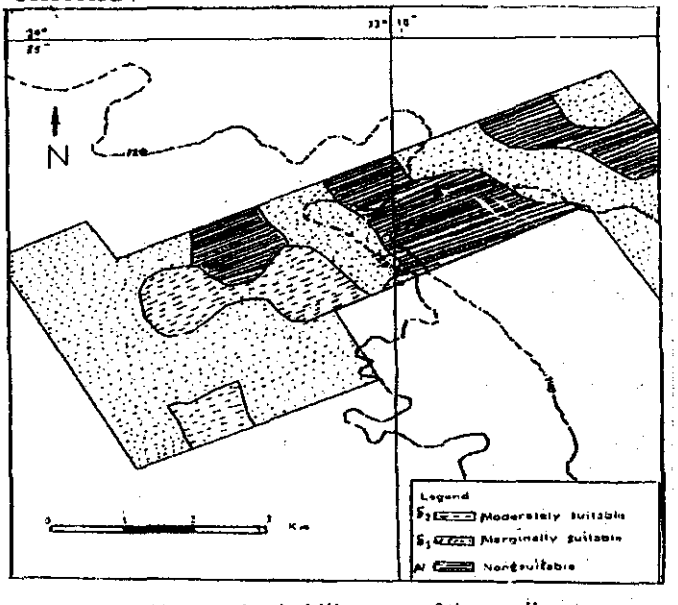

Figure (4): Land suitability map of the studied area.

Table (7) Suitability of the studied soils for some crops according to Sys et al. (1993)

Prof No.	Field Crops															
	Alfalfa		Wheat		Barley		Maize		Sorghum		Mills		Sunflower		Soybean	
	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC
1	19.0	N	12.3	N	12.6	N	13.3	N	17.7	N	16.9	N	12.5	N	9.1	N
2	21.6	S3	13.1	N	11.9	N	22.4	S3	26.5	S3	8.7	N	20.1	S3	7.2	N
3	35.8	S2	19.7	N	19.9	N	30.7	S3	39.8	S2	9.1	N	28.0	S3	14.0	N
4	18.0	N	16.4	N	25.4	S3	10.1	N	16.5	N	15.3	N	7.3	N	5.3	N
5	39.1	S2	20.5	S3	20.5	S3	34.1	S3	40.5	S2	24.1	S3	30.6	S3	15.7	N
6	39.8	S2	17.8	N	62.0	S2	18.3	N	51.3	S2	18.3	N	21.6	S3	7.9	N
7	41.2	S2	11.0	N	35.2	S2	18.7	N	38.4	S2	25.8	S3	25.0	S3	16.3	N
9	18.5	N	16.1	N	55.1	S2	9.8	N	16.0	N	14.0	N	7.0	N	5.6	N
11	40.8	S2	20.7	S3	21.1	S3	34.5	S2	42.1	S2	22.9	S3	20.0	S3	16.5	N
13	44.6	S2	20.3	S3	21.8	S3	38.3	S2	39.7	S2	26.3	S3	21.9	S3	18.8	N

Prof No	Field Crops				Vegetables											
	Sesame		Sugarcane		Potato		Carrots		Tomato		Onion		Green pepper		Beans	
	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	SI	SC
1	12.5	N	9.1	N	14.3	N	10.5	N	9.1	N	13.6	N	11.5	N	3.4	N
2	20.1	S3	7.2	N	8.8	N	14.0	N	6.7	N	13.4	N	12.1	N	4.6	N
3	28.0	S3	14.0	N	20.8	S3	24.3	S3	17.6	N	30.7	S3	28.1	S3	13.1	N
4	7.3	N	5.3	N	13.9	N	8.4	N	8.3	N	12.8	N	7.6	N	3.0	N
5	30.6	S3	15.7	N	23.6	S3	25.8	S3	19.1	N	37.7	S2	32.4	S3	18.1	N
6	21.6	S3	7.9	N	12.6	N	6.8	N	7.4	N	19.7	N	8.5	N	8.7	N
7	25.0	S3	16.3	N	19.1	N	14.3	N	20.7	S3	33.7	S3	16.9	N	10.1	N
9	7.0	N	5.6	N	14.3	N	10.3	N	17.5	N	14.7	N	8.6	N	3.3	N
11	20.0	S3	16.5	N	22.4	S3	31.0	S3	20.1	S3	33.7	S3	33.5	S3	17.7	N
13	21.9	S3	18.8	N	24.1	S3	28.4	S3	22.3	S3	46.9	S2	37.1	S2	6.1	N

Prof. No.	Vegetables		Fruits													
	Water-melon		Date palm		Olives		Citrus		Guava		Mango		Banana		Pineapple	
	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC	CI	SC
1	12.2	N	25.4	S3	13.4	N	2.5	N	13.1	N	12.4	N	2.3	N	2.1	N
2	14.0	N	16.6	N	15.1	N	9.2	N	8.5	N	10.0	N	4.9	N	11.0	N
3	27.5	S3	28.7	S3	28.7	S3	23.9	S3	20.3	S3	26.6	S3	11.1	N	7.8	N
4	8.2	N	28.0	S3	18.1	N	2.0	N	9.8	N	7.2	N	2.6	N	0.6	N
5	31.6	S3	29.5	S3	29.6	S3	27.5	S3	25.1	S3	32.6	S3	13.6	N	9.8	N
6	12.5	N	43.6	S2	43.7	S2	4.9	N	14.3	N	8.3	N	5.7	N	1.3	N
7	13.8	N	53.1	S2	53.8	S2	11.5	N	13.0	N	15.4	N	6.9	N	8.1	N
9	7.9	N	30.1	S3	21.6	S3	2.6	N	9.6	N	8.5	N	3.3	N	1.4	N
11	31.0	S3	42.8	S2	42.8	S2	30.6	S3	22.5	S3	30.0	S3	12.6	N	13.1	N
13	35.8	S2	37.9	S2	37.9	S2	33.6	S3	24.3	S3	39.2	S2	12.4	N	16.0	N

Abbreviations : CI = Suitability index
SC = Suitability class
S2 = Moderately suitable (Ci 35-64)
S3 = Marginally suitable (Ci 20 -34)
N= Not suitable (CI< 20)

Soils of profile 1 are not suitable for growing all studied crops, except date palm. Soybean, sesame, beans, banana and pineapple are considered unsuitable crops(N1 and N2)to be grown in these soils due to their moderate to severe limitations of fertility, salinity, alkalinity, $CaCO_3$ content and coarse texture. Proper fertilization and management associated with intensive leaching can correct most of currently encountered soil problems.

Table (8): Suitability ratings for different tested crops.

Suitable Class	Field crops										Vegetables	
Sc	Alfalfa	Wheat	Barley	Maize	Sorghum	Mills	Sunflower	Soybean	Sesame	Sugarcane	Potato	Carrots
S2	60	-	30	20	60	-	-	-	-	-	-	-
S3	10	30	40	30	10	40	70	-	-	50	40	40
N	30	70	30	50	30	60	30	100	100	50	60	60
Suitable Class	**Vegetables**					**Fruit**						
Sc	onion	Tomato	Green pepper	Water-melon	Beans	Date palm	Olives	Citrus	Guava	Mango	Banana	Pineapple
S2	20	-	10	10	-	40	40	-	-	10	-	-
S3	30	30	30	30	-	50	30	40	40	30	-	-
N	50	70	60	60	100	10	30	60	60	70	100	100

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تصنيف وتقييم بعض اراضى وادى عتمور النقره للإستخدام الزراعى

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تم اجراء هذا البحث بدراسة اربعة عشر قطاعا بوادى عتمور النقره بصحراء مصر الشرقيه علـــى بعد ٧٠كم شرق مدينة كوم امبو بمحافظة اسوان ، وذلك بهدف التعرف على تقسيم وتقويم مدى ملائمة هذه الاراضى للزراعة المرويه وكذلك مدى ملائمتها لزراعة بعض المحاصيل الهامة

ولقد اتضح من الدراسة الحقلية والمعملية انه يمكن تقسيم اراضى المنطقة تحت الدراسة حسب التقسيم الامريكى الحديث (١٩٧٥– ١٩٩٨) حتى مستوى العائلة (Family) كالاتى :–

- Sandy, mixed (calcareous), hyperthermic, sandy-skeletal, mixed (calcareous), hyperthermic and sandy-siliceous (calcareous), hyperthermic, Typic Torripasmments.
- Siliceous (calcareous), hyerthermic, Typic Quartzipsamments.
- Coarse Loamy, mixed (calcareous), hyperthermic, Typic Torriothents
- Fine loamy, mixed (caleareous), hyperthermic, Sodic Torriorthents
- Coarse loamy, mixed (calcareous), hyperthermic and loamy–skeletal, mixed (calcareous), hyperthermic, Typic Natrargids.

وعـــند تقييم الاراضى تحت الدراسة لمدى صلاحيتها للزراعة المروية وذلك بتطبيق النظام الذى اقترحه سايس وفرهاى ١٩٧٨ (Sys and Varheye 1978) باستخدام الخواص الطبيعية والكيمائـــية والمحددات الاخـــرى . اتضـــح ان غالبية اراضى المنطقة المدروسه تعتبر صالحة للزراعة المروية (S2 &S3) ماعدا تلك التى بها محددات شديدة او شديدة جدا مثل القوام الخشن وطبيعة التربه الملحية والقلويه .

وطبقا لنظام Sys et al, (1993) لتحديد أنسب المحاصيل التى يمكن زراعتها فى المنطقة تحت الدراسة تم تقييم أربعة وعشرون محصولا رئيسيا من محاصيل الحقل والخضر والفاكهة . وإتضـــح مـــن الدراسة ان نخيل البلح هو أكثر المحاصيل صلاحية فى معظم الأراضى الصالحة للإستغلال الزراعى . كما اتضح ان البرسيم الحجازى –الذرة الرفيعة –الزيتون –الشعير وعباد الشمس يتبعها الذرة الشامية – قصب السكر والبصل تعتبر محاصيل مناسبة للاستغلال الزراعى فـــى اغلـــب المـــناطق تحـــت الدراسة ، ومن ناحية اخرى اتضح ان فول الصويا – السمسم – البقوليات – الموز وكذلك الاناناس تعتبر محاصيل غير صالحة للزراعة فى هذه المناطق .