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Evaluation for Some Soils of Al-Bahariya Oases and The Optimal Planning for Their Agricultural Exploitation

Abdalla, I. M . *

Soil, water & Environ. Res. Inst.: Agric. Res. Center; Giza, Egypt.

Cross Mark

ABSTRACT

The aim of this investigation is to study the characteristics of Al-Bawoiti soils for evaluating their capability and suitability for growing main crops using Remote Sensing (RS), Geographic Information Systems (GIS), and Sys, Model. Thirty-one representative soil profiles were selected. The profiles were morphological described and samples were collected representing the vertical variation for different laboratory analysis. According to the RS and GIS works three geomorphic units are recognized. These units are depression plain (18.06%), Aeolian plain (28.9%), and Pediplain (53.04%). The correlation between geomorphic unit and soils was carried out and then the soil maps where created using the ArcGIS 10.4.1 software. Based on the soil characteristics, the studied soil were evaluated according to their suitability for agriculture. In the current situation, they categorized into their capability classes namely, moderately suitable (S2=1.88%), marginally suitable (S3=85.87%), and not suitable (N=12.24%). These soils are suffering from limitations of texture class, salinity and alkalinity, topography and soil depth with different intensity degrees (slight, moderate, and severe). The severity of these limitations could be corrected by future land improvement according the potential suitability of the most studied soils could be improved to highly suitable (S1=0.2%), moderately suitable (S2=25.97%), marginally suitable (S3=73.53%), and not suitable (N_2= 0.3%).Moreover, the suitability of 18 main crops in these soils was evaluated in the current and potential situation. The potential suitability of the soils for these crops could be improved according to the satisfaction conditions between soil properties and crops requirements. Keywords: Remote Sensing (RS), Geographic Information Systems (GIS), Land Evaluation.

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INTRODUCTION

The Egyptian government faces a major challenge in ensuring the security of its food population paths, the first is agricultural intensification or vertical expansion, and the second is horizontal expansion. In this regard our interest is the second track, which means introduction new areas of not cultivated land or Desert lands to cultivated areas. This study is considered a step for achieving this goal as it was implemented in a promising area in the Western Desert in Egypt, which is characterized by ease of terrain and fresh groundwater, as well as a network of roads linking to some of the most populous provinces such as Cairo and Al-Fayoum, this area is Al-Bahariya oases , which its soils have been subject to much of studies to evaluate them such as Khater et al (2008) and Mustafa et al. (2008).

The studied area is located 44 km southeast of Al-Bawoiti which characterized by presence of high quality groundwater, easy terrain and a good road network and so the area is considered promising for agriculture. It also offers the possibility to correct a lot of limitations of agriculture such as salinity, alkalinity and others. The studied area is located between latitude 28°3′18″To 28°1′48″ North and longitude 28°51′18″To 28°27′24″ East. It covers about 3030 fedden Fig(1)

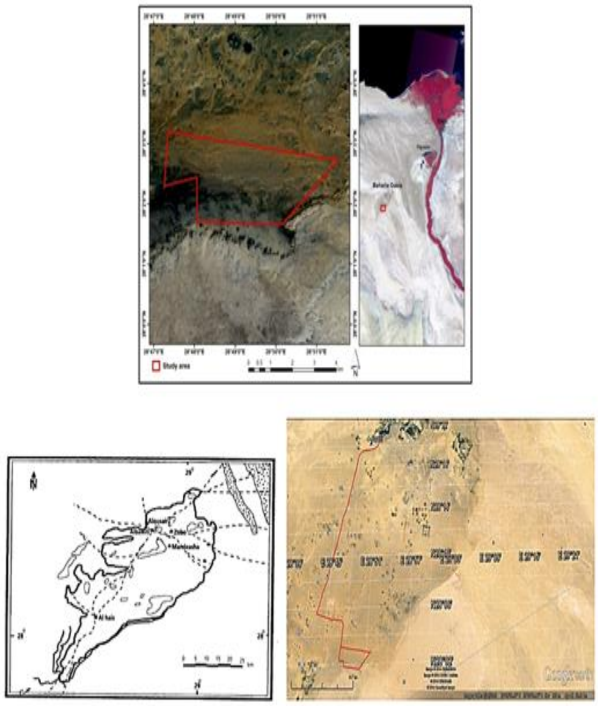

Fig .1. Location map of the studied area of (Al-Bahariya)

Said(2000) reported that the succession of the formation of Al-Bahariya oases was described from the

*** Corresponding author.**
E-mail address: ibrahemmohamed437@yahoo.com
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oldest to the youngest, i.e., Cretaceous, Paleogene (Paleocene and Eocene), Neogene (Miocene) and Quaternoig (Pleistocene and Holocene). The Cretaceous Sandstones, Clays, and Marls of Al-Bahariya formation are the oldest outcropping deposits in the oases from the floor of the depression. The dolomite beds with sandstones form most of escarpments and some of the hills within the dipression. Sandy clay inter beds are followed conformably in the middle and southern parts of the western scarp by chalk deposits.

Shahin et. al., 1996 reported that Al-Bahariya oases rely entirely on groundwater for agriculture, drinking, industry and all purposes. Ground water is available in the sandstone rocks formed during the Nubian period. The thickness of the Nubian sandstone layer is about 400 to 800 meters. The groundwater of the oases is fresh, with salinity of 1000 mg / l, and the salt is often less than 500 mg / L and sometimes reaches to 120-150 mg / l.

The physical, chemical land capability evaluation and mapping for Al-Bawoiti area is one essential action in order to mountain the sustainable development of effort and investment as well as the sustainable usage of the soils(Bandyopadhyay et. Al., 2009)

Satellite remote sensing (RS) in conjunction with geograpjic information systems (GIS) have been widely applied and recognized as a powerfull and effective tools in analyzing land use categories (Ehlers et. al., 1990, and weng, 2001). GIS provide indispensable tools for decision makers. Both RS and GIS techniques are considered very important geometric tools, which are fully utilized in the developed countries(Arafat, 2003). The integration of remotely sensed data, GIS and spatial statistics provides useful tools for modeling variability to predict the distribution presence and pattern of soil characteristics (KalKhan et al., 2000). The potential of the integrated approach in using GIS and RS data for quantitative and evaluation has been demonstrated by Martin & Saha (2009).

The aim of this study was to demonstrate the usefulness of RS and GIS technologies to producing the geomorphic map of the studied area. These techniques are also used to produce the soil characteristics and land evaluation maps of the studied area

MATERIALS AND METHEODS

Remote Sensing

LandSAT 8 (2020) data scene that cover Al-Bawoiti village. The satellite image was geometrically corrected to UTM grid system (zone 35 N datum WGS84). The image was radiometrically corrected to remove any noise and additives from the atmospheres by using Arc. 10.41 software. Topographic maps covering Al-Bawoiti village(district) was used to generate digital elevation model DEM through grouping and processing in ArcGIS 10.4.1 to define the different landforms of the studied area Fig (2) .

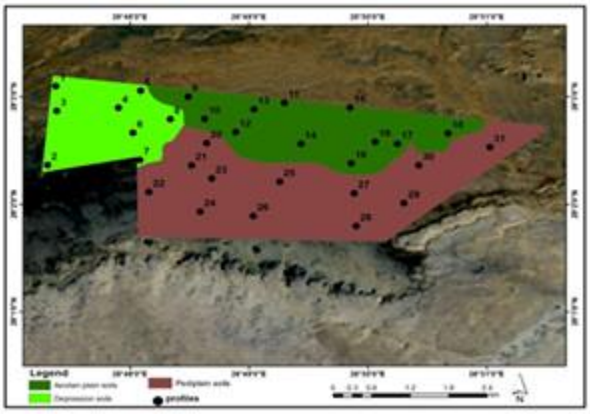


Fig .2. Land Sat (8) image for the studied area

The extracted data are utilized to generate a preliminary geomorphological map which was checked and completed through field observation. Resolution merge is used for imagery integration of different spatial resolution (Dobos et al., 2002)

Field work and Laboratory analyses

Thirty one soil profiles were dug in the field for an area about 3030 feddan. The soil profiles were described in the field according to (FAO, 1990) table (1).

Table 1. Morphological description of the studied soil profiles.

Geomorphic unit	Profile No.	Depth (cm)	Color (dry)	Texture class	Structure	Consistence (dry)	Gravels	Surface cover
Depression plain	1	0-30	10YR 6/6	S	Massive	Soft	Few F. fragm.	Common different seizes fragments & sand & few soft gypsum accumulations.
		30-90	10YR 4/3	S	Massive	Slightly hard	Few F. fragm.	
		90-160	10YR 4/3	L.S	Massive	Slightly hard	Few F. fragm.	
	2	0-70	10YR 6/6	LS	Massive	Soft	Few Fine fragm.	Common different seizes fragments, sand and stones.
		70-120	10YR 7/4	S	Massive	Hard	Non	
	3	0-25	10YR 5/4	SL	Massive	Soft	Few F.&M. fragm.	Common different seizes fragments and sand.
		25-60	10YR 5/4	LS	Massive	Slightly hard	Non	
		60-90	10YR 3/2	LS	Massive	Slightly hard	Few F. fragm.	
		90-…..	10YR 5/3	SCL	Massive	Hard	Few F. fragm.	
	4	0-20	10YR 6/6	LS	Massive	Soft	Few fine fragm.	Common different seizes fragments, sand and stones.
		20-90	10YR 6/4	LS	Massive	Hard	Non	
		90-150	10YR 7/6	LS	Massive	Hard	Non	
	5	0-60	10YR 7/3	SL.	Massive	Soft	Few diff. seizes fragm.	Common different seizes fragments and sand.
		60-125	10YR 7/4	SCL.	Massive	Hard	Non	
	6	0-40	10YR 3/2	C	Massive	Soft	Few fine fragm.	Common different seizes fragments and sand.
		40-110	10YR 5/4	LS	Massive	Hard	Non	
		110-140	10YR 5/4	LS	Massive	Hard	Non	
	7	0-20	10YR 5/6	LS	Massive	Soft	Few F. fragm.	Common different seizes fragments and sand.
		20-60	10YR 7/6	LS	Massive	Hard	Few F. fragm.	
		60-150	10YR 6/6	SCL	Massive	Hard	Non	
	8	0-20	10YR 5/6	SL	Massive	Soft	Few F. fragm.	Common different seizes fragments and sand.
		20-50	10YR 5/6	SL	Massive	Hard	Few F. fragm.	

S = Sand LS = Loamy sand SL = Sandy loam SCL = sandy clay loam C = clay F.S = fine sand c.S = coarse sand Few F.&M. fragm. = few fine and medium fragments. Few diff. seizes fragm. =few different seizes fragments. W. platy =weak platy.

Table 1. Cont.

Geomorphic unit	Profile No.	Depth (cm)	Color (dry)	Texture class	Structure	Consistence (dry)	Gravels	Surface cover
Aeolian plain	9	0-50 50-80 80-170	10YR 5/4 10YR 7/6 10YR 7/3	LS S S	Massive Massive Massive	Soft Slightly hard Slightly hard	Few F. fragm. Few F. fragm. Non	Common different seizes fragments and sand.
	10	0-30 30-90 90-150	10YR 7/6 10YR 7/6 10YR 7/6	S S S	Massive Massive Massive	Soft Soft Slightly hard	Few diff. seizes fragm. Few F.&M. fragm. Few diff. seizes fragm.	Common different seizes fragments, sand.
	11	0-30 30-100 100-150	10YR 7/6 10YR 7/6 10YR 7/4	S S S	Massive Massive Massive	Soft Slightly hard Slightly hard	Few F.&M. fragm. Few F. fragm. Non	Common fine and medium fragments and sand.
	12	0-55 55-115 115-125	10YR 7/6 10YR 7/6 10YR 7/6	S LS LS	Massive Massive Massive	Soft Soft hard	Few diff. seizes fragm. Non Few F. fragm.	Common different seizes fragments and sand.
	13	0-30 30-110 110-150	10YR 6/6 10YR 7/6 10YR 7/6	LS S c.S	Massive Massive Massive	Soft Soft Slightly hard	Few F. fragm. Common F.&M. fragm. Common F.fragm.	Common different seizes fragments and sand.
	14	0-50 50-95 95-145	10YR 6/6 10YR 7/4 10YR 6/6	LS S S	Massive Massive Massive	Soft Soft Soft	Few F. fragm. Common F.fragm. Few F. fragm	Common different seizes fragments and sand.
	15	0-15 15-55 55-135	10YR 6/6 10YR 7/6 10YR 7/6	SL S S	Massive Massive Massive	Soft Soft Slightly hard	Few F. &M. fragm. Non Non	Common fine and medium fragments and sand.
	16	0-35 35-60 60-120	10YR 6/6 10YR 7/4 10YR 6/6	S S S	Massive Massive Massive	Soft Soft Hard	Few F. fragm. Non Non	Desert pavement.
Aeolian plain	17	0-50 50-170	10YR 6/6 10YR 6/3	LS C	Massive Massive	Soft Hard	Few F. fragm. Non	Common different seizes fragments, sand and stones.
	18	0-70 70-120	10YR 6/6 10YR 7/4	LS S	Massive Massive	Soft Hard	Few F. fragm. Non	Common different seizes fragments, sand and stones.
	19	0-30 30-100	10YR 6/6 10YR 7/6	LS LS	Massive Massive	Soft Hard	Few diff. seizes fragm. Non	Desert pavement.
Pedi plain	20	0-60 60-95 95-155	10YR 6/6 10YR 6/6 10YR 6/6	c.S c.S c.S	Massive Massive Massive	Soft Soft Hard	Few F. &M. fragm. Few F. fragm. Non	Desert pavement.
	21	0-60 60-150	10YR 6/6 10YR 6/6	S S	Massive Massive	Soft Hard	Few F. fragm. Non	Common different seizes fragments and sand.
	22	0-45 45-80	10YR 6/3 10YR 7/4	SCL S	Massive Massive	Soft Very hard	Few F. fragm. Few F. fragm.	Common different seizes fragments and stones.
	23	0-20 20-120	10YR 7/6 10YR 7/6	S S	Massive Massive	Soft Soft	Few F. fragm. Non	Common different seizes fragments and sand .
	24	0-65 65-150	10YR 7/6 10YR 7/6	S S	Massive Massive	Soft Soft	Few F. fragm. Few F. fragm.	Common different seizes fragments, sand and stones.
	25	0-40 40-150	10YR 7/6 10YR 6/6	S S	Massive Massive	Soft Hard	Few F. fragm. Non	Common different seizes fragments and sand.
	26	0-40 40-60	10YR 7/4 10YR 7/2	SL SCL	Massive Massive	Soft Slightly hard	Few F. fragm. Non	Common different seizes fragments and sand.
	27	0-15 15-75 75-110	10YR 7/4 10YR 7/4 10YR 7/2	F.S LS S	Massive Massive Massive	Soft Slightly hard Hard	Few diff. seizes fragm. Non Non	Common different seizes fragments, sand and stones.
Pedi plain	28	0-20 20-80 80-120	10YR 7/6 10YR 7/6 10YR 7/4	S c.S CL	Massive Massive Massive	Soft Soft Hard	Few F. fragm. Common F.&M. fragm. Non	Common fine fragments, sand, stones and boulders.
	29	0-30 30-100	10YR 7/4 10YR 7/4	SL SL	Massive Massive	Soft Hard	Few F. fragm. Non	Desert pavement.
	30	0-40 40-85 85-145	10YR 7/4 10YR 6/1 10YR 5/3	LS C SL	Massive Massive Massive	Slightly hard Very hard Very hard	Few diff. seizes fragm. Non Non	Common different seizes fragments, sand, stones and boulders.
	31	0-20 20-70	10YR 7/6 10YR 7/1	S C	Single G. W. platy	Loose Hard	Few F. fragm. Non	Common different seizes fragments and sand.

All soil profiles were geo-referenced using the GARMIN GPS 1996. Representative 80 distributed soil samples have been collected from the studied soil profiles according to the morphological variations and were used for laboratory analyses. The laboratory analyses were carried out according to the methods outlined by Burt 2004, Tables 2 and 3. This properties were particle size distribution, soil pH, electrical conductivity (ECe) in the soil paste extract, soluble cations and anions, $CaCO_3$, OM, Gypsum content and SAR

Table 2. Particle size distribution, texture class, $CaCO_3$, Gypsum(%) and O.M of the studied soil profiles.

Geomorphic unit	Profile No.	Depth (cm)	Particle size distribution (%)			Texture class	$CaCO_3$ (%)	Gypsum (%)	O.M
			Sand	Silt	Clay				
Depression plain	1	0-30	95.0	2.8	2.2	Sand	3.46	4.50	0.2
		30-90	94.9	2.9	2.2	Sand	3.44	4.75	0.15
		90-160	90.0	4.9	5.1	Loamy sand	2.82	3.75	0.15
	2	0-70	89.8	5.2	5.2	Loamy sand	8.92	2.75	0.3
		70-120	95.0	2.8	2.8	Sand	8.14	1.80	0.2
	3	0-25	59.9	11.9	28.2	Sandy clay	3.44	5.45	0.2
		25-60	70.2	19.6	10.2	Sandy loam	3.46	4.35	0.15
		60-90	78.3	10.5	11.2	Sandy loam	2.86	3.41	0.15
		90-…..	70.4	7.8	21.8	Sandy clay loam	2.86	2.22	0.1
	4	0-20	89.2	5.4	5.4	Loamy sand	5.23	3.85	0.25
		20-90	89.1	5.6	5.3	Loamy sand	3.46	2.65	0.15
		90-150	90.0	4.8	5.2	Loamy sand	3.44	1.58	0.15
	5	0-60	89.1	5.5	5.4	Loamy sand	2.86	3.76	0.17
		60-125	70.3	8.1	21.6	Sandy loam	3.15	4.15	0.15
	6	0-40	31.1	14.8	54.1	Clay	2.45	4.66	0.22
		40-110	89.1	55	5.4	Loamy sand	2.45	1.75	0.18
		110-140	90.0	4.8	5.2	Loamy sand	2.15	1.86	0.16
	7	0-20	88.0	5.8	6.2	Loamy sand	2.10	4.66	0.23
		20-60	84.0	8.6	9.4	Loamy sand	1.64	2.84	0.2
		60-150	70.0	8.2	21.8	Sandy clay loam	2.86	1.27	0.15
	8	0-20	69.8	20.2	10.0	Sandy loam	3.46	3.87	0.24
		20-50	78.1	11.3	10.6	Sandy loam	2.10	3.15	0.17
Aeolian plain	9	0-50	58.1	6.2	35.7	Sandy clay	3.15	6.48	0.33
		50-80	95.0	3.0	2.0	Sand	1.85	2.35	0.3
		80-170	95.6	2.1	2.3	sand	2.10	2.25	0.25
	10	0-30	95.0	2.7	2.3	Sand	8.14	5.40	0.3
		30-90	94.9	2.7	2.4	Sand	9.15	3.24	0.25
		90-150	94.6	3.2	2.2	Sand	8.14	2.25	0.2
	11	0-30	94.3	3.3	2.4	Sand	9.31	1.89	0.15
		30-100	93.4	2.9	3.7	Sand	1.08	2.15	0.15
		100-150	94.6	3.2	2.2	Sand	2.15	2.33	0.12
	12	0-55	94.3	3.3	2.4	Sand	4.98	6.86	0.35
		55-115	60.3	9.6	30.1	Sandy clay	7.14	6.86	0.3
		115-125	84.3	13.3	2.4	Sandy loam	5.65	3.15	0.3
	13	0-30	89.2	4.8	6.0	Loamy sand	8.14	6.48	0.25
		30-110	95.0	2.9	2.1	Sand	7.65	2.25	0.2
		110-150	94.6	3.2	2.2	Sand	8.14	2.89	0.15
Aeolian plain	14	0-50	58.9	10.3	29.8	Sandy clay	7.14	7.62	0.25
		50-95	94.6	3.2	2.2	Sand	5.86	2.35	0.2
		95-145	94.3	3.3	2.4	Sand	5.86	3.15	0.15
	15	0-15	58.1	6.2	35.7	Sandy clay	8.14	3.85	0.3
		15-55	94.8	2.8	2.4	Sand	3.46	6.89	0.3
		55-135	95.6	2.1	2.3	Sand	1.85	2.35	0.25
	16	0-35	95.0	3.1	1.9	Sand	8.14	7.68	0.35
		35-60	94.7	3.1	2.2	Sand	2.86	3.45	0.32
		60-120	95.0	2.9	2.1	Sand	5.98	3.30	0.3
	17	0-50	89.8	5.2	5.0	Loamy sand	8.14	8.15	0.17
		50-170	28.2	30.0	40.8	Clay	0.98	3.45	0.15
	18	0-70	89.8	5.2	5.0	Loamy sand	8.14	5.36	0.22
		70-120	95.0	2.8	2.2	sand	4.46	1.08	0.20
	19	0-30	89.0	5.3	5.7	Loamy sand	8.65	3.72	0.30
		30-100	88.6	5.2	6.2	Loamy sand	8.14	6.12	0.25
Pedi plain	20	0-60	94.3	3.3	2.4	Sand	8.14	7.68	0.18
		60-95	95.0	2.9	2.1	Sand	3.44	4.12	0.16
		95-155	94.6	3.2	2.2	sand	3.44	3.15	0.16
	21	0-60	95.0	2.9	2.1	Sand	6.92	4.12	0.3
		60-150	94.3	3.3	2.4	Sand	7.65	1.25	0.25
	22	0-45	70.4	7.8	21.8	Sandy clay loam	9.04	1.08	0.22
		45-80	94.6	3.2	2.2	Sand	1.64	3.72	0.2
	23	0-20	94.3	3.3	2.4	Sand	8.92	1.15	0.35
		20-120	95.0	2.9	2.1	Sand	8.14	1.08	0.3
	24	0-65	95.1	2.9	2.0	Sand	6.65	1.27	0.25
		65-150	94.6	3.2	2.2	Sand	7.04	0.98	0.22
	25	0-40	94.6	3.2	2.2	Sand	7.04	3.35	0.34
		40-150	95	2.9	2.1	Sand	1.64	1.08	0.3
	26	0-40	70.2	19.6	10.2	Sandy loam	7.04	3.98	0.25
		40-60	70.4	7.8	21.8	Sandy clay loam	1.64	1.15	0.22
	27	0-15	95.1	2.9	2.0	Sand	2.86	0.98	0.30
		15-75	89.1	5.5	5.4	Loamy sand	0.98	1.08	0.25
		75-110	95.0	2.8	2.2	sand	0.98	1.08	0.25
	28	0-20	95.0	2.8	2.2	Sand	8.14	1.15	0.20
		20-80	94.9	2.9	2.2	Sand	7.04	1.25	0.20
		80-120	50.1	30.1	20.8	Clay loam	0.98	1.08	0.18
	29	0-30	84.3	13.3	2.4	Sandy loam	1.64	1.15	0.44
		30-100	69.8	19.1	11.1	Sandy loam	1.64	1.55	0.34
	30	0-40	20.6	19.1	60.3	Clay	1.64	0.98	0.4
		40-85	10.0	29.3	60.7	Clay	0.98	1.15	0.35
		85-145	58.9	10.3	29.8	Sandy clay	1.64	0.98	0.3
	31	0-20	95.0	2.9	2.1	Sand	7.86	1.13	0.32
		20-70	20.6	19.1	60.3	Clay	1.04	1.15	0.28

Table 3. Chemical properties of the studied soil profiles.

Geomorphic unit	Profile no.	Depth (Cm)	pH 1:2.5	EC dSm^{-1}	Cations (meq / L)				Anions (meq / L)				SAR
					Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}	
Depression	1	0-30	7.9	100.3	560.3	369.4	580.6	10.8	-	10.14	611.8	899.66	27
		30-90	7.9	61.2	365.4	182.8	332.6	6.6	-	8.25	356.4	572.75	16
		90-160	7.9	112.1	565.3	316.9	782.1	16.2	-	12.34	793.3	859.4	29
	2	0-70	7.8	20.4	108.2	56.8	91.8	8.4	-	4.3	107.2	153.7	8
		70-120	7.8	32.5	190.65	89.3	149.2	10.8	-	6.2	163.8	268.3	10
	3	0-25	8.0	200.1	1240.3	238.1	1003.06	20.9	-	10.87	1502.1	1489.1	27
		25-60	7.7	73.4	536.2	253.07	320.1	9.3	-	2.11	3907.8	704.02	12
		60-90	7.9	38.2	215.7	144.05	1601.3	10.2	-	3.05	185.09	349.95	10
		90-…..	7.7	17.1	87.1	50.4	75.8	11.2	-	2.45	93.4	132.55	7
	4	0-20	7.7	25.6	125.8	70.2	127.8	9.4	-	2.87	142.0	187.93	10
		20-90	7.7	45.1	254.1	164.0	205.0	10.5	-	4.13	221.1	407.87	11
		90-150	7.8	10.8	58.4	31.0	46.0	5.0	-	2.29	62.4	75.71	5
	5	0-60	7.8	60.1	350.45	165.0	341.0	15.0	-	10.41	391.45	469.59	16
		60-125	7.7	90	522.0	304.1	495.0	30.4	-	12.03	590.4	747.97	19
	6	0-40	7.6	60.2	388.9	152.0	317.8	15.2	-	2.37	392.0	477.63	15
		40-110	7.5	13	64.0	35.0	61.0	9.0	-	1.30	74.0	93.7	7
		110-140	7.7	22.4	116.2	41.1	128.4	4.0	-	1.46	155.2	135.54	11
	7	0-20	7.8	100.1	588.5	375.5	512.5	25.0	-	2.74	613.5	885.26	18
		20-60	7.7	98	580.0	360.0	510.0	21.0	-	2.11	608.0	859.89	19
		60-150	7.8	90.2	545.0	380.9	419.1	9.3	-	2.65	480.8	867.85	15
	8	0-20	7.8	51	312.0	112.0	308.0	7.6	-	2.09	380.0	357.41	16
		20-50	7.8	50	309.0	120.0	277.3	6.3	-	2.10	308.0	389.9	14
Aeolion plain	9	0-50	7.7	27.8	120.5	63.4	188.4	3.1	-	1.98	215.8	157.52	15
		50-80	7.8	22.2	119.6	49.8	116.0	3.2	-	1.56	128.6	158.44	10
		80-170	7.8	10	43.0	20.0	55.0	2.0	-	1.32	62.0	56.68	8
	10	0-30	7.8	30	140.0	80.0	182.0	3.0	-	1.62	195.0	208.38	14
		30-90	7.8	30.8	155.8	90.0	168.2	2.1	-	1.61	182.3	221.39	12
		90-150	7.8	25	137.0	47.0	139.0	2.0	-	1.54	150.0	173.46	11
	11	0-30	7.7	7.1	32.2	175	34	2.1	-	1.18	44.2	39.92	3
		30-100	7.8	24	14.2	6.2	104	4	-	1.63	111.3	199.37	25
		100-150	7.8	27.3	168.5	67.05	129.1	4.2	-	1.67	145.3	221.83	9
	12	0-55	7.8	15.1	71.3	26.2	97.1	2.4	-	1.25	109.0	86.75	11
		55-115	7.9	116	578	354	797	11	-	5.41	840	894.59	29
		115-125	7.8	148	780	521	890	29	-	6.20	970	1243.8	28
	13	0-30	7.8	24	149	29	132	2	-	1.45	150	160.55	10
		30-110	7.9	15.8	78.2	38.2	88.1	3.1	-	1.28	105.2	100.72	9
		110-150	7.8	19.3	93.5	43.4	110	4	-	1.40	133.9	115.6	10
	14	0-50	7.8	24	108	75.0	120	9	-	1.64	130	180.36	10
		50-95	7.7	20	106	58	94	2	-	1.58	116	142.42	8
		95-145	7.9	19	105	50	90	2	-	1.54	105	140.46	8
Aeolion plain	15	0-15	7.9	50.1	265.4	188.5	236.5	11	-	3.28	256.4	441.72	12
		15-55	7.8	40.2	251.8	108.6	197.4	5	-	3.04	224.8	334.96	11
		55-135	7.7	32	120	72	145	4	-	1.89	165	265.11	11
	16	0-35	7.8	16	88	38	81	1	-	1.45	102	104.55	8
		35-60	7.7	23	146.5	63	98	3	-	1.65	112	196.85	7
		60-120	7.8	12	69	31	55	1	-	1.34	67	87.66	6
	17	0-50	7.7	22	129	54	100	3	-	1.61	115	169.39	8
		50-170	8.1	17.4	97.2	45.3	81.1	3.2	-	1.45	107.2	117.55	7
	18	0-70	7.8	20	110	49	98	3	-	1.53	110	148.47	8
		70-120	7.8	32.1	187.35	84.1	157.4	5.8	-	1.88	182.35	250.12	10
	19	0-30	7.7	16	85	40	81	2	-	1.41	95	111.59	8
		30-100	7.9	35	208	82.5	178	4	-	1.85	193	277.65	11
Pedi plain	20	0-60	7.9	52.6	328	145.7	278.1	11.3	-	1.25	298.7	462.75	14
		60-95	7.6	66	345	233	410	12	-	1.48	430	558.52	19
		95-155	7.6	99.1	640.5	323.8	514.2	8.3	-	2.36	561.5	922.64	18
	21	0-60	7.8	45	301	170	155	4.2	-	1.99	160	468.01	8
		60-150	7.8	50.2	298.8	187.5	212.9	5.1	-	1.48	232.8	468.52	11
	22	0-45	7.9	70.1	513.5	231.5	302.5	4.8	-	2.1	352.5	697.9	12
		45-80	7.9	20.6	98.8	47	120	2.8	-	1.4	137.8	128.6	11
	23	0-20	7.9	8	35	18	42	1	-	1.2	50	44.8	6
		20-120	7.8	24	142	69	100.2	1.8	-	1.72	120.9	190.28	8
	24	0-65	7.8	12.3	63	35	72	1.4	-	1.24	81.2	79.76	8
		65-150	7.8	12	60	32	61	3	-	1.3	70	84.7	7
	25	0-40	7.8	9	38	20	49.5	1.9	-	1.2	55.8	52.8	7
		40-150	7.8	6	20	12	30	4	-	1.1	35	29.9	6
	26	0-40	7.8	30	175	72	155	3	-	1.7	170	233.3	11
		40-60	7.8	27.2	150	69.7	145.5	2	-	1.6	160	202.9	11
	27	0-15	7.8	25	146	68	108	3	-	1.69	120	203.31	8
		15-75	7.8	30.4	185	75.4	148.2	5.1	-	1.82	166.8	243.18	10
		75-110	7.8	70.0	376.1	269.2	389.4	16	-	1.7	401.7	647.3	17
	28	0-20	7.8	8	35	19	41	1.8	-	1.2	50.8	44.8	6
		20-80	7.7	12	64	30	61	1.6	-	1.3	70.6	84.7	7
		80-120	7.8	20	102	41	115	2.0	-	1.44	130	128.56	10
	29	0-30	7.8	21	111	56	104	2.0	-	1.52	120	151.48	9
		30-100	7.8	26	143	67	125	3	-	1.72	135	201.28	9
	30	0-40	7.9	23.5	142	69.25	104	2	-	1.61	133.25	182.39	8
		40-85	7.8	19.4	160	53.2	91	2.4	-	1.55	110.2	140.45	7
		85-145	7.7	20.0	113	47	98	2	-	1.57	115	143.43	8
	31	0-20	7.8	15	75	27	92	1	-	1.28	105	88.72	10
		20-70	7.9	37	208	107	200	3	-	1.82	230	286.18	12

Land Evaluation:

Data input process is the operation of entering the spatial and non-spatial data into GIS database. The digital geomorphological map was used as base map in the database. The spatial analysis function in ArcGIS 10.4 was used to create the thematic layers of EC, Soil depth, CaCO3, and Gypsum contents. The thematic layers were matched to produce the soil capability map. The land capability classes were defined using the ratings and the methods of Sys and Verheye (1978) and Says et al. (1991)

Soil suitability classification for certain crops was done by selecting eighteen (18) crops to assess their convenience for cultivation in the studied area Sys et al. 1993. Selected crops can be grouped into three categories as follows:

1 – field crops (Alfaalfa, barley, beans, Wheat, sorghum, sunflower, maize, and sesame)

2 – vegetable crops (cabbage, green pepper, water melon, Pea, tomato and onion)3 – fruit trees(citrus, guava, mango, and olive).

RESULTS AND DISCUSSION

Based on the field observations, profiles description, interpretation of satellite images and geological and topographic maps the study area can be divided into three major geomorphic. Units namely, depression plain, Aeolian plain, and pediplain Fig (3). A brief note about the identified geomorphic units and morphological description, physical and chemical properties which are carried out as follows:

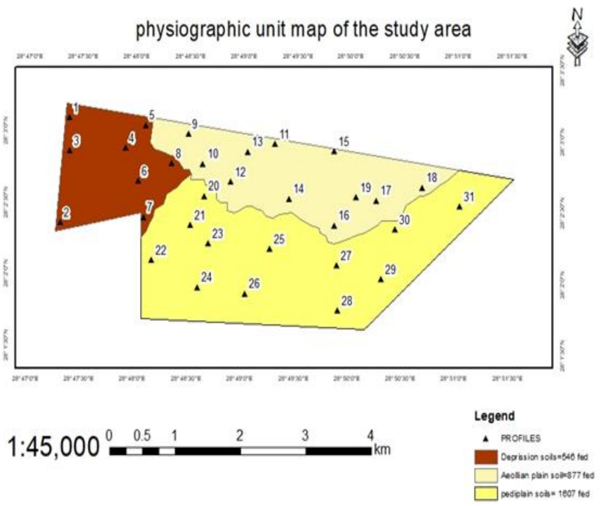


Fig. 3.Geomorphic units and soil profiles location of the studied area.

Depression plain:. It occupies the northwestern part of the study area and covering about feddan (548) . The topography is almost flat; few hills or uplands from sandstone are scattered on the surface. The soil profile depths are deep to moderately deep(>50 cm). The soil texture class is sand, loamy sand, sandy loam, or sandy clay loam, with few to common fin gravels, and gypsum horizons. It represented by profiles Nos. 1, 2, 3, 4, 5, 6, 7 and 8.

The analytical data of soil profiles were given in tables 2 &3. The data revealed that $CaCO_3$ content ranged between 1.64 and 8.92% and tends to decrease with profile depths, except for the soils of profile 5 where $CaCO_3$ tends to increase with depth. In profile 7 $CaCO_3$ content does not portray any specific pattern with the soil profile depth. Gypsum content is very low and varied from 1.27 to 5.45%. pH values varied from 7.5 to 8.0 indicating that these soils where slightly to moderate alkaline. Ec values varied between 13 to 200.1 ds/m(moderately to extremely saline). Soluble cations were dominated by Ca^{++} followed by Na^{+}, Mg^{++}, and K^{+}, while soluble anions follows the order $SO4^{--}$ > cl- > $HCO3^{-}$.

Aeolian plain soils: The surface level of this geomorphic unit ranges from 160 to 180 m. above sea level and located in the northern part of the study area and covering about (877) feddan. The topography is almost flat to gently undulating; ; many hills or uplands from sandstone (low to medium height) are scattered on the surface. The effective soil depth varied from 100 to 170 cm (deep to very deep) and consists of loose sand formed often by wind deposition, containing few to many fine gravels. The soil texture class varied from fine sand to sandy loam. It represented by profiles Nos 9, 10, 11, 12, 13, 14, 15, 16, 17, 18 and 19.

Physical and chemical analyses of the fine fractions (tables 2,3) reveal that $CaCO_3$ content ranged from 0.93 to 9.34%. The distribution pattern of $CaCO_3$ does not portray any specific pattern with depth, except for the soils of profiles 15, 17, 18, and 19 where carbonate tends to decrease with depth. Gypsum content varied from 1.08 to 8.15 and their content is enough to the requirements of gypsic horizon.

With regard to the chemical composition of the soil extract data in table (3) indicates that pH values varied from 7.7 to 8.1 showing that these soils were slightly to moderate alkaline. The soils were moderate to extremely saline where Ec values ranged between 10 and 50.1 ds/m. the cations composition were dominated with Na+ and Ca++ followed by Mg^{++} and K^{+}. the anions composition was dominated by $SO4^{=}$ followed by cl^{-}, while HCO3- is the least abundant soluble anion.

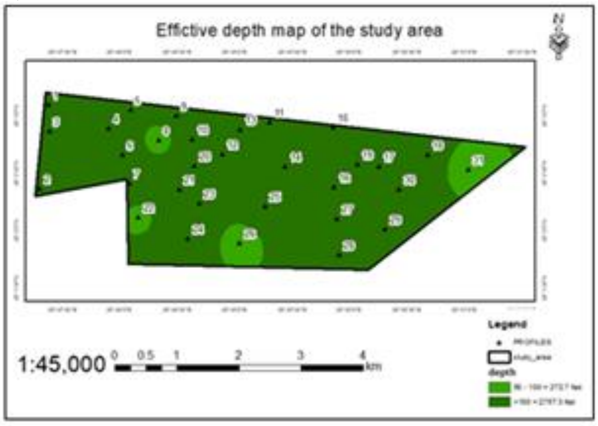
Pediplain soils: It represented by profiles :20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 and 31. Soil elevation ranges from 160 to 190 m above sea level. It is located in the southern part of the study area and covering about (1607) feddan close to the mountain. The topography is gently undulating to undulating; many hills or uplands from sandstone (medium to height) are scattered on the surface; the soil contains common to many various sizes of stones. These soil have a coarse to fine classes varied texture from sandy to clay table (2) reveals that the studied soil profiles of pediplain unit have CaCO3 content ranged from 0.93% in the middle layer of profile 27 to 9.04% in the surface layer of profile 22.the distribution pattern of CaCO3 tends to decrease with profile depths,except the soils profiles 21 and 24 where CaCO3 content tends to increase with soil depth.Gypsum content was mainly less than 7.65%.

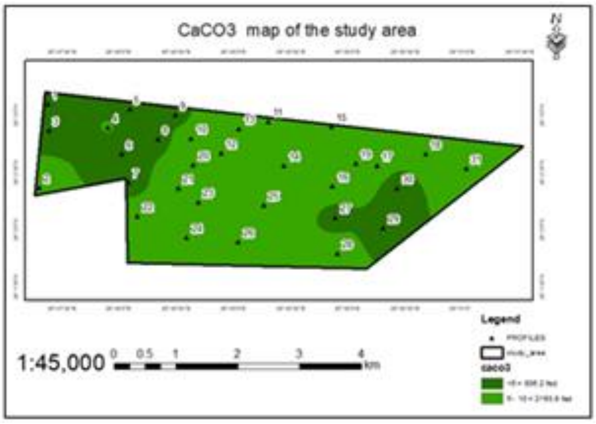
Table (3) pointed out that soils reaction values (pH) indicate that these soils are slightly to moderately alkaline as pH values varied from 7.6 to 7.9.Ec values ranged between 6 (slightly saline) to 99.1(very extremely saline). The distribution pattern of soluble cations in the studied soils are in general dollowed the descending order

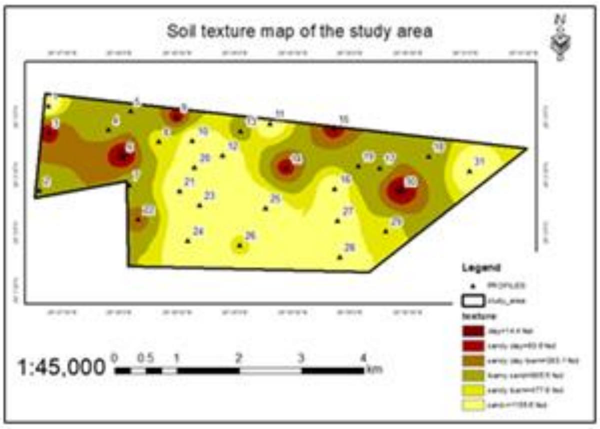
Ca^{++}>Na^{+}>Mg^{++}>k^{+}, while soluble anions of $SO4^{--}$ and cl- > HCO3-.

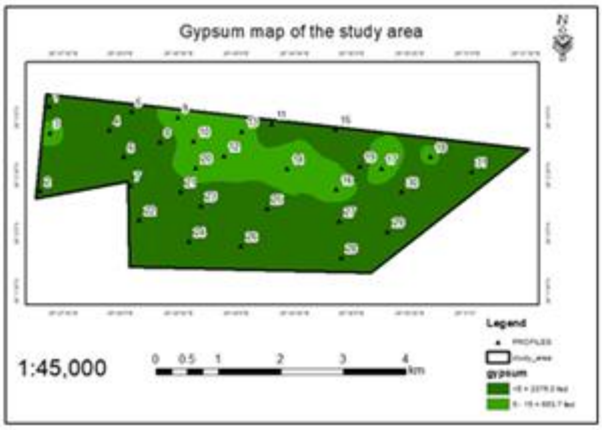
Soil mapping units:

The soil mapping units of the studied area were extracted from the overlay of the main soil properties layers in the GIS environment such as soil texture, soil depth, salinity, caco3 and gypsum content.(fig 5,6,7,8 and 9).









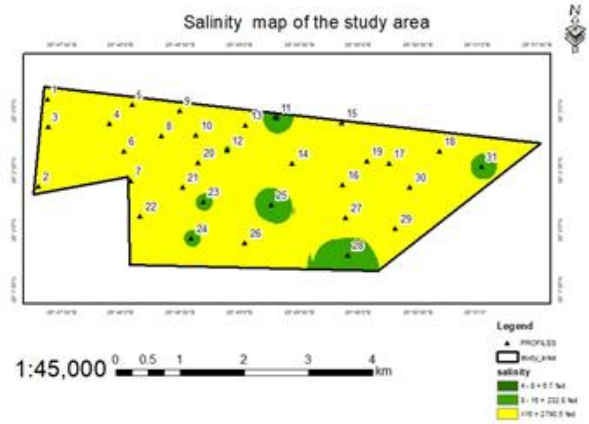


Table 4.the distribution pattern of some soil properties in the studied area

Soil property	classification	Area (Feddan)	%
Depth	Moderately deep	272.7	9%
	deep	2757.3	91%
	Total	3030	100%
ECe dS/m	4-8 ds/m	6.7	0.22%
	8-16 ds/m	232.8	7.68%
	>16 ds/m	2790.5	92.1%
	Total	3030	100%
CaCO3	<5%	836.2	27.6%
	5-10%	21.93.8	72.4%
	Total	3030	100%
Gypsum	<5%	2376.3	78.43%
	5-15%	653.7	21.57%
	Total	3030	100%
texture	Clay	14.4 fed	0.48%
	Sandy Clay	93.6 fed	3.1%
	Sandy clay loam	383.1 fed	12.64%
	Loamy sandy	905.5 fed	29.88%
	Sandy loam	477.8 fed	15.77%
	sand	1155.6 fed	38.14%
	Total	3030 fed	100%

Land Evaluation:

The studied soils are evaluated by matching between their characteristics and their ratings outlined by Sys and Verheye(1978)to get their suitability for agriculture in the current and potential state. The current study deals with spatial analysis techniques to evaluate the agricultural land capability in the studied area. The geomorphic units of the studied area were delineated by using the digital elevation model, LandSAT 8 image, and ground truth data of the studied area. The produced map represents the land forms of the studied area is imported in a geo-database and considered as a base map

A- Current land capability:

Table (5) and Fig(10) showed that the current land capability index of the studied geomorphic units. Data showed that there are three capability classes in the study area namely, moderately suitable (S2), marginally suitable (S3) and not suitable (N1). These classes could be divided into four subclasses i.e. S2s1,n, , S3s1,n, S3t,s,n,and N1s1,n. The obtained data showed that the most limiting factors in the soils of depression plain and Aeolian plain are texture class , and salinity, and alkalinity. The most limiting factors afficting the pedi plain soils are topography, physical properties(profile depth, texture) and salinity. The soils of pediplain were affected by soil texture and salinity and alkalinity with different intensity degrees(slight, moderate and severe)

Table 5. Currently and potential capability of the studied soils (according to Sys et al., 1991).

Geomorphic unit	Profile No.	Rating of factors														Capability index		Class		UNIT	
		Topography		Drainage		Texture		Depth		Calcium carbonate		Gypsum		Salinity/ alkalinity							
		(t)		(d)		(S1)		(S2)		(S3)		(S4)		(n)		(Ci)					
		C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P
Depression	1	95	100	100	100	31.1	31.1	100	100	95	95	100	100	80.00	100	22.45	29.55	N1	S3	$N1_{s1,n}$	$S3_{s1}$
	2	90	100	100	100	52.5	52.5	100	100	95	95	100	100	84.50	100	37.9	49.88	S3	S3	$S3_{s1,n}$	S3s1
	3	95	100	100	100	68.5	68.5	100	100	95	95	100	100	80.13	100	49.54	65.08	S3	S2	$S3_{s1,n}$	S2s1
	4	95	100	100	100	55.0	55.0	100	100	95	95	100	100	82.00	100	40.70	52.25	S3	S2	$S3_{s1,n}$	S2s1
	5	95	100	100	100	78.5	78.5	100	100	95	95	100	100	80.00	100	56.68	74.58	S2	S2	$S2_{s1,n}$	S1s1
	6	90	100	100	100	83.13	83.1	100	100	95	95	100	100	83.75	100	59.52	78.95	S2	S1	$S2_{s1,n}$	S2s1
	7	90	100	100	100	71.50	71.5	100	100	95	95	100	100	80.00	100	54.34	67.93	S2	S2	$S2_{s1,n}$	$N2_{s1,s2,s3,s4}$
	8	95	100	100	100	56.30	56.3	60	60	71	71	75	75	60.00	100	10.79	18.00	N1	N2	$N1_{s1,s3,n}$	S3s1
Aeolion plain	9	95	100	100	100	48.80	48.8	100	100	95	95	100	100	85.25	100	37.54	46.36	S3	S3	$S3_{s1,n}$	S3s1
	10	95	100	100	100	30.00	30.0	100	100	95	95	100	100	85.00	100	37.54	28.50	S3	S3	$S3_{s1,n}$	S3s1
	11	95	100	100	100	30.00	30.0	100	100	95	95	100	100	90.00	100	23.01	28.50	N1	S3	$N1_{s1,n}$	S3s1
	12	95	100	100	100	35.31	35.3	100	100	95	95	100	100	81.50	100	24.37	33.53	N1	S3	$N1_{s1,n}$	S3s1
	13	90	100	100	100	40.00	40.0	100	100	95	95	100	100	87.50	100	25.97	38.00	S3	S3	$S3_{s1,n}$	S3s1
	14	95	100	100	100	48.75	48.7	100	100	95	95	100	100	85.00	100	29.93	46.27	S3	S3	$S3_{s1,n}$	S3s1
	15	95	100	100	100	41.81	41.8	100	100	95	95	100	100	80.00	100	30.19	39.71	S3	S3	$S3_{s1,n}$	S3s1
	16	95	100	100	100	30.00	30.0	100	100	95	95	100	100	88.69	100	24.01	28.50	N1	S3	$N1_{s1,n}$	$S3_{s1}$
Aeolion plain	17	90	100	100	100	66.25	66.3	100	100	95	95	100	100	85.00	100	48.15	62.99	S3	S2	$S3_{s1,n}$	S2s1
	18	90	100	100	100	30.00	30.0	100	100	95	95	100	100	84.50	100	21.67	28.50	N1	S3	$N1_{s1,n}$	S3s1
	19	95	100	100	100	55.00	55.0	100	100	95	95	100	100	85.00	100	42.19	52.25	S3	S2	$S3_{s1,n}$	S2s1
Pedi plain	20	95	100	100	100	30.00	30.0	100	100	95	95	100	100	80.00	100	21.66	28.50	N1	S3	$N1_{s1,n}$	S3s1
	21	95	100	100	100	30.00	30.0	100	100	95	95	100	100	80.00	100	21.66	28.50	N1	S3	$N1_{s1,n}$	S3s1
	22	95	100	100	100	73.19	73.2	80	80	90	90	95	95	77.31	100	38.07	50.07	S3	S2	$S3_{s1,s2,s3,n}$	S2s1,s2,s3
	23	95	100	100	100	30.00	30.0	100	100	95	95	100	100	85.50	100	23.15	28.50	N1	S3	$N1_{s1,n}$	S3s1
	24	95	100	100	100	30.00	30.0	100	100	95	95	100	100	90.00	100	24.37	28.50	N1	S3	$N1_{s1,n}$	S3s1
	25	95	100	100	100	30.00	30.0	100	100	95	95	100	100	91.88	100	24.88	28.50	N1	S3	$N1_{s1,n}$	S3s1
	26	90	100	100	100	65.88	65.9	80	80	78	78	82	83	85.00	100	28.70	34.13	S3	S3	$S3_{s1,n}$	$S3_{s1,s2,s3,s4}$
	27	95	100	100	100	30.00	30.0	100	100	95	95	100	100	84.69	100	22.93	28.50	N1	S3	$N1_{s1,n}$	S3s1
	28	90	100	100	100	33.50	33.5	100	100	95	95	100	100	91.50	100	26.10	31.83	S3	S3	$S3t_{s1,n}$	S3s1
	29	90	100	100	100	75.00	75.0	90	90	95	95	100	100	85.00	100	49.06	64.13	S3	S2	$S3_{ts1,s2,n}$	S2s1,s2
	30	90	100	100	100	65.88	65.9	100	100	95	95	100	100	85.00	100	47.88	62.60	S3	S2	$S3_{ts1,n}$	S2s1
	31	90	100	72	100	62.56	62.6	60	60	91	91	96	96	80.50	100	19.01	32.81	N1	S3	$N1_{t,d,s1,s2,n}$	S3s1,s2,s3

S1 : soil depth (cm) , S2: Texture , S3 : $Caco_3$, S4: Gypsum and n= salinity & alkalinity

Si : high suitable , S2 : moderately suitable , S3: marginal suitable , N : not suitable

(100 – 75) (75-50) (50-25) (<25)

C: current P: potential

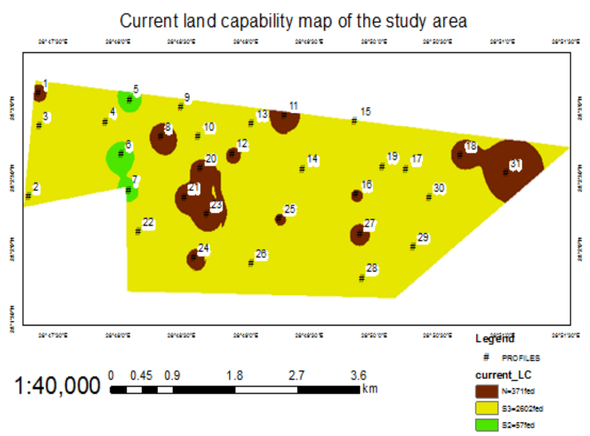


Fig .10. Current land capability map of the study area.

Potential land capability:

Further land improvements are required to correct or reduce the severity of limitations exiting in the studied area. These are such as 1) leveling the undulating surface. 2) leaching of soil salinity and reclamation of alkalinity existing in the soils, 3) using gypsum as soil amendment, 4) continuous application of organic manure to improve soil-physiochemical properties and fertility status, 5) application of modern irrigation systems, such as: drip and sprinkler to save irrigation water. By applying the previous improvement practices potential suitability of the studied soils could be amlurated to four suitability classes, namely highly suitable (S!), moderately suitable(S2), marginally suitable(S3), and not suitable(N1). This could be divided into four sub classes namely $S1_{s1}$, , $S2_{s1}S2_{s1,s2}$, $S3_{s1}$,and $N2_{s}$.(table 6) and fig (11)

Table 6. Current and Potential Suitability classification of the studied soil profiles.

Geomorphic Unit	Field crops: Crop	Si c	Si p	Class c	Class p	Vegetable crops: Crop	Si c	Si p	Class c	Class p	Fruits: Crop	Si c	Si p	Class c	Class p
Depression	Alfalfa	26.85	59.60	S3	S2	Cabbage	23.84	54.68	N1	S2	Citrus	10.24	25.04	N2	S3
	Barley	20.83	54.16	N1	S2	Green pepper	16.32	35.08	N1	S3	Guava	24.48	60.12	N1	S2
	Beans	4.35	14.87	N2	N2	Pea	18.88	49.59	N1	S3	Mango	14.41	29.83	N1	S3
	Sesame	25.52	58.25	S3	S2	Watermelon	25.90	60.86	S3	S2	Olives	36.54	68.18	S3	S2
	Sorghum	25.34	58.19	S3	S2	Tomato	11.32	27.56	N1	S3					
	Sunflower	17.72	46.70	N1	S3	Onion	16.51	34.05	N1	S3					
	Wheat	20.70	56.30	N1	S2										
	Maize	21.01	50.24	N1	S2										
Aeolien Plain	Alfalfa	24.65	56.29	N1	S2	Cabbage	25.28	55.12	S3	S2	Citrus	7.64	17.31	N2	N2
	Barley	17.55	50.1	N1	S2	Green pepper	11.54	23.98	N2	N2	Guava	27.27	63.11	S3	S2
	Beans	4.62	14.75	N2	N2	Pea	19.45	49.15	N1	S3	Mango	10.75	20.63	N2	N2
	Sesame	25.46	59.61	S3	S2	Watermelon	32.26	69.61	S3	S2	Olives	39.28	71.59	S3	S2
	Sorghum	23.02	52.08	N1	S2	Tomato	10.08	19.01	N2	N2					
	Sunflower	18.69	47.14	N1	S3	Onion	10.47	21.18	N2	N2					
	Wheat	17.54	51.85	N1	S2										
	Maize	21.44	49.15	N1	S3										
Pediplain	Alfalfa	28.32	64.28	S3	S2	Cabbage	31.18	65.96	S3	S2	Citrus	15.05	31.65	N1	S3
	Barley	22.46	55.33	N1	S3	Green pepper	25.10	50.94	S3	S2	Guava	28.23	64.47	S3	S2
	Beans	8.40	26.53	N2	S3	Pea	21.50	54.78	N1	S2	Mango	20.87	40.80	N1	S3
	Sesame	23.38	57.20	N1	S2	Watermelon	27.76	60.95	S3	S2	Olives	39.02	65.63	S3	S2
	Sorghum	28.93	61.76	S3	S2	Tomato	15.48	38.47	N1	S3					
	Sunflower	19.57	49.88	N1	S3	Onion	23.94	47.98	N1	S3					
	Wheat	21.49	57.86	N1	S2										
	Maize	24.14	55.46	N1	S2										

C: current **P: potential**

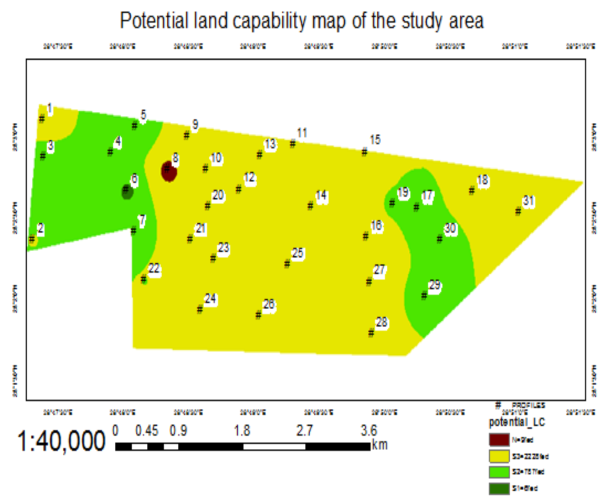


Fig. 11. Potential land capability map of the study area

Soils of grad(I) $S1_{s1}$:

This unit occupies an area of about (6 fed) . It represented soils of depression plain (profiles 6), capability index (Ci) is 78.95%. these soils have slight intensity of soil texture.

Soils of grade (II) ($S2_{s1}$)($S2_{s1,s2}$):

It is occupies an area of about (787 fed) . and represent the soils of depression plain (profiles 3,4,5,and 7), soils of Aeolian plain (profiles 17 and 19) and soils of pediplain(profiles 22,29,30)capability index (Ci) values varied from 50.07 to 74.58. these soils have moderate to very severe intensity of texture classes as soil limitation.

Soils of grade (III) ($S3_{s1}$):

Capability index (Ci) of this unit varied from 28.5 to 49.88 this unit occupies an area of about (2228 fed) . and represent the soils of dipression plain (profiles 1 and 2), Aeolian plain (profiles 9,10, 11, 12,13, 14,15,16, and18) and soils of pediplain (profiles 20,21,23, 24,25,26,27,and 31). These soils characterized by very severe to moderate intensity of soil texture as soil limitation.

Soils of grade (IV) $N2_s$

It is represented by profile 8 (depression plain) and occupies an area of about (9 fed) . where capability index (Ci) was 18.0 . These soils have severe intensity of soil texture and soil profile depth and moderate intensity of CaCO3 and gypsum limitations.

Land suitability classification for specific crops:

Eighteen crops (field crops, vegetable crops, and fruit trees)were selected to know their suitability for cultivation in the study area. Prevailing climatic condition taking in consideration.

By using parametric approach of land index mentioned by Sys et al. (1991) and (1993), the obtained data throw matching soil properties together there with crop requirements, Tables (8 & 9) led to the current and potential suitability index for each of the studied crops

Currently land suitability: According to Sys et al. (1993)

(1) Current land suitability for selected crops could be evaluated

land suitability of specific crops as given as follows:

(A) Depression plain Soils

Marginally Suitable (S3) for Alfalfa , Sesame , Sorghum , Watermelon and Olives , and not suitable (N1) for all the studied crops.

(B) Aeolian plain soils

Marginally Suitable (S3) for Sesame , Cabbage , Watermelon , Guava and Olives , and not suitable (N1) for all the studied crops.

(C) Pediplain Soils

Marginally Suitable (S3) for Alfalfa , Sorghum , Cabbage , Green pepper , Watermelon , Guava and Olives, and not suitable (N1) for all the studied crops.

(2) Potential land suitability:

According to Sys et al. (1993) the potential land suitability for selected crops could be evaluated after verifying aforementioned land improvement the potential land suitability of specific crops as given as follows:

(1) Depression plain Soils

moderately suitable (S2) for Alfalfa, Barley, Sesame, Sorghum, Wheat , Maize, Cabbage, Watermelon, Guava and Olive and marginally suitable (S3) for Sunflower, Green pepper, Pea, Tomato, Onion, Citrus and Mango, and not suitable (N2) for beans.

(2) Aeolian plain soils

moderately suitable (S2) for Alfalfa, Barley , Sesame, Sorghum , Wheat, Cabbage, Watermelon, Guava. and Olives Marginally Suitable (S3) for Sunflower, Maize and Pea and not suitable (N2) for Beans, Green Pepper, Tomato, Onion, Citrus and Mango.

(3) Pediplain Soils

Moderately suitable (S2) for of Alfalfa, Sesame, Sorghum, Wheat, Maize, Cabbage, Green Pepper, Pea, Watermelon, Guava and Olive and Marginally suitable (S3) for Barley, Beans, , Sunflower, Tomato, Onion, Citrus, and Mango.

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تقييم بعض أراضي الواحات البحرية والتخطيط الأمثل لاستغلالها زراعيا

إبراهيم محمد عبد الله

معهد بحوث الأراضي و المياه و البيئة – مركز البحوث الزراعية

تعد واحات البحرية من المناطق الواعدة للتوسع الزراعي في مصر ، والجدير بالذكر أن مسح التربة التفصيلي وتقييم الأراضي ومدى ملاءمتها للزراعة يعتبر من أهم الخطوات لتحقيق هذا الهدف والهدف من هذا البحث هو دراسة خصائص اراضي البويطي لتقييم قدرتها الانتاجية وصلاحيتها لزراعة المحاصيل الرئيسية باستخدام الاستشعار عن بعد (RS) ، نظم المعلومات الجغرافية (GIS) ، ونموذج sys لتقييم الأراضي حيث تم اختيار 31 قطاعا ارضيا للتربة (من أصل 158 تم وصفها في منطقة الدراسة وتحديد احداثيتها بأستخدام جهاز ال(GPS). وتم وصف المظاهر المورفولوجية وتم أخذ عينات من القطاعات للتحاليل المعملية. وفقًا لعمل RS و GIS ، تم التعرف على ثلاث وحدات أرضية. هذه الوحدات هي منخفض Depression plain (% 18.6) ، السهل الهوائيAeolian plain(% 28.6) ، و السهل التحاتي Pediplain (53.04%). تم إجراء الارتباط بين الوحدة الجيومورفولوجية والتربة ثم خرائط التربة التي تم إنشاؤها باستخدام برنامج ArcGIS 10.4.1. بناءً على خصائص التربة ، تم تقييم صلاحية التربة المدروسة حسب ملاءمتها للزراعة. الوضع الحالي ، تم تصنيفهم إلى فئات القدرات الخاصة بهم وهي مناسبة بشكل متوسطة الصلاحية (S2 =1.88%) ، هامشية (S3 =85.87%) ، وغير ملائمة (N =12.24%). وتعاني هذه التربة من محددات التربة والتي تشمل القوام والملوحة والقلوية والتضاريس وعمق قطاع التربة بدرجات شدة مختلفة (خفيفة ومتوسطة وشديدة). يمكن التغلب على بعض هذه المشاكل(الملوحة و القلوية و التضاريس) من خلال تحسين الأراضي في المستقبل. يمكن تصنيف الصلاحية المستقبلية (الكامنة) للتربة التي تمت دراستها إلى عالية الصلاحية (S1 =0.2%) ، ومتوسطة الصلاحية (S2 =25.97%) ، هامشيًا الصلاحية (S3 =73.53%) ، وغير صالحة دائما (N_2 =0.3). علاوة على ذلك ، تم تقييم ملاءمة 18 محصولًا رئيسيًا في هذه التربة في الوضع الحالي والكامن. وقد أشارت النتائج إلى أن هذه التربة غير مناسبة لبعض المحاصيل في الوضع الحالي. وبأجراء عمليات التحسين تصبح التربة ملائمة لزراعة المحاصيل الملاءمة وفقًا لشروط خصائص التربة ومتطلبات المحاصيل.