Classification and Evaluation of Wadi Abu Omira Soils, West of Matrouh North Western Coast, Egypt

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ABSTRACT

The northwest coastal region of Egypt is one of the most promising areas for agricultural development that due to its distinction in that it has all the resources and components of development available in one place.The study area was carried out on Wadi Abu Omira locate in the north western coast of Egypt west Marsa Matruh city to identify the geomorphic units and landforms in the study area as well as, classified the soils according to their taxonomy and land capability. The study area occupies an area of 1600 feddan and landforms were determined by geomorphological and topographical maps. Twenty three profiles have been selected to represent the main landform units in the soils study. The study area could be categorized by two orders namely Entisols and Aridisols. The Aridisols subgroups namely classified as Typic haplocalcids, lithic Torripsamments and Typic Torripsamments. The main diagnostic horizons of Aridisls are calcic horizons while Entisols are less developed soils. The different properties of the study area are profile depth, texture and topography properties, three soil mapping units were differentiated, deep coarse to moderately coarse textured, moderately deep coarse to moderately coarse textured, shallow coarse to moderately coarse textured soil. The field investigations showed that, 11.00% of the studied area has deep profile, moderately deep 38.00% while shallow depth covers only 51.00%. Regarding to the texture of the soil under study, 55.26 % to 44.73 of the area were sandy loam to loamy sand soil and the rest of area has either sand or sandy clay loam texture. Most of the area considered non saline to slightly saline and the studied area is moderately calcareous to extremely calcareous. According to USDA (1962), the study area classified into four capability classes II cover 154 feddan (9.63%), III cover 199 feddan (12.43%), VII cover 637 feddan (39.81%) and VIII cover 610 feddan (38.13%). According to FAO (2006), the current suitability of these soils can be placed at class S1 (slightly suitable), S2 (moderately suitable) S3, (marginally suitable) and N (unsuitable). The most limiting factors in the studied soils are profile depth, salinity index (EC), and available water (AW) while the rest limitation factors represent minor limitations. The present study is a trial to evaluate soil potentialities of this region in terms of land capability classification. In future such work will be useful as around basis for agricultural development policy of that region.

Key words: landforms, Soil classification, Soil potentialities, Soil capability, Soil suitability

INTRODUCTION

Egypt has a total area of about million Km^2, of which only a small area concentrated around the Nile Valley (4% of the total area) is agriculturally productive area and the rest area is desert. The major challenge which Egypt faces today is the need for better development and management of natural resources, to meet the needs of a growing nation. Consequently reclamation of desert lands is one of the most important strategic initiatives in Egypt. The target of land reclamation and water management development is to increase Egyptian farm land (Pautsch and Abdelrahman, 1998).

The development could be give more successful if it far away of the soil which adjacent to the Nile Valley. In this respect, the North Western Coastal considers one of the regions that could be the solution to increase the agriculture land in Egypt. At present, northwestern coastal zone of Egypt is enjoying more attention for future sustainable development (Shaaban, 2010). This area has excellent locality for land reclamation and development projects. Water resources in the region are rainwater and groundwater Yousif *et al.,* 2015). In this respect, Ali *et al.,* 2007 indicated that, rainwater is the main source of water for cultivation, but the amount of water is insufficient as a result of the climatic changes. Therefore, groundwater may become the most reasonable complementary resource that is capable to supply or at least to share the resource in providing the area with the needed water (Shaaban, 2010 and Yousif, 2014).

The area under investigation occupies a portion of the Northwestern Coastal region of Egypt. It extends to about 140 km. west Marsa Matrouh city. It is bounded by latitudes 31° 26' - 31° 31' N and longitudes 26° 30' - 26° 35' E. The studied area occupies an area of 1600 feddan.

According to the profile depth, texture, salinity and degree of development Abd El-Rahman *et al.,* (1984) reported that, northwestern coastal soils from the pedological point of view are a nine main soil associations were recognized. Its defined to thirteen soil families under the order Entisols and Aridisols and soils

were found to be very much associated with the type and locations of the defined geomorphic units (Abd El-Rahman *et al.,* 1984).

On the other hand, El-Kady (1970) stated that, soils under study are low in their natural fertility levels due to the problem of phosphorous fixation, low nitrogen level and deficiency of zinc, iron and manganese. While, in other study Abd El-Rahman *et al.* (1986 and 1987) reported that, about 35-40% of the soils of northwestern coastal were marginal to moderate suitable for agricultural land utilization practices.

The present work carried out to identify the geomorphic units and landforms in the study area as well as, study the relationship between landforms and soils characteristics. In addition to classified the soils according to their taxonomy and land capability.
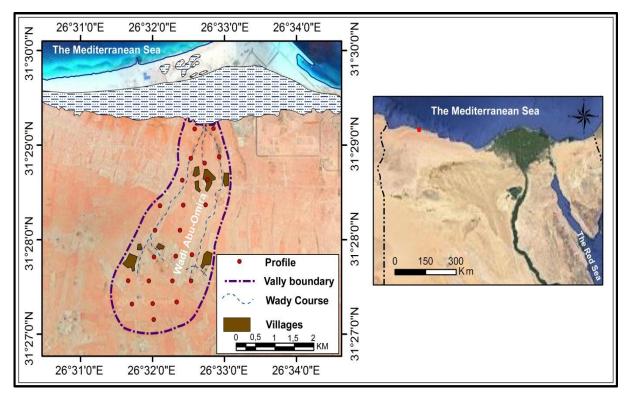
MATERIAL AND METHODS

1. Physiographic feature of the studied area:

The study area lies in the Mediterranean coastal zone west Matrouh city at northwestern coastal region of Egypt .It occupies an area of about 1600 feddan. It lies between latitudes 31° 26' - 31° 31' N and longitudes 26° 30' -26° 35' E, 23 soil profiles were chosen and examined in different locations covering the wadi to represent the different soil as seen in map (1).

The Digital Elevation Model (DEM) of the study area (Map..2) was extracted from the SRTM data (30 m resolution). DEM was employed to offer varieties of data that assist in produced landforms map, where the results indicated that elevations of the study area ranged between less 15 m to more than 60 m above Sea level.

1.1. Climatologically:

The region is considered one of the mildest over Mediterranean zone. Its climate is characterized by long hot dry summer and short cool rainy winter typical of sub-arid region, defined as "Arid Mediterranean". In general, monthly temperature varied between 14.4 and 26.8 °C, wind speed averaged at 18.9 km/h., and the average annual rainfall ranged from 100 to 190 mm (DRC staff, 2010). According to the limits outlined by DRC staff (2010) soils are characterized by torric moisture and hyper thermic temperature regimes.

Map 1.Location of the study area
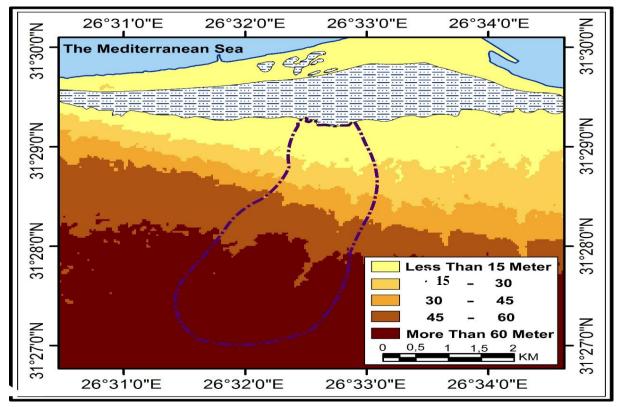
1.2. Geologically:

The main rocks which contribute to the soil formation dominate by a sedimentary succession ranging from Tertiary period (Middle Miocene) to Quaternary. Middle Miocene sediments are widely spread in the table land. Quaternary deposits are differentiated into Pleistocene and Holocene formations. They have wide distribution and constitute the bulk of the coastal plain (El-Shazly *et al.*, 1975). The area between the present shoreline and Libyan plateau is mostly constituted of calcareous Pliocene and Pleistocene formations and covered by recent deposits (Shata, 1971). The main source of irrigation water in the area is rainfall which insufficient. The amount of rainfall shows a steady decrease in the inland direction reaching about 50 mm at the southern limit of the catchment zone (FAO, 1970).

2. Laboratory Analyses

Twenty four soil profiles were collected representing the subsequent layers of the studied soil profiles according to FAO Guidelines (FAO, 2006). Forty four samples were air dried, crushed sieved through 2 mm, the percentage of gravels was determined by volume. Then the fine earth (<2mm) subjected to the following physical and chemical analyses were performed

2. Chemical analyses

- Soil reaction (pH) was determined potentiometrically in the saturated soil paste using a Backman bench-type pH-meter, (Richards, 1954)
- Total salinity (EC_e) was determined conductimterically in the soil saturation extract according to Richards (1954) and Nassem et al. (2008) .
- Organic carbon and organic matter contents were determined following the Walkley and Black titration method (Jackson, 1973)
- Calcium carbonate was estimated volumetrically by means of Collins Calcimeter (Piper, 1950).
- Total N was determined by the microkjeldahl method as described by Jackson (1963).
- Available Iron, Manganese, Zinc, Phosphorus, and Potassium were determined according to the method illustrated by Soltanpour and Schwab (1977) and using Atomic absorption spectrophotometer, while phosphorus was determined by the techniques that was described by Olsen *et al*. (1954).
- Particle size distribution was done according to methods described by Kilmer and Alexander(1949)

Map 2. Digital elevation model (DEM)

Table 1. Classes of land suitability

Class	Soil limitations
S1 (slightly suitable)	Land units without or with only 3:4 slight limitations and no more than 1/2 moderate limitations
S2 (moderately suitable)	Land units without or with only 2:3 slight limitations and no more than 2/3 moderate limitations
S3 (marginally suitable)	Land units with more than 3 moderate limitations and/or no more than severe limitations
N (unsuitable)	Land units with one or more severe or very severe limitations that exclude the use of the land.

3. Land capability classification:

Land capability assessment is based on a broader range of characteristics of soil properties *i.e.* slope angle, climate, flood and erosion risk. According to USDA, 1962 system classification structure namely capability classes which are the broadest category and includes eight classes from I to VIII.
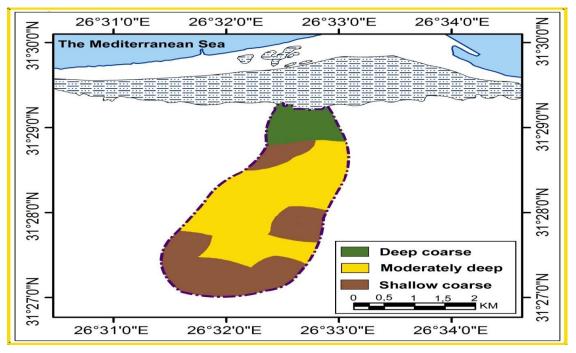
4. Land suitability

Land suitability is classified according to FAO (2006) as shown in the Table (1) four degrees were used in this study S1 (Slightly suitable) S2 (moderately suitable), S3 (marginally suitable) and N1 (actually unsuitable).

The most limiting factors in the studied soils are topography of the terrain, profile depth, gravel, $CaCO_3$, salinity index (EC), Exchangeable sodium ratio (ESP), available water (AW), while land suitability subclasses reflect kinds of limitations. The limitation were differentiated to five classes according to their expected hazards *e.g.,* very low, low, moderate, severe and very severe.

RESULTS AND DISCUSSION

1. Morphopedological, physical, chemical characteristics and nutrients status of the studies soil:

Representative soil profiles taken from the geomorphic units of the investigated area (from north to south of Wadi Abu-Omira) which divided to three units; coastal plain, Piedmont plain and plateau. The most relevant some morphological, physical and chemical properties of studied soil profiles were set out. According to differences in profile depth, texture and topography, the results indicated that, three soil mapping units were differentiated (a) deep coarse to moderately coarse-textured soils profiles No.1,2,3 and 4, (B) shallow coarse to moderately coarse textured soils sometimes with moderately fine layers profiles No. 6,7,8,9,10,11,12,14,17,18 and 19, and (c) moderately deep coarse to moderately coarse textured soils profiles No. 5,12,1,16,20,21,22,23 are set out in Map (3).

Map 3.Soil unit of study area

1.1. Coastal plain soil of Wadi Abu-Omira

This unit occupies an area of about 191 feddan (12% of the studied area), and it is represented by four soil profiles No. 1, 2, 3 and 4. Soil topography is almost flat (0.5-2%) to gently undulating (2-5%). Data in Table (2) indicate that, the soil is generally deep where the depth is ranging from 100-150 cm. The color have a little change within the different layers of the profiles which indicate that, it may be inherited from the parent material and soil forming factors have a little effect in soil formation of this area.

The gravels content through the entire depth of the soil profile varies from 1.67 to 63.53%, except profile No.3 the gravel are concentrated in the subsurface layer (Table 3). Natural vegetation is absent or scattered with few to many green desert plants with low hummocks. Soil texture of the profiles is almost sandy to sandy loam in the surface layer. The field capacity and wilting point varies from 9.70 to 26.56% and 5.60 to 11.51%respectively, the available water varies through the subsequent layers between 4.0 to 15.05% and that is agrees well with soil texture (Table 3).

Table 2. Main morphological characteristics of the soils derived from coastal plain

No.	Depth	Color	Texture	Coarse Fragments	Structure	Consistence			Roots	Boundary
	0-25	7.5YR6/6	LS	-	MA	SO	SST,NPL		FF	CS
1	25-50	7.5YR6/8	LS	-	MA	SHA	SST,NPL		FF	CS
	50-125	7.5YR6/8	SL	-	MA	FR	SST,NPL		-	-
	0-25	7.5YR6/6	LS	-	MA	SHA	SST,NPL		FF	……..
2	25-50	7.5YR6/8	LS	-	MA	HA	SST,NPL		FF	CS
	50-125	7.5YR6/8	SL	-	MA	FR	SST,NPL		-	-
	0-20	7.5YR6/6	S	CFM	MA	SHA	NST,NPL		FF	CS
3	20-50	7.5YR6/6	LS	AFM	MA	HA	SST,NPL		FF	AS
	50-120	7.5YR6/6	S	VF	MA	FR	NST,NPL		MFM	-
	0-40	7.5YR6/6	LS	VF	MA	SHA	SST,NPL		FF	CS
4	40-60	7.5YR6/6	LS	VF	MA	HA	SST,NPL		CM	CS
	60-120	7.5YR6/6	SL	VF	MA	HA	SST,SPL		FM	-

Table 3. Some physical properties of the soils derived from coastal plain

Profile No.	Depth (cm)	Gravel%	Particle size distribution %			Texture class	Moisture characteristics		
			Sand	Silt	Clay		F.C	W.P	A.W
	0-25	-	84.38	7.22	8.4	LS	13.22	6.11	7.11
1	25-50	-	82.92	7.89	9.19	LS	14.23	7.23	7.00
	50-125	-	78.15	10.75	11.1	SL	15.42	5.65	9.77
	0-25	-	86.92	8.50	4.58	LS	15.52	8.02	7.5
2	25-50	-	82.90	7.12	9.98	LS	9.70	5.60	4.00
	50-125	-	78.87	9.43	11.7	SL	10.93	6.36	4.57
	0-20	9.30	89.82	5.18	5.0	S	18.04	9.71	8.33
3	20-50	63.53	84.97	12.2	2.83	LS	14.83	7.10	7.73
	50-120	1.67	89.30	6.37	4.33	S	11.79	6.60	5.19
	0-40	4.35	83.92	7.53	8.55	LS	20.53	6.23	14.30
4	40-60	5.71	86.35	3.20	10.45	LS	17.20	8.96	8.24
	60-120	4.62	76.32	8.20	15.48	SL	26.56	11.51	15.05

The contents of total carbonates indicated that, soils are moderately to extremely calcareous as calcium carbonate. Contents vary widely from 7.76 to 31.31%, profile No. 1 recorded the highest contents (Table 4). In this respect, Abdou *et al.,* (1983) and Abdel–Aal *et al.,* (1990) found that, virgin calcareous soils had a relatively coarse texture with high content of carbonate mainly in the form of calcite, texture becomes finer and total $CaCO_3$ level being minimized and associated with dominancy of dolomite due to particle dissolution of the lower calcic portion. The electrical conductivity values revealed that soils salinity varies widely from Non saline to slightly saline as indicated from its EC values which ranged from 0.202 to7.620 dS m^{-1} (Table 4). Cationic composition of soil extract is dominated by Na^+ ions followed by Ca^{++} and Mg^{++} then K^+. Soluble anions are most dominated by Cl^- followed by So_4^- then HCO_3. These soils are classified two orders Aridisols and Entisols and two sub great groups level Typic Haplocalcids for profiles No. 1,2 and 3 and Typic Torripsamments for profile No. 4 and on family level

recognized soil Taxonomic unit is coarse loamy, siliceous, hyper thermic, Typic Haplocalcids.

The data of the macro nutrients (N, P and K) and organic matter in the study area which are given in Table (5) show that, the total nitrogen is varies from 41.3 to 63.1 mg/kg, the lowest and the highest value are detected in the soil profiles No. 3&4. Available phosphorus in the soils ranges from 0.91 to 11.78 mg/kg, while the available potassium ranges from 72.8 to 155.3 mg/kg. The organic matter in coastal plain landform is concentrated on the surface and decreases with depth of profiles No. 1 & 2 and ranges between 0.115 to 0.377% (Table 5).

Regard to micro nutrients status, the available Fe in coastal plain fluctuates between 3.93 to 7.76 mg/kg. In this respect, the lowest value detected in the subsurface layer of the soil profile No. 4 while the highest one is detected in the substratum of profile No.3. Available Mn in the soils under study ranges between 1.883 to 3.49 mg/kg while, available zinc concentration ranges from 1.387 to 1.929 mg/kg (Table, 5).

Table 4. Some chemical properties of the soils derived from coastal plain

Profile No.	Depth (cm)	CaCO$_3$ %	pH	Ec (dS/m^{-1})	Cations (m.eq/L)				Anion (m.eq/L)		
					Na$^+$	K$^+$	Ca^{++}	Mg^{++}	Cl$^-$	HCO$_3^-$	SO$_4^-$
	0-25	10.76	7.97	2.660	18.3	0.62	4.87	2.92	18.86	1.72	6.08
1	25-50	7.76	8.28	3.510	1.59	0.21	0.87	0.73	1.98	0.65	1.44
	50-125	31.31	7.69	7.620	61.7	0.78	14.5	11.2	69.36	2.3	16.33
	0-25	10.67	8.00	0.597	3.72	0.25	1.25	0.75	3.95	1.25	0.77
2	25-50	10.84	8.28	1.466	8.36	0.52	3.43	2.35	9.34	1.77	3.55
	50-125	27.30	8.28	2.89	20.2	1.13	4.93	2.74	20.48	2.75	5.57
	0-20	10.41	8.09	0.347	1.76	0.27	0.89	0.55	1.87	0.85	0.75
3	20-50	27.05	8.20	0.272	1.35	0.15	0.85	0.37	1.40	0.30	1.02
	50-120	11.77	8.37	0.202	1.01	0.09	0.53	0.39	1.10	0.25	0.67
	0-40	13.48	7.98	0.566	3.55	0.25	1.11	0.75	3.72	1.23	0.71
4	40-60	13.74	8.49	0.229	1.08	0.12	0.85	0.24	1.24	0.25	0.80
	60-120	14.33	8.42	0.268	1.21	0.15	0.83	0.49	1.34	0.32	1.02

Table 5. Macro and micro nutrients and organic matter contents on the soils derived from coastal plain

Profile No.	Depth	Available nutrients, mg/kg							Organic matter (%)
		N	P	K	Fe	Mn	Zn	Cu	
1	0-25	61.0	1.73	93.3	4.591	1.883	1.572	1.015	0.142
	25-50	42.8	1.12	86.3	5.248	2.049	1.177	0.697	0.122
2	0-25	55.1	0.91	111.1	4.503	2.176	1.387	0.897	0.276
	25-50	49.4	2.51	155.3	6.652	3.198	1.538	1.790	0.203
3	0-20	63.1	11.78	108.9	7.763	3.490	1.349	1.128	0.377
	20-50	54.1	4.63	72.8	4.200	2.242	1.180	0.737	0.284
4	0-40	41.3	6.66	106.7	3.926	2.104	1.929	0.843	0.115

1.2. Soils of Piedmont plain

This landform occupies an area of about 794 feddan (50% of the studied area) which constitute the major part of the considered area. These soils are represented by soil profiles No. 5 to 15 (Table 6). Soils depths are varied from shallow in profiles No. 6,7,8,9,10,11,13 and 14 to, moderately deep in profiles No. 12 and 15 (Table 6).

Soil topography is gently undulating (2-5%). Main soil of this unit are; a) shallow coarse to moderately coarse – textured soils, sometimes with moderately fine layers b) moderately deep coarse to moderately coarse – textured soils.

Pedological features are limited and mostly observed as lime segregations on surface of soil profiles No.12 and 15. Color does not change much within the different layers of profiles as they are reddish yellow 7.5 YR6/6 at the dry condition and strong brown (7.5 YR5/6). Soil structure is massive in the surface layer, while, in subsurface gradually from slightly hard to hard. Stickiness and plasticity varied between non-sticky to slightly sticky and non-plastic to slightly plastic according to different texture (Table 6).

Land surface is covered with many varied size of gravel rock, limestone fragments, few shell fragments and desert pavement. Gravels content in their soil profiles ranges from 3.13 to 34.78% (Table 7). Distribution of natural vegetation ranges from none to common scattered desert shrub. Field capacity and wilting point range between 10.98-30.11%, 2.74-13.22% respectively, available water varies throughout the subsequent layers between 4.11 and 16.89 %, reflecting the nature of soil texture (Table 7).

Data in Table (8) show that, salinity of the soil extract ranges from non-saline (EC 0.32 dS m^{-1}) to moderately salty (EC 10.78 dS m^{-1}), these soils are, relatively of low EC values, may be due to the continuous leaching by rainfall during Pleistocene age (Harga 1967). The pH values are slightly alkaline moderately alkaline pH (7.61-8.52) (Table 3). The soils of piedmont plain are calcareous. The content of calcium carbonates ranges from 10.24 to 24.74%. The accumulation of calcium carbonates on some surface layers may be due to the natural of profiles location which near of the Marmarica plateau which contains a siliceous type of limestone and enriched with silica sand (El-Shalzly 1964 and Harga 1967).

The cationic composition of the soil extract is dominated by Na$^+$ followed by Ca^{++} and, Mg^{++} while K$^+$ is the least in dominance. On the other hand the anionic composition is dominated by Cl$^-$ followed by SO$_4^{--}$ while HCO$_3^-$ is the least abundant soluble anions (Table 8). Soil of this unit are classified as subgreat group level classes were differentiated these are Typic Torripsaments for profile No. 5,6,7,8,12 and 15 and lithic Torripsaments for profiles No. 9,10,11,13 and 14 and Typic Haplocalcids for profile No. 15. On the family level they are classified as fine loam, siliceous, hyper Thermic, lithic Torripsamments and sandy skeletal, siliceous hyperthermic and Typic Haplocalcids.

Table 6. Main morphological characteristics of the soils derived from piedmont plain

No.	Depth	Color	Texture	Coarse Fragments	Structure	Consistence		Roots	Boundary
5	0-25	7.5YR6/6	S	CFM	MA	SHA	NST,NPL	FF	CS
	25-55	7.5YR6/6	LS	CFM	MA	HA	SST,NPL	-	AS
6	0-35	7.5YR6/8	LS	MFM	MA	SHA	SST,NPL	FF	AS
7	0-40	7.5YR6/6	LS	MFM	MA	SHA	SST,NPL	FF	AS
8	0-35	7.5YR6/6	S	MFM	MA	SHA	SST,SPL	FF	AS
9	0-35	7.5YR6/6	LS	CFM	MA	SHA	SST,NPL	FF	AS
10	0-30	7.5YR/6	LS	MFM	MA	SHA	SST,NPL	FF	AS
11	0-40	7.5YR6/6	SL	MF	MA	SHA	SST,SPL	FF	AS
12	0-30	7.5YR6/6	LS	CF	MA	SO	SST,NPL	FF	CS
	30-60	7.5YR6/6	SL	MF	MA	HA	SST,SPL	-	AS
13	0-20	7.5YR6/6	SL	CFM	MA	SHA	SST,SPL	FF	AS
	20-40	7.5YR6/6	SCL	MFM	MA	SHA	SST,SPL	FF	AS
14	0-20	7.5YR6/6	SL	MFM	MA	D	SHASST,SPL	FF	D
	20-45	7.5YR7/6	SL	FFM	MA	AS	HASST,SPL	-	AS
15	0-30	7.5YR7/6	LS	CFM	MA	CS	SHASST,NPL	-	CS
	30-60	5YR6/6	SL	MFM	MA	AS	FISST,SPL	FF	AS

Table 7. Some physical properties of the soils derived from piedmont plain

Profile No.	Depth (cm)	Gravel%	Particle size distribution %			Texture class	Moisture characteristics		
			Sand	Silt	Clay		F.C	W.C	A.W
5	0-25	6.60	89.55	4.25	6.20	S	17.68	5.16	12.52
	25-55	9.20	81.05	12.2	3.70	LS	11.39	6.17	5.22
6	0-35	15.61	85.97	10.3	3.58	LS	10.98	6.87	4.11
7	0-40	19.23	84.12	12.3	8.18	LS	18.59	5.78	12.81
8	0-35	23.81	71.22	20.6	2.25	SL	22.27	8.92	13.53
9	0-35	9.09	83.30	14.5	6.10	LS	14.32	8.89	5.43
10	0-30	31.25	87.75	6.15	6.20	LS	11.80	2.74	9.06
11	0-40	30.43	73.17	20.6	10.12	SL	15.26	6.28	8.98
12	0-30	5.88	81.18	8.7	13.90	LS	11.98	6.42	5.56
	30-60	20.0	69.49	16.6	10.60	SL	24.30	6.67	17.63
13	0-20	8.13	74.70	14.7	24.55	SL	17.05	8.09	8.96
	20-40	28.57	50.45	25.0	12.89	S.C.L	30.11	13.22	16.89
14	0-20	26.67	70.61	16.5	17.10	SL	18.65	6.30	12.35
	20-45	3.13	60.44	22.5	8.56	SL	16.70	7.67	9.03
15	0-30	11.63	82.14	9.30	14.30	LS	18.52	6.19	12.33
	30-60	34.78	68.46	17.2	14.32	SL	16.78	7.57	9.21

Table 8. Some chemical properties of the soils derived from piedmont plain

Profile No.	Depth (cm)	CaCO₃ %	pH	Ec (dS/m⁻¹)	Cations (m.eq/L)				Anion (m.eq/L)		
					Na^+	K^+	Ca^{++}	Mg^{++}	Cl^-	CO_3	HCO_3^-
5	0-25	11.01	8.48	0.320	1.65	0.15	0.87	0.53	1.71	0.0	0.45
	25-55	12.63	8.48	0.412	2.50	0.23	0.84	0.55	2.90	0.0	0.55
6	0-35	10.24	8.52	0.438	2.70	0.25	0.79	0.55	2.90	0.0	0.55
7	0-40	12.88	8.11	0.352	1.57	0.15	0.97	0.83	1.63	0.0	0.55
8	0-35	21.67	8.14	2.970	16.68	1.22	7.35	3.45	17.95	0.0	4.85
9	0-35	14.33	8.34	0.612	3.85	0.36	1.12	0.79	4.40	0.0	0.70
10	0-30	13.52	8.20	0.296	1.25	0.15	0.87	0.69	1.64	0.0	0.32
11	0-40	22.18	7.73	3.24	36.80	1.70	7.28	3.24	36.80	0.0	2.65
12	0-30	11.26	8.15	0.429	2.62	0.25	0.79	0.63	2.97	0.0	0.55
	30-60	12.12	8.67	0.237	1.05	0.12	0.96	0.24	1.18	0.0	0.23
13	0-20	16.98	7.97	0.514	2.55	0.14	1.65	0.80	3.46	0.0	0.85
	20-40	14.33	8.07	0.313	1.41	0.13	1.12	0.47	1.50	0.0	0.79
14	0-20	10.41	8.29	3.340	20.79	1.01	7.09	4.51	21.30	0.0	2.43
	20-45	24.74	8.04	10.780	106.52	0.81	20.76	4.51	21.30	2.55	2.43
15	0-30	22.78	7.83	0.812	2.37	0.35	3.44	1.96	2.69	0.0	2.55
	30-60	15.44	7.45	0.235	1.06	0.13	0.90	0.27	1.12	0.0	2.25

The obtained data from Table (9) showed that, the content of total N ranges from 36.7 to 71.2 mg/kg, the highest value detected in the soil profile No. 5, while the available phosphorus ranges from 0.85 to 12.11 mg/kg which detected in soils profiles No. 6 and14

respectively. However, available potassium in this soils range from 68.0 to 166.9 mg/kg.

The content of organic matter in piedmont plain in different soils depths is generally very low, being in the range of 0.095 to 0.0513%. This may be due to the lake of natural vegetation in the upper layers.

Table 9. Macro and micro nutrients and organic matter contents on the soils derived from piedmont plain

Profile NO	Depth	Available nutrients, mg/kg							OM%
		N	P	K	Fe	Mn	Zn	Cu	
5	0-25	71.2	3.88	88.8	4.314	2.286	1.402	0.810	0.425
6	0-35	38.1	0.85	83.6	3.398	2.898	0.691	0.455	0.162
7	0-40	44.6	2.90	123.0	3.394	1.810	0.661	0.346	0.219
8	0-35	68.8	1.34	71.6	1.691	2.844	0.822	0.519	0.513
9	0-35	52.6	1.63	125.0	2.904	1.626	0.622	0.392	0.200
10	0-30	55.9	1.89	117.6	5.334	3.419	0.652	0.438	0.238
11	0-40	41.1	1.73	93.3	4.222	1.920	0.554	0.412	0.133
12	0-30	58.7	1.11	98.0	5.669	2.452	1.354	0.634	0.143
13	0-20	47.7	12.11	166.9	3.082	2.838	0.542	0.309	0.266
	20-40	27.8	1.50	111.3	4.646	3.951	1.268	0.461	0.095
14	0-20	36.7	2.61	124.6	3.705	2.388	0.725	0.298	0.228
	20-45	36.8	1.50	84.7	3.904	2.759	0.666	0.375	0.181
15	0-30	59.9	2.06	68.0	3.625	2.085	0.910	0.596	0.330

In case of micro nutrients status date in Table (9) illustrated that, the content of available Fe ranges from 1.691to 5.334 mg/kg which recorded in profiles No. 8 &10. The available Mn fluctuate between 1.626 to 3.951 mg/kg, the lowest value is detected in the surface layer of the soil profile No.9. However the content of available Zn in the piedmont plain fluctuates between 0.542 to 1.402 mg/kg. The content of available Cu ranges between 0.81 to 0.634 mg/kg, the highest value is detected in the surface layer of the soil profile No. 5, while the lowest value is detected in the surface layer of the soil profile No. 12 (Table, 9).

1.3. Soil of structural plateau

The geomorphic unit occupies an area about 615 feddan (38% of the studies area) and it is represented by eight soil profiles (**Table 10**). The structure plateau occupies the southern portion of the studied area which characterized by uniform with general slope towards the north. The mean elevation is more than 100 above the sea level. Soil topography is almost flat (0.5-2%) to gently undulating (2-5%). Soil texture varied from loam sand to loam profiles and depth are varied from shallow in profiles No. 16, 17, 18 and 19 to moderately deep in profiles No. 20, 21, 22 and 23.

Table 10. Main morphological characteristics of the soils derived from plateau

No.	Depth	Color	Texture	Coarse Fragments	Structure	Consistence	Roots	Boundary
16	0-30	7.5YR6/6	LS	FFM	MA	SHA SST,NPL	FF	D
	30-55	7.5YR6/6	SL	MFM	MA	VHA SST,SPL	FF	AS
17	0-20	7.5YR6/6	SL	MFM	MA	SHA SST,SPL	FF	AS
	20-40	7.5YR6/6	L	CFM	MA	VHA ST,PL	FF	AS
18	0-30	7.5YR6/6	SL	FFM	MA	HA SST,SPL	VF	CS
	30-50	7.5YR6/6	SL	MFM	MA	HA SST,SPL	VF	AS
19	0-20	7.5YR6/6	SL	CFM	MA	HA SST,SPL	FFM	CS
	20-40	7.5YR6/6	L	CFM	MA	HA ST,PL	FF	AS
20	0-20	7.5YR6/6	SL	CFM	MA	SHA SST,SPL	FF	CS
	20-55	7.5YR6/6	LS	MFM	MA	HA SST,NPL	FF	AS
21	0-20	7.5YR6/6	SL	MFM	MA	SHA SST,SPL	FF	CS
	20-55	7.5YR7/6	SL	MFM	MA	HA SST,SPL	FF	AS
22	0-40	7.5YR6/6	LS	CFM	MA	HA SST,NPL	FF	CS
	40-90	7.5YR7/6	SL	CFM	MA	HA SST,SPL	FF	AS
23	0-30	7.5YR6/6	SL	CFM	MA	SHA SST,SPL	FF	CS
	30-90	7.5YR7/6	SL	CFM	MA	HA SST,SPL	FF	AS

The land surface is covered with gravels and limestone fragments. The gravels content through the entire depth of soil profile ranges from 8.0 to 35%. Natural vegetation is absent or scattered with few to common green deserts shrubs. While, the field capacity and wilting point were 11.34 to 26.26 and 2.74 to 11.93% respectively. Moreover, the calculated available water ranges from 4.991 to 17.50% (Table 11).

Electrical conductivity (EC) values of the soil saturation extract vary widely from 0.276 to 6.760 dS m^{-1}, these soil are non-saline to slightly saline. The soils reaction varies from neutral to strongly alkaline (pH values range from 7.19 to 8.66). The cationic composition of the soils are generally dominated by Na followed by Ca^{++}, Mg^{++} and K^{+} and anionic compositions are generally dominated by Cl^{-} and SO_4^{--} then HCO_3^{-} (Table12).

Soil were classified into three sub great group level classes were differentiated these are Typic Torripsamments for profile No.16, 19, 20, 21 and lithic Torrpsamments for profile No.17 and 18 and Tipic Haplocalcids for profile No. 22 and 23 DRC staff (2010), family levels could be defined sandy skeletal siliceous hyperthermic Typic Haplocalcids

The analytical data which obtained from Table (12) show that, calcium carbonates fluctuates from 12.2 to 32.51% through the entire depth of soil profile. On the other hand there are no big different in the lime content of the successive horizons.

The presented data in Table (13) showed that, the soil of structural plateau have moderate levels of a total nitrogen it ranges between 31.2 and 63.3 mg/kg, the lowest value was detected in soil profile No.18 while the highest value was detected in soil profile No.22.Available phosphorus recorded low values compared to the total nitrogen; it ranges from 1.18 to 8.32 mg/kg. Regard to the available potassium in the soil of structural plateau, it ranges from 60.2 to 151.4 mg/kg. However, the organic matter ranges between 0.19 to 0.366 mg/kg, the lowest value was detected in soil profile No.17 while the highest value was detected in soil profile No.23 (Table 13).

Regard to micro nutrients status data in Table (9) illustrated that, the content of available Fe ranges from 1.981to 6.379 mg/kg, soil profile No.19 recorded the lowest value, while the highest value was detected in soil profile No.20. The content of available Mn as well as both of Zn and Cu doesn't give a big difference between soil profile and their values ranged between 1.117 and 2.980 mg/kg for Mn, 0.664 and 1.546 for Zn and 0.166 and 0.366 for Cu.

Table 11. Some physical properties of the soils derived from plateau

Profile No.	Depth (cm)	Gravel%	Particle size distribution %			Texture class	Moisture characteristic		
			Sand	Silt	Clay		F.C	W.P	A.W
16	0-30	8.00	13.4	18.0	8.70	LS	11.80	2.74	9.06
	30-55	33.33	71.6	16.2	12.25	SL	13.67	5.10	8.57
17	0-20	19.44	72.7	17.2	10.13	SL	17.96	8.05	9.91
	20-40	8.70	44.2	40.9	25.15	L	25.21	11.60	13.61
18	0-30	4.55	72.0	17.6	10.45	SL	16.92	8.28	8.64
	30-50	23.08	79.1	13.3	7.55	SL	18.65	6.30	12.35
19	0-20	8.00	64.2	18.1	17.65	SL	16.31	7.43	8.88
	20-40	5.56	47.3	30.2	22.50	L	24.15	10.62	13.52
20	0-20	20.45	75.0	18.3	6.73	SL	14.44	5.14	9.30
	20-55	35.00	71.1	24.0	4.93	LS	26.26	8.78	17.50
21	0-20	25.00	80.4	11.6	8.03	SL	13.93	4.99	8.94
	22-55	28.57	74.0	21.9	4.13	SL	22.27	8.92	13.35
22	0-40	8.00	73.2	21.1	5.70	LS	11.34	6.17	5.22
	40-90	12.50	65.6	20.5	13.88	SL	26.36	11.93	14.45
23	0-30	13.33	73.8	15.4	10.85	SL	11.53	6.53	5.00
	30-90	12.50	65.4	19.9	14.68	SL	11.50	6.51	4.99

Table 12. Some chemical properties of the soils derived from plateau

Profile No.	Depth (cm)	CaCO$_3$ %	pH	Ec (dS/m^{-1})	Cations (m.eq/L)				Anion (m.eq/L)		
					Na$^+$	K$^+$	Ca^{++}	Mg^{++}	Cl$^-$	HCO$_3^-$	SO$_4^{--}$
16	0-30	15.61	7.19	0.457	1.80	0.25	1.84	0.68	2.36	0.60	1.61
	30-55	18.6	8.07	1.049	3.69	0.35	4.51	1.94	4.06	1.85	4.58
17	0-20	15.7	7.53	0.909	3.55	0.73	33.38	1.43	3.99	2.30	1.78
	20-40	15.7	8.45	0.888	3.89	0.55	3.49	0.95	3.98	1.66	2.24
18	0-30	16.89	7.76	6.760	66.1	1.01	8.40	4.65	65.8	4.55	7.95
	30-50	20.9	8.03	6.230	61.1	0.95	8.55	4.46	60.75	3.50	8.05
19	0-20	13.57	8.30	0.436	1.86	0.38	1.26	0.86	1.95	0.82	0.39
	20-40	14.85	8.43	0.276	1.25	0.15	0.86	0.50	1.40	0.35	1.01
20	0-20	13.91	8.23	1.067	5.63	0.45	3.06	1.53	6.12	1.79	2.77
	20-55	17.41	8.20	2.850	20.1	1.13	4.93	2.74	20.48	2.70	5.67
21	0-20	14.08	8.37	0.713	4.54	0.45	1.25	0.85	4.72	1.25	1.11
	22-55	15.7	7.90	1.376	9.05	0.25	3.30	1.52	9.60	1.90	2.57
22	0-40	12.2	8.39	0.788	5.55	0.08	1.89	1.26	5.89	0.63	2.54
	40-90	32.17	8.55	0.698	4.16	0.45	1.43	0.94	4.99	0.51	1.48
23	0-30	13.05	8.66	0.314	1.39	0.15	0.87	0.73	1.50	0.53	1.11
	30-90	32.51	8.68	0.748	4.45	0.39	2.72	0.92	4.72	1.20	1.56

Table 13. Macro and micro nutrients and organic matter contents on the soils derived from structural plateau

Profile NO	Depth	Available nutrients, mg/kg							OM%
		N	P	K	Fe	Mn	Zn	Cu	
16	0-30	74.6	1.89	143.0	5.569	2.400	1.410	0.849	0.341
17	0-20	49.0	2.28	151.4	5.062	2.942	0.822	0.469	0.190
	20-40	33.9	2.12	107.9	2.544	2.938	1.152	0.600	0.200
18	0-30	31.2	3.36	150.4	3.292	1.794	0.721	0.450	0.257
19	0-20	41.4	1.44	131.1	1.981	2.809	0.688	0.501	0.191
	20-40	34.4	7.04	140.0	2.482	2.318	0.664	0.348	0.228
20	0-20	54.5	8.32	140.2	4.699	2.545	1.309	0.656	0.264
	20-55	42.7	2.36	91.3	6.379	2.183	0.903	0.554	0.225
21	0-20	50.0	3.07	147.9	3.497	2.980	1.546	0.751	0.297
	20-55	51.9	2.19	60.2	2.724	1.117	1.314	0.682	0.166
22	0-40	63.3	2.77	81.8	5.116	2.645	1.201	0.551	0.297
23	0-30	56.8	1.18	128.8	4.124	2.057	1.435	0.615	0.366

3. Land capability

Data in Map (4) showed that, soils of the study area classified their capability according to USDA (1962) into four classes II,III,VII,VIII soil in class II (profiles No.1,2,4) soil in this class have a slight limitation and conservation practices are easy to apply. These soils may be used for cultivated crops, pasture, and woodland or wildlife food. The soils have one or more limitation slight hazard of wind or water erosion, occasional damaging overflow, moderate soil depth wetness and gentle slopes. Soils in class III (profiles No 17&19) have moderate limitations and conservation practices are usually more difficult to apply and maintain. These soils may be used for cultivated crops, pasture, range, and woodland or wildlife food. The soils have one or more limitations: moderate hazard of wind or water erosion; frequent damaging overflow; wetness;
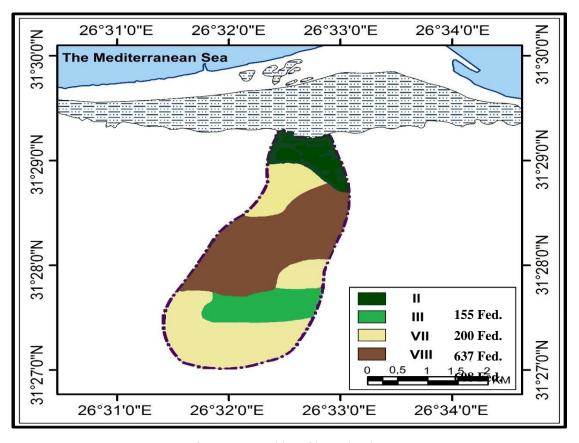
moderately shallow rooting depth; moderately low moisture holding capacity; low fertility not easily corrected and moderate slopes. Soil in this class (profiles No.5,12,15,16,18,20,21,22and 23) have severe one or more continuing limitations that cannot be corrected such as very steep slopes, erosion, shallow soil, stones, salt or sodium. This unit can be used safety for grazing or woodland or wildlife. While, soils in class VIII (profiles No. 6, 7, 8, 9, 5,10,11,13 and 14) have limitations preclude their use for commercial plant production. Limitations that cannot be overcome consist of one or more of the following: erosion or erosion hazard; wetness; stones and rocks; and very low moisture capacity.

4. Land suitability

4.1. Current land suitability

Applying the land suitability is classified according to FAO (2006) to the soils of the study area, Data in Table (14) reveals that, the current suitability

of these soils can be placed at the following classes; class S1 (slightly suitable) which represented by profiles No. 1, 2, 4 and 5. These soils have slightly limitations that differ in their kind and degree. The S2 is the second class (moderately suitable) which including eight profiles (No. 3, 12, 15, 16, 20, 21, 22 and 23). These soils have moderately limitations that differ in their kind and degree. The third class S3 (marginally suitable) represented by profiles No. 7, 8, 9, 10, 11, 13, 14, 17, 18 and 19. The soils of this class are affected by moderate and severe limitations that differ in their kind and degree (unsuitable) was the last degree of suitability which represented by profiles No. 6. This class of soil is affected by severe limitations such as depth and ESP in profile No. 6. The most limiting factors in the studied soils are profile depth, salinity index (EC), and available water (AW) while the rest limitation factors represent minor limitations.

Map 4. Land capability of investigation area

Table 14. Degree of soil limitations and suitability classes of the studied soil profiles

Profile No.	Topography of the terrain	Gravel	Depth	CaCO₃	EC	ESP	AW.C	Suitability*
1	Very low	Very low	Low	Low	Moderate	Very low	Moderate	S1
2	Very low	Very low	Low	Low	Very low	Very low	Moderate	S1
3	Low	Low	Low	Low	Very low	Very low	Moderate	S2
4	Very low	Very low	Low	Low	Very low	Very low	Low	S1
5	Low	Very low	Moderate	Low	Very low	Very low	Moderate	S1
6	Low	Low	Severe	Low	Very low	Very low	Severe	N1
7	Low	Low	Severe	Low	Very low	Very low	Low	S3
8	Low	Low	Severe	Low	Very low	Very low	Low	S3
9	Low	Very low	Severe	Low	Low	Very low	Moderate	S3
10	Low	Low	Severe	Low	Very low	Very low	Moderate	S3
11	Low	Low	Severe	Low	Very low	Very low	Moderate	S3
12	Low	Very low	Moderate	Low	Low	Very low	Moderate	S2
13	Low	Low	Severe	Low	Low	Very low	Low	S3
14	Low	Low	Severe	Low	Low	Very low	Moderate	S3
15	Low	Low	Moderate	Low	Moderate	Very low	Moderate	S2
16	Very low	Low	Moderate	Low	Very low	Very low	Moderate	S2
17	Very low	Very low	Severe	Low	Very low	Very low	Moderate	S3
18	Very low	Very low	Severe	Low	Moderate	Very low	Moderate	S3
19	Low	Very low	Severe	Low	Very low	Very low	Moderate	S3
20	Very low	Low	Moderate	Low	Very low	Very low	Low	S2
21	Very low	Low	Moderate	Low	Very low	Very low	Moderate	S2
22	Very low	Very low	Moderate	Low	Very low	Very low	Moderate	S2
23	Very low	Very low	Moderate	Low	Very low	Very low	Moderate	S2

* S1 (slightly suitable)**,** S2 (moderately suitable)**,** S3 (marginally suitable)**,** N (unsuitable)

4.2. Potential land suitability

This current suitability can be more profitable after executing the main growth limitations as agricultural mechanization to improve soil characteristics from depth, in addition continuous application of organic manure to improve soil properties and fertility status, and application of drip and sprinkler irrigation system.

Data in Table (15) showed that, profiles No. 1, 2 and 21 are slightly suitable (S1) for Alfalfa and profiles No. 8,9,11,13,15,16,17,18,19,20,22, and 23 are moderately suitable (S2), while profiles No.3,4,5,6,7and 10 are marginally suitable (S3) for Alfalfa.

For Barley crop data showed that, profiles No.1,2,8,9,12,14,15, and 16 are S1 and profiles No. 4,7,10,11,17,18,19,20,21,22 and 23 are S2 while profiles No. 3, 5, 6 and 13 are S3. Wheat crop showed S2 for soil profiles No.8, 11,14,18,19 & 21 and N for soil profile No. 23 while the rest profiles are S3. For Maize crop profiles No.1, 2, 12, 15, 16, 20 and 21 are S1 while profiles No.3, 4, 8,9,13,14,18,22 and 23 are S2 and the rest profiles are S3. Sorghum is considered one

of the crops that gave promising results in terms of its suitability as profiles No.8,11,13,14,18 and 21 are S1 and profiles No. 1,2,3,4,9,10,12,15,16,17,19 and 20 are S2 while profiles No.5, 6,7 and 22 are S3 and profile No. 23 is N1. Quite the contrary, peanuts have not shown promising results in their suitability, as profiles No.12, 14 and 18 are S1 No. 1,2,16 and 17 are S2 and 7,8,9,13,20&21 are S3 while the rest profiles give unsuitable N (No.3,4,5,6,19,22 & 23). The same trend showed with cabbage, tomato and green pepper, in this respect, cabbage, only showed S1 for soil profiles No. 12, 14 and 18, and recorded in profiles 9 unsuitable (N). While tomato and green pepper never showed soil profiles S1 and give 15 profiles unsuitable (N) for tomato crop and 12 profiles for green pepper. In the same time, the trees did not show promising results in suitability for the study soils, in this regard, Olive showed only four profiles S2 and S3 and Citrus showed three profiles S3, while Guava tree give the best result in this regard whereas gives 9 profiles S3

Table 15. Gross current and potential land suitability for seasonal crops and trees

Profile No.	Suitability Status	Alfalfa	Barley	wheat	Maize	Sorghum	Groundnut	Cabbage	Tomato	Green pepper	Olive	Citrus	Guava
1	S1	S1	S1	S3	S1	S2	S2	S1	S3	S2	S2	S3	N
2	S1	S1	S1	S3	S1	S2	S2	S2	S3	S2	S2	S3	S3
3	S2	S3	S3	S3	S2	S2	N	S2	S3	S3	S3	S3	N
4	S1	S3	S2	S3	S2	S2	N	N	N	N	N	N	N
5	S1	S3	S3	S3	S3	S3	N	N	N	N	N	N	N
6	N	S3	S3	S3	S3	S3	N	N	N	N	N	N	N
7	S3	S3	S2	S3	S3	S3	S3	N	N	N	N	N	N
8	S3	S2	S1	S2	S2	S1	S3	S3	N	N	N	N	N
9	S3	S2	S1	S3	S2	S2	S3	S3	N	S3	N	N	S3
10	S3	S3	S2	S3	S3	S2	N	N	N	N	N	N	S3
11	S3	S2	S2	S2	S3	S1	S3	S3	N	N	N	N	N
12	S2	S1	S1	S3	S1	S2	S1	S1	S3	S2	N	N	S3
13	S3	S2	S3	S3	S2	S1	S3	S1	N	S3	N	N	S3
14	S3	S1	S1	S2	S2	S1	S1	S2	N	S3	N	N	S3
15	S2	S2	S1	N	S1	S2	S3	S1	S3	N	N	N	N
16	S2	S2	S1	S3	S1	S2	S2	S1	N	S2	N	N	S3
17	S3	S2	S2	S3	S3	S2	S2	S2	N	S3	N	N	S3
18	S3	S2	S2	S2	S2	S1	S1	S2	S3	S3	N	N	N
19	S3	S2	S2	S2	S3	S2	N	N	N	N	N	N	N
20	S2	S2	S2	S3	S1	S2	S3	S2	S3	S3	N	N	N
21	S2	S1	S2	S2	S1	S1	S3	S2	S3	S3	N	N	S3
22	S2	S2	S2	S3	S2	S3	N	N	N	N	S3	N	N
23	S2	S2	S2	N	S2	N	N	N	N	N	N	N	N

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الملخص العربي

تقسيم وتقييم اراضى وادى ابو عميرة–غرب مطروح الساحل الشمالى الغربى –مصر

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تعتبر منطقة الساحل الشمالي الغربي لمصر من أكثر المناطق الواعدة للتنمية الزراعية والتي تتميز بتوفر جميع موارد ومكونات التنمية فيها. أجريت الدراسة على موقع وادي أبو عميرة بالساحل الشمالي الغربي لمصر غرب مدينة مرسى مطروح بغرض تحديد انواع الأراضي السائدة في منطقة الدراسة وتقسيمها وتعيين قدرتها الانتاجية. تشغل منطقة الدراسة مساحة ١٦٠٠ فدان وتم تحديد الأشكال الأرضية بإستخدام الخرائط الجيومورفولوجية والطوبغرافية. تم اختيار ثلاثة وعشرين قطاع لتمثيل وحدات التشكيل الأرضي الرئيسية في دراسة التربة. يمكن تصنيف منطقة الدراسة من خلال رتبتين هما (Entisols و.Aridisols). والتحت مجموعات لرتبة Aridisols هم Typic haplocalcids و lithic Torripsamments و Typic Torripsamments. إن الآفاق التشخيصية لرتبة Aridisls هي آفاق كلسية بينما تعتبر أفاق رتبة Entisols أقل تطورًا.

وبناءا على صفات عمق القطاع الأرضي وقوام التربة وطبوغرافية السطح قسمت أراضى المنطقة إلي ثلاث وحدات ، قطاع تربة عميق وذات قوام خشن إلى متوسط الخشونة و متوسط العمق ذات قوام خشن إلى متوسط الخشونة واخيراً ضحل ذا تربة خشنة إلى حد ما. أظهرت الفحوصات الميدانية أن ١١,٠٠٪ من مساحة الدراسة ذات قطاعات عميقة و ٣٨,٠٠٪ ذات قطاعات متوسطة العمق بينما ٥١,٠٠٪ ذات عمق ضحل. فيما يتعلق بقوام التربة قيد الدراسة ، كانت ٥٥,٢٦٪ إلى ٤٤,٧٣٪ من المنطقة عبارة عن طميية رملية إلى تربة رملية طينية وبقية المنطقة إما ذات قوام طمي رملي أو طيني رملي. تعتبر معظم المناطق غير ملحية إلى قليلة الملوحة والمنطقة المدروسة عبارة عن معتدلة الكلسية إلى عالية. وبحسب وزارة الزراعة الأمريكية (١٩٦٢) ، فقد صنفت قدرة التربة الإنتاجية لمنطقة الدراسة إلى أربع مجموعات هم II وهي تغطي ١٥٤ فدانًا (٩,٦٣٪ تعادل ٪ من المساحة) ، و III وهي تغطي ١٩٩ فدانًا (تعادل ١٢,٤٣٪ من المساحة) ، و VII وهي تغطي ٦٣٧ فدانًا (تعادل ٣٩,٨١٪ من المساحة) ، واخيرا VIII وهي تغطي ٦١٠ فدانًا (تعادل ٣٨,١٣ ٪ من المساحة). . بينما وفقًا لمنظمة الأغذية والزراعة (٢٠٠٦) ، يمكن وضع صلاحية تربة منطقة الدراسة للزراعة إلي اربع اقسام ، القسم الاول S1 (صالحة قليلاً) و S2 (صالحة إلى حد ما) و S3 (أراضي هامشية) و N (غير مناسبة للزراعة). وذلك في ضوء نوعية المحدات المدروسة وهي عمق القطاع الارضي، وملوحة التربة (EC) ، والمياه المتاحة (AW) بينما تمثل بقية العوامل المحددة قيودًا طفيفة.

الدراسة الحالية عبارة عن تجربة لتقييم إمكانات التربة في هذه المنطقة من حيث تصنيف قدرة الأرض. وسيكون هذا العمل مفيدًا في المستقبل باعتباره أساسًا لسياسة التنمية الزراعية في تلك المنطقة.

الكلمات المفتاحية: تكوين الأراضي، تقسيم الأراضي ، امكانات التربة، قدرة التربة، ملائمة التربة