J. Agric. & Env. Sci. (Damanhour University) **2023, 22(1): 309-337**
Print: ISSN 1687-1464 **Online: 2735-5098**

EVALUATION OF SOIL CHEMICAL PROPERTIES VARIABILITY USING GIS TECHNIQUE IN WADI SAIDA AREA-ASWAN-EGYPT

Atef A. A. Sweed[1*], Ahmed Ghallab[1], Mohsen A. Gameh[2] and Hasnaa Naser H. Naser[1]

[1]Department of Soil and Natural Resources, Faculty of Agriculture, Aswan University, Egypt.[2]Department of Soil and Water, Faculty of Agriculture, Assiut University, Egypt.

***Corresponding author: Email:** atefsweed@agr.aswu.edu.eg

ABSTRACT

Accurate evaluating of soil properties is an important factor for assessing soil fertility, especially in newly reclaimed lands. Wadi El-Saida region (24° 57′ and 25° 06′ N latitude and 32° 39′ and 32° 48′) is regarded one of the most important agricultural investment areas adopted by the Egyptian government in order to achieve the goals of sustainable agricultural development in Aswan governorate. For this purpose, An 87 soil samples were collected positions from the surface and subsurface layers using GIS. Our findings obtained indicated that the soil pH ranged between 7.18 (slightly) and 9.05 (strongly alkaline). While, ECe (2.23-281.10 dSm^{-1}) and $CaCO_3$ (0.09 – 13.57%) indicated that the soil under study was varied among slight to very strongly saline (281.10 dS m^{-1}) and non-calcareous to strongly calcareous, respectively. Meanwhile, the cation Exchange Capacity (CEC) and exchangeable sodium percentage (ESP) ranged from 8.22 to 53.51 Cmol$_c$kg^{-1} and 0.50 to 93.49%, respectively. Furthermore, their content of soil organic matter (SOM), as their values did not exceed 2.91%. The correlation coefficient for all studied traits ranged between positive and negative, especially that the positive correlation of ECe has a positive correlation with ESP. In short, the studied area needs

strenuous efforts to reclaim it and make it suitable for cultivation through modifying its properties

Keywords: Soil chemical and physical properties, land reclamation and cultivation, geographic information system.

https://doi.org/10.21608/jaesj.2023.196694.1067

INTRODUCTION

In recent years, the Egyptian political leadership has started some agricultural investment projects such as Toshka and East Oweinat to achieve agricultural sustainable development objectives. Egypt has a total area of around 1,000,000 km2, with less than 4% of that being cultivated, leaving 96% of it to be desert. This area's Western Desert makes up roughly two-thirds of it. Additionally, Egypt, one of the developing nations, faces a significant agricultural output gap between production and consumption due to both the country's limited agricultural area and rising population (**Awad *et al.*, 2022**).

The agriculture is the backbone of economies of most development countries. Especially, in Egypt of which the agricultural sector represents about 40% of the workforces. Based on the aforementioned, the reclamation and cultivation of lands has become an urgent necessity in order to achieve self-sufficiency and reduce the volume of exports, especially of strategic crops that represent national security. Wadi Saida area is one of the promising areas, along with other agricultural projects that achieve this purpose. Wadi Saida, belonging to Aswan Governorate, 100 km to the north, and is located in the northwestern part of Edfu city. The project includes six villages, El-Shahama, Amr bin Al-As, El-Eman, El-Smaha, El-Ashraf (El-Alfin is an affiliated area to El-Ashraf), and El-Nmo. GIS is one of the important tools for producing soil fertility maps for an area, which helps us to write recommendations regarding fertilizer needs, as well as providing many information to understand the status of soil fertility at both spatial and temporal levels (**Thakor *et al.*, 2014**). Spatial distribution maps of soil chemical properties, obtained from soil surveys, help to determine soil fertility (**Brevik *et al.*, 2015**). Also, spatial distribution maps are important to know the processes of spatial variation of soil properties (**Moe *et al.*, 2019**). **NajafiGhiri *et al.*, (2010)** showed that soil fertility is determined on the basis chemical properties of soil such as soil organic matter content and soil reactivity.

In general, the studies available for soil evaluation in Egypt, the general trend of the Egyptian soil indicates that the soil pH ranged from neutral to highly alkaline, In addition to the decrease in the SOM. Moreover, there are significant differences in the values of EC, CEC, ESP and $CaCO_3$ based on the nature of the parent material and the prevailing climatic conditions (**Mohammed *et al.*, 2019; Ali *et al.*, 2015 and Elwa *et al.*, 2021**).

From this point of view, our research was accomplished with the aim of a comprehensive assessment of soil chemical properties at two different depths (0 -30 cm and 30 to 60 cm), representing surface and subsurface samples, to make reclamation and cultivation plans on scientific basis.

MATERIALS and METHODS

Study area description and climatic conditions

This study was carried out in t Wadi Saida region, Edfu district, Aswan. It is located about 100 km north of Aswan Governorate between latitudes 24° 57' and 25° 6' N and longitudes 32° 39' and 32° 48' E, Egypt and covers total area of 23,820 acres. It consists of six villages at different sea level elevations (82-127m). The Nile River is the main source of irrigation, which is transported by giant pumps. (Fig.1). The climatic data was averaged from the past 30 years (1992-2021), which is the average maximum temperature (27.88 to 45.27) and the average minimum temperature (3.3 to 23.66). The mean precipitation rate was less than 1mm.

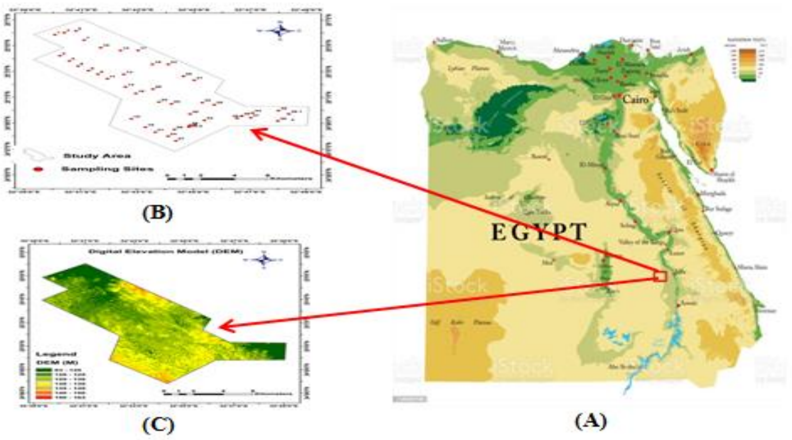


Fig. (1): Maps of the studied area showing Egypt map (A), soil sampling locations (B) and elevations of the studied area (C).

Soil Sample Collection and Preparation

An eighty seven samples were taken in December 2019 from forty-three positions from two depths (0-30 and 30-60 or 200 cm, respectively). The soil samples were collected and carefully transported for soils, water and plant analysis laboratory to the Faculty of Agriculture and Natural Resources, Aswan University. GPS was used to locate soil samples. Soil samples collected were based on differences in soil morphological characteristics in order to represent all soil types in each village. The data obtained included topographic maps drawn using ArcGIS 10.8.2 software (**ESRI, 2001**). The samples were air-dried, crushed, sieved to pass through 2 mm sieve, and characterized for their some soil properties according to procedure **Klute (1986)** and **Cottenie *et al.* (1982).**

Statistical analysis

Data were analyzed using XLSTAT 2022 to study the correlation between the estimated soil properties under study by calculating the Pearson’s linear correlation coefficients (**Machado and Conceicao, 2007**).

RESULTS AND DISCUSSION

Soil physical and chemical properties

Particle size distribution

Particle size distribution (PSD) is one an important factors that has an impact on soil properties and soil fertility (**Bechtold and Naiman 2006; Hamarashid *et al.*, 2010)**. The results in Table 2 indicated that, several classes were found in the surface and subsurface samples of the study site, according to the PSD of sand, silt, and clay. Which, they are signed in the soil texture triangle. The results indicated that the sand amounts ranged between 46.18 to 53.37% and from 91.26 to 93.00%, with an average of 78.73 to 79.96%. Silt content ranged from 2.99 to 1.75% and from 53.00 to 38.40.50%, with an average of 12.19 to 9.26%. The clay content ranged from 0.80 to 2.00 and 21.60 to 27.15%, with an average of 9.08 to 10.78% in the surface and subsurface samples, respectively. These results indicated that, the differences in soil texture and the increased amount of sand are probably due to the nature of the parent material (**Kiflu and Beyene, 2013; Mesfin *et al.*, 2018**). Based on these data, the sand content was higher than silt and clay in the study area, and this is due to the sandy nature and may be a result of the bedrock from which the soil was formed (**Opeyemi *et al.*, 2020**). The low silt and clay content may have been the result of their removal by wind erosion, but these results were consistent with **Thangasamy *et al.* (2005)**, who showed that the spatial distribution and PSD was most likely due to difference in parent material, weathering and topography. Accordingly, the soil texture was mostly loamy sand and sandy loam in about half of the area (53.49 and 50.00%) in the surface and subsurface layers, respectively. Then, it was sandy loam and sandy loam in about one-third of the area (32.56 and 36.36%) in the surface and subsurface samples, respectively. While the content of sand was estimated to be (9.30 and 11.36%) in the surface and subsurface layers, respectively.

Table 1. Particle size distribution and soil texture in surface and subsurface (0–30 and 30–60 and 200) samples in studied area.

Location	Site No.	Depth (cm)	Particle-size distribution (%)			Soil texture	Location	Site No.	Depth (cm)	Particle-size distribution (%)			Soil texture
			Sand	Silt	Clay					Sand	Silt	Clay	
El-Alfin	1	0-30	79.60	10.40	10.00	LS	Amr Ebn Alas	12	0-30	82.44	10.27	7.29	LS
		30-60	80.40	8.00	11.60	SL			30-60	79.20	7.20	13.60	SL
	2	0-30	74.00	14.00	12.00	SL		13	0-30	74.00	21.60	4.40	SL
		30-60	76.00	12.40	11.60	SL			30-60	78.56	4.99	16.45	SL
Al-Ashraf	3	0-30	62.00	16.40	21.60	LS	Al-Shahama	14	0-30	87.20	5.20	7.60	LS
		30-60	84.00	12.00	4.00	SL			30-60	86.80	6.00	7.20	LS
	4	0-30	72.00	12.40	15.60	SL		15	0-30	77.20	12.80	10.00	SL
		30-60	59.60	38.40	2.00	SL			30-60	78.00	9.20	12.80	SL
	5	0-30	89.20	5.20	5.60	S		16	0-30	80.80	9.20	10.00	LS
		30-60	86.40	6.40	7.20	LS			30-60	82.00	7.60	10.40	LS
	6	0-30	82.40	16.80	0.80	LS		17	0-30	83.01	7.08	9.91	LS
		30-60	82.78	5.83	11.38	LS			30-60	85.43	7.43	7.14	LS
	7	0-30	64.14	20.18	15.68	SL		18	0-30	86.26	6.08	7.66	LS
		30-60	60.45	24.28	15.27	SL			30-60	89.24	4.71	6.05	S
	8	0-30	68.76	29.70	1.54	SL		19	0-30	86.62	5.11	8.27	LS
		30-60	82.29	7.25	10.46	LS			30-60	82.68	4.57	12.75	SL
Amr Ebn Alas	9	0-30	46.18	53.00	0.82	SiL	El-Eman	20	0-30	87.83	6.99	5.18	S
		30-60	56.28	28.34	15.38	SL			30-60	91.62	3.27	5.12	S
	10	0-30	76.00	20.40	3.60	LS		21	0-30	62.78	23.29	13.93	SL
		30-60	76.00	10.80	13.20	SL			30-60	53.37	19.48	27.15	SCL
	11	0-30	62.48	17.24	20.27	SCL		22	0-30	86.91	7.81	5.28	LS
		30-60	62.40	18.00	19.60	SL			30-60	82.28	3.48	14.24	SL

LS = Loamy sand, SL= Sandy loam, S= Sand, SiL = Silty loam and SCL= Sandy clay loam

Table 1. *Cont.*

Loc	Site No.	Depth (cm)	Particle-size distribution (%)			Soil texture
			Sand	Silt	Clay	
El-Eman	23	0-30	82.41	10.22	7.38	LS
		30-60	81.38	6.24	12.38	SL
	24	0-30	87.09	6.13	6.78	LS
		30-60	83.32	5.32	11.37	LS
	25	0-30	86.98	4.71	8.31	LS
		30-60	84.10	4.70	11.20	LS
Al-Nemo	26	0-30	75.60	13.96	10.44	SL
		30-60	83.38	7.46	9.16	LS
	27	0-30	83.61	7.69	8.70	LS
		30-60	83.34	5.53	11.13	LS
	28	0-30	78.19	13.40	8.41	SL
		30-60	81.15	10.48	8.37	LS
	29	0-30	83.10	7.88	9.02	LS
		30-60	79.09	11.63	9.28	SL
	29*1	0-30	84.14	7.18	8.68	LS
		30-60	84.85	6.53	8.62	LS
	29*2	0-30	84.69	5.53	9.78	LS
		30-60	85.76	5.34	8.90	LS
	30	0-30	85.41	6.84	7.75	LS
		30-60	88.78	3.84	7.38	S
	31	0-30	77.03	10.69	12.28	SL
		30-60	79.10	9.44	11.46	SL

Loc	Site No.	Depth (cm)	Particle-size distribution (%)			Soil texture
			Sand	Silt	Clay	
Al-Shahama	32	0-30	82.79	11.62	5.58	LS
		30-60	79.65	8.56	11.79	SL
	33	0-30	82.63	7.87	9.50	LS
		30-60	83.38	10.42	6.20	LS
	34	0-30	65.97	23.58	10.45	SL
		30-60	78.16	9.40	12.43	SL
	35	0-30	91.26	3.26	5.48	S
		30-60	84.20	5.81	9.99	LS
	36	0-30	80.68	5.56	13.76	SL
		30-60	76.12	11.06	12.82	SL
	36*1	0-30	86.46	2.99	10.56	LS
		30-60	87.27	4.53	8.20	LS
	37	0-30	82.95	5.74	11.32	LS
		30-60	78.80	8.40	12.80	SL
	38	0-30	70.72	19.00	10.28	SL
		30-60	75.56	10.46	13.98	SL
	38*1	0-30	71.71	14.67	13.62	SL
		30-60	79.72	6.92	13.36	SL
	39	0-40	90.34	4.41	5.25	S
		40-100	92.45	3.82	3.73	S
		100-200	93.00	1.75	5.24	S

LS = Loamy sand, SL= Sandy loam and S= Sand.

While the silt loam texture (2.33%) was present only in the surface samples. While the texture of sandy loamy clay was formed (2.33 and 2.27%) in the surface and subsurface samples, respectively. This result reflects the nature studied area (**Table 1 and Figure 2**). These results supported the results **Abd El-Azem,** (**2016 and 2020**).

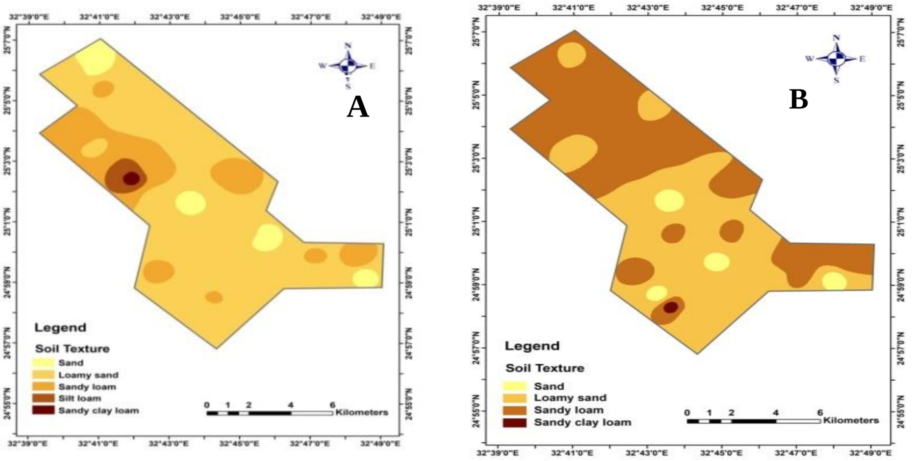


Fig. 2. Spatial distribution of soil texture at the surface (A) and subsurface samples (B) of the studied area.

Soil Chemical characteristics.

Soil pH

The results depicted in **Tables 2 and 4** show that the lowest soil pH values (7.18 vs. 7.31) were obtained in samples 6 and 33 at the surface and subsurface layers, respectively. While the maximum soil pH values (8.76 vs. 9.05) were detected in samples 25 and 39 at the surface and subsurface layer, respectively. Based on the averages of the obtained values, about 23.25, 51.16, 23.26 and 2.33% of the samples at the surface layer classified into near neutral, slightly alkaline, moderately alkaline and strongly alkaline, respectively. While, at the subsurface samples, about 9.09, 54.55, 31.81and 4.55% classified as near neutral, slightly alkaline, moderately alkaline and strongly alkaline, respectively

(**Table 3**). Soil pH values showed ranged between near natural (7.18) to strongly alkaline (9.05) in the overall studied area. This is due to the bedrock of the soil and the dominance of basic cations such as (Ca^{2+} and Mg^{2+}), alongside, low precipitation. (**Hamad and Khalafalh, 2007**). Our findings were consistent with those of **Sweed and awad, (2020),** they mentioned that soil pH in upper Egypt, in general, ranged was near neutral to strongly alkaline. **(Table 3** and **Fig. 3).**

Table 2. Spatial distribution of soil chemical properties in surface and subsurface layers (0–30 and 30–60 and 200 cm) in studied area.

Location	**Site No.**	**Depth (cm)**	**pH (1:2.5 susp.)**	**ECe (dSm^{-1})**	**$CaCO_3$ (%)**	**CEC ($Cmolc·kg^{-1}$)**	**ESP (%)**	**SOM (%)**
El-Alfin	1	0-30	7.72	10.10	1.39	21.15	1.52	1.11
		30-60	8.14	9.93	0.87	20.35	2.14	0.61
	2	0-30	7.42	7.12	5.74	25.10	1.96	0.93
		30-60	7.53	18.45	5.22	24.85	3.15	1.17
Al-Ashraf	3	0-30	7.46	27.69	0.96	39.55	10.87	0.67
		30-60	7.52	49.52	2.96	18.70	12.67	0.20
	4	0-30	7.43	16.69	6.96	29.20	6.00	0.61
		30-60	7.41	19.64	7.39	41.51	5.09	2.33
	5	0-30	7.51	13.39	5.65	16.71	1.90	1.75
		30-60	8.33	8.77	11.22	14.41	4.15	0.82
	6	0-30	7.18	13.12	0.78	18.21	4.77	0.64
		30-60	7.68	14.26	1.74	17.81	2.13	1.89
Al-Smaha	7	0-30	7.56	4.74	1.22	36.71	3.71	1.75
		30-60	7.57	2.23	0.52	37.02	1.22	1.37
	8	0-30	7.90	3.68	2.61	31.21	0.86	1.37
		30-60	8.14	7.00	1.04	18.41	0.72	0.50
Amr Ebn Alas	9	0-30	8.23	3.43	2.17	53.51	9.52	0.67
		30-60	8.02	5.10	2.70	45.61	16.99	1.11
	10	0-30	7.79	7.08	2.17	28.81	0.98	1.89
		30-60	7.85	7.07	0.87	24.41	1.30	0.64
	11	0-30	7.86	4.26	2.96	38.81	0.58	0.87
		30-60	7.66	9.83	2.09	38.51	0.77	0.41

Table 2. *Cont.*

Loc.	Site No.	Depth (cm)	pH (1:2.5 susp.)	ECe (dsm^{-1})	$CaCO_3$ (%)	CEC (Cmolc·kg^{-1})	ESP (%)	SOM (%)
Amr Ebn Ala	12	0-30	7.82	7.97	2.87	18.61	2.60	0.90
		30-60	7.95	7.70	1.74	21.41	0.96	1.60
	13	0-30	7.99	5.54	2.35	27.92	0.71	1.63
		30-60	7.96	5.69	3.39	22.02	0.50	1.46
Al-Shahama	14	0-30	7.40	9.11	1.04	14.51	0.80	1.69
		30-60	7.67	8.73	1.30	13.41	2.23	1.25
	15	0-30	7.29	7.43	1.30	24.61	1.03	2.53
		30-60	7.62	5.66	0.87	20.21	0.88	1.17
	16	0-30	8.25	25.56	3.91	20.51	81.27	1.60
		30-60	8.35	10.10	3.48	19.41	15.48	0.93
	17	0-30	7.76	6.36	1.74	17.81	1.24	2.71
		30-60	7.79	6.12	3.57	15.61	1.19	1.34
	18	0-30	7.86	8.19	1.30	14.41	1.19	1.69
		30-60	7.96	8.57	0.87	10.02	1.52	2.04
	19	0-30	8.19	7.26	1.39	14.51	0.92	1.02
		30-60	8.17	10.90	0.87	14.31	0.92	0.78
El-Eman	20	0-30	8.28	10.39	1.74	14.61	6.47	0.87
		30-60	8.29	12.02	1.65	9.41	1.17	0.58
	21	0-30	7.32	6.39	4.70	37.92	4.60	2.33
		30-60	7.88	4.32	4.35	47.82	7.72	1.08
	22	0-30	7.83	7.71	2.17	15.72	1.11	1.75
		30-60	8.09	11.11	1.74	19.12	0.78	2.36
El-Eman	23	0-30	7.89	9.58	2.96	19.31	0.89	2.59
		30-60	7.95	9.90	2.09	19.24	0.80	2.06
	24	0-30	8.10	268.41	2.00	42.31	93.49	2.42
		30-60	7.98	171.44	2.87	40.71	88.57	0.76
	25	0-30	8.76	82.41	3.04	29.62	86.99	2.15
		30-60	8.19	19.12	3.48	14.52	26.34	1.75

Soil pH = soil reaction, ECe = soil electrical conductivity, $CaCO_3$ = calcium carbonate content, CEC = cation exchange capacity and SOM = soil organic matter.

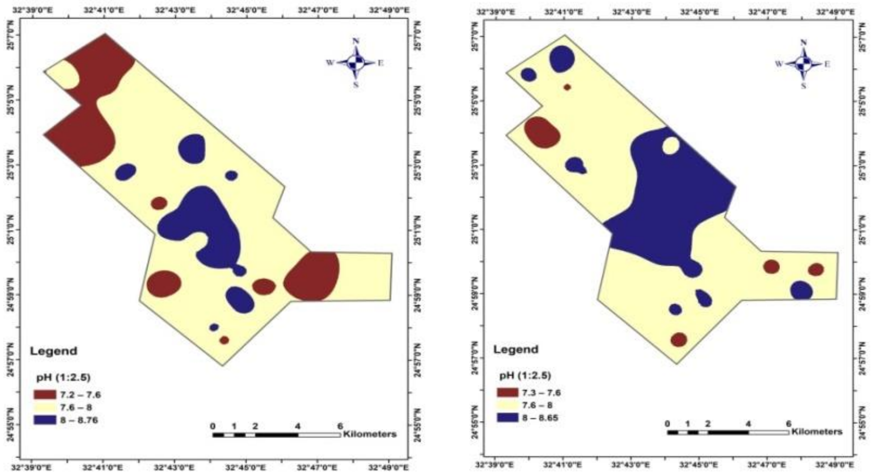
Table 2. *Cont.*

Loc.	**Site No.**	**Depth (cm)**	**pH (1:2.5 susp.)**	**ECe (dsm^{-1})**	**$CaCO_3$ (%)**	**CEC ($Cmolc \cdot kg^{-1}$)**	**ESP (%)**	**SOM (%)**
Al-Nemo	26	0-30	7.79	8.89	2.17	27.71	0.95	2.30
		30-60	8.08	10.74	4.35	16.82	1.95	1.66
	27	0-30	7.54	49.00	3.04	17.42	1.65	0.15
		30-60	7.43	64.47	4.00	17.26	1.39	0.82
	28	0-30	8.04	10.60	2.26	22.02	6.82	2.01
		30-60	8.31	15.72	1.91	19.80	1.04	1.78
	29	0-30	8.30	24.84	2.00	17.52	14.42	1.22
		30-60	7.56	59.16	1.30	21.82	8.77	1.08
	29*1	0-30	8.43	17.14	1.74	17.26	5.93	1.51
		30-60	8.65	18.84	0.78	15.96	2.66	1.46
	29*2	0-30	7.88	44.72	2.00	15.96	53.05	2.16
		30-60	7.91	16.11	3.48	16.82	8.70	1.46
	30	0-30	8.05	17.91	4.35	15.82	1.56	1.51
		30-60	8.10	11.96	4.00	13.61	0.87	1.49
	31	0-30	7.59	109.73	4.00	23.92	34.70	1.78
		30-60	8.20	110.57	4.87	21.31	54.04	1.17
Al-Shahama	32	0-30	7.82	16.95	4.09	18.21	2.48	2.18
		30-60	7.89	13.00	4.35	21.21	0.62	1.51
	33	0-30	7.18	7.70	0.17	18.61	0.97	2.91
		30-60	7.31	7.33	0.09	14.51	1.25	2.33
	34	0-30	7.20	19.72	0.87	34.20	8.69	1.46
		30-60	7.45	29.51	2.35	22.21	0.52	1.40
	35	0-30	7.88	237.70	1.74	23.12	51.02	2.31
		30-60	7.93	135.23	3.48	17.92	43.62	1.81
	36	0-30	7.56	11.57	13.48	20.31	0.73	2.48
		30-60	7.75	13.90	12.61	24.62	0.81	1.75
	36*1	0-30	7.39	10.46	6.96	15.21	1.16	1.95
		30-60	7.74	8.46	4.35	14.62	2.73	1.89
	37	0-30	7.56	281.10	8.26	40.52	92.54	1.31
		30-60	7.70	55.83	13.57	21.21	34.18	1.17
	38	0-30	7.88	14.78	3.91	30.82	77.12	2.18
		30-60	7.69	47.72	4.52	23.62	40.32	1.89
	38*1	0-30	8.10	13.59	3.57	29.51	29.10	1.86
		30-60	7.51	43.03	6.09	19.21	21.86	1.69
	39	0-40	7.78	17.71	0.43	10.22	2.73	1.02
		40-100	8.26	13.31	0.17	9.62	1.51	1.08
		100-200	9.05	13.74	0.09	8.22	20.12	1.25

Soil pH = soil reaction, ECe =soil electrical conductivity, $CaCO_3$ = calcium carbonate content, CEC = cation exchange capacity and SOM = soil organic matter

Table 3. Soil reaction (pH) classification for the studied area.

pH (1:2.5 susp.)	(6.50 - 7.50) Near neutral	(7.50 – 8.0) Slightly alkaline	(8.0 - 8.50) Moderately alkaline	(> 8.50) Strongly alkaline	Reference
Surface layer	23.25%	51.16%	23.26%	2.33%	**Kumar *et al.*, (2009)**
Subsurface layer	9.09%	54.55%	31.81%	4.55%	



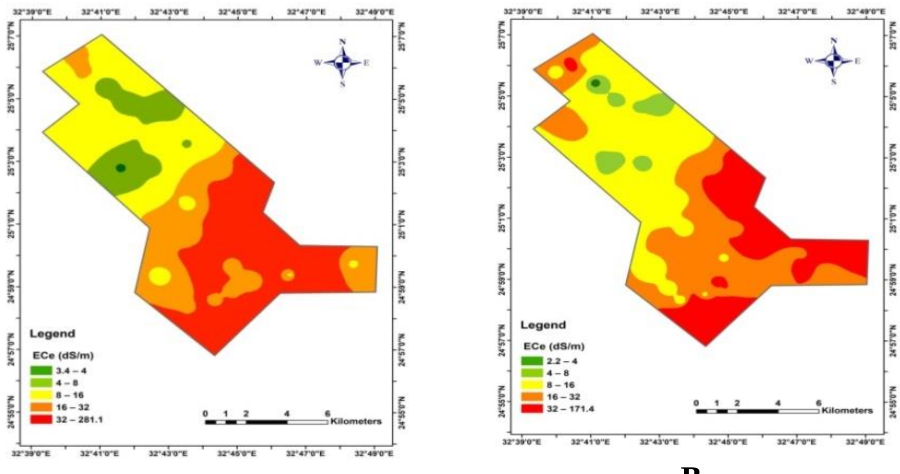
A **B**

Fig. 3. Spatial distribution of soil pH at the surface (A) and subsurface samples (B) (0–30 and 30–60 and 200 cm) of the studied area.

Soil Electrical conductivity

The results of ECe, as seen in **Table 2**, revealed that the values varied among 2.23and 281.10 dS.m^{-1} in samples 7 and 37, respectively with an average 30.11 dSm^{-1}. According to **Abrol *et al.* (1988)**, the soil was classified into five classes**;** ECe <2.0 dS.m^{-1} (non-saline); (EC$_e$ 2 - 4 dSm^{-1}) slightly saline; (ECe 4-8 dSm^{-1}) moderately saline; (ECe 8-16 dSm^{-1}) strongly saline and (EC$_e$ >16 dSm^{-1}) very strongly saline. Accordingly, our results indicated that 4.65, 27.91, 30.23 and 37.21% of surface layers were slightly saline, moderately saline, strongly saline and very strongly saline respectively. Moreover, 2.27, 20.46, 43.18 and 34.09 % in the subsurface layers were classified into slightly saline, moderately saline, strongly saline and very strongly saline, respectively (**Table 4 and Figure 4**). The observed increase of EC$_e$ values may be attributed as a result of high concentrations of soluble ions, such as Na$^+$ and Cl$^-$ ions**.** Moreover, the prevailing climate conditions, including high temperature, increase evaporation and low of precipitation in the study area led to an increase in soil salinity. These results were confirmed with **Bannari, (2020**).

It was observed that the EC$_e$ values in both surface and subsurface layers increased together. The lower EC$_e$ values in the soil surface layer may be related to the effect of irrigation process on leaching and/or the movement of soluble salts from the surface toward subsurface layer.



A **B**

Fig. 4. Spatial distribution of electrical conductivity (ECe) at the surface (A) and subsurface samples (B) of the studied area.

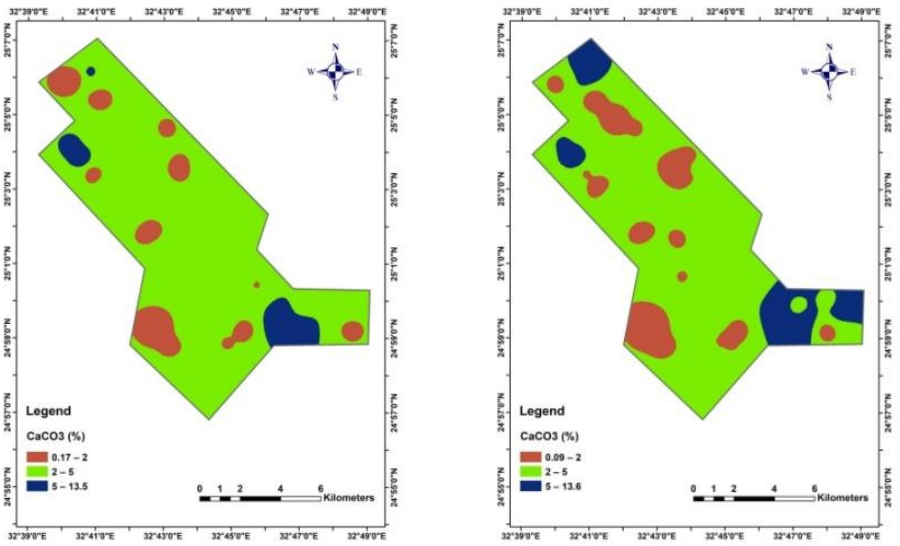
Table 4. Electrical conductivity (ECe) classification for the studied area.

ECe dSm^{-1}	Slightly saline (2-4)	Moderately saline (4-8)	Strongly saline (8-16)	Very strongly saline (>16)	Reference
Surface	4.65%	27.91%	30.23%	37.21%	**Abrol et al. (1988)**
Subsurface	2.27%	20.46%	43.18%	34.09%	

Total calcium carbonate ($CaCO_3$)

As shown in **Table 2**, the results displayed a wide variation of $CaCO_3$ content. It ranged among 0.09 % in the samples 33 and 39 to 13.57 % in the sample 37 with an average of 3.16 %**.** Our results were agreement with those of **Moursy *et al.*, (2020**), they reported that the $CaCO_3$ in East Sohag region (part of upper Egypt) ranged between 4.06 and 14.57%. According to the **FAO, 2006**), about 34.88, 62.79 and 2.33% of the surface soil samples were slightly calcareous (between 0 and 2%), and moderately calcareous (between 2 and 10%), and strongly calcareous (between 10 to 25%), respectively. While they were 40.91, 52.27 and 6.82% in the subsurface layers of the measured samples classified fall low calcareous, moderate calcareous and strong calcareous, respectively **Awad and Sweed, (2020)** (**Table 5 and Fig. 5**).

In general, these results are mostly associated with coarse and moderately coarse textured soils **(Sayed. 2013).** In conclusion, these results can be explained due to the prevailing continental climatic conditions at the study location, as a result of low evaporation rate sand coarse-textured soils. (**El-Sayed, et al., 2016**).



A **B**

Figure 5. Spatial distribution of total calcium carbonate (TCC) at the surface (A) and subsurface samples (B) of the studied area.

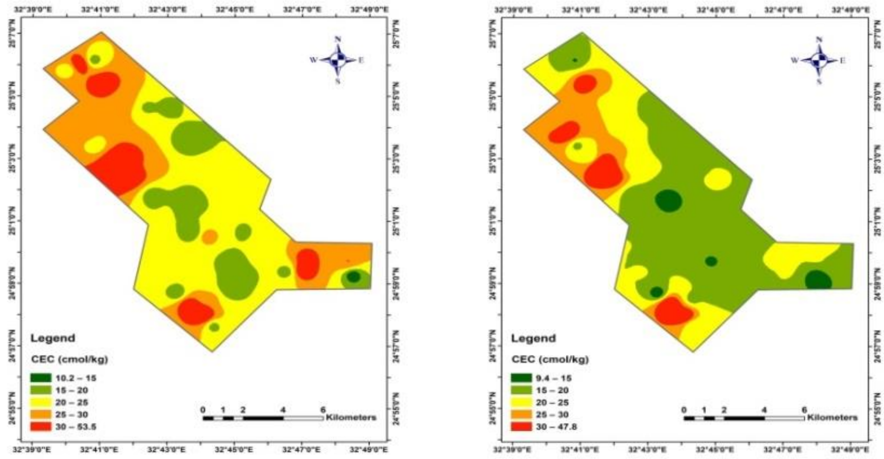
Table 5. Total calcium carbonate (TCC) classification for the studied area.

Total $CaCO_3$ (%)	**Slightly calcareous (0-2)**	**Moderately calcareous (2-10)**	**Strongly calcareous (10-25)**	**Reference**
Surface layers	34.88%	62.79%	2.33%	**FAO, (2006)**
Subsurface layers	40.91%	52.27%	6.82%	

Cation exchange capacity (CEC)

The results are related with Table 2 revealed that the CEC values varied among 10.22 to 53.51 $Cmol_c kg^{-1}$ with an average of 24.41 $Cmol_c kg^{-1}$ at the surface layers of the measured samples. While, it was 8.22 to 47.82 $Cmol_c kg^{-1}$, with an average of 21.12 $Cmol_c kg^{-1}$ at the subsurface layers (**Table 2**). It was also noticed that, in most cases, the surface soil samples had higher CEC values than the subsurface ones. This may be due to high content of SOM in surface soil layers. Furthermore, the soil mineral and organic colloids have the ability to increase soil CEC. Thus, soils containing high clay and SOM have high CEC values (**Tomasic *et al.*, 2013**).

The highest CEC value was recorded for a silty loam textured soil sample while the lowest value was found in a sand-textured soil sample. According to the CEC classification described by **Metson, (1961),** CEC values were 2.33, 55.81, 34.88 and 6.97% at the surface samples of the measured samples classified into low (6-12 Cmolc·kg^{-1}), moderate (12-24 Cmol$_c$kg^{-1}), high (24-40 Cmol$_c$kg^{-1}) and very high (value > 40 Cmol$_c$kg^{-1}), respectively **(**Fig. 6 **)**. On the other side, the CEC values were 9.09, 70.45, 11.36 and 9.09% in the low, medium, high and very high subsurface soil samples, respectively (**Table 6 and Fig. 6**).



A B

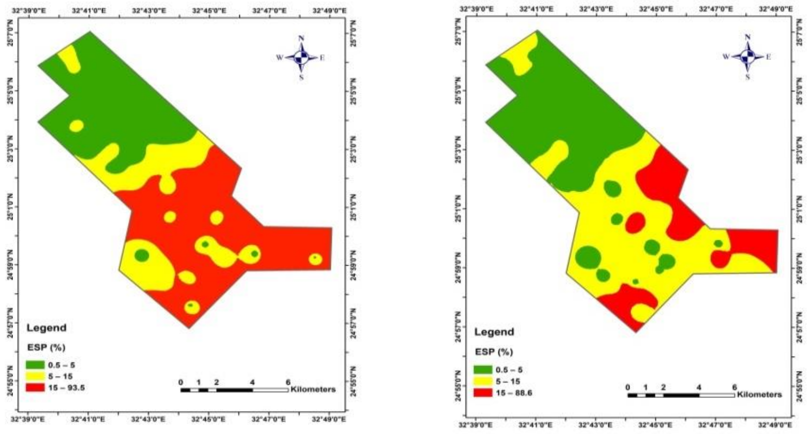
Fig. 6. Spatial distribution of cation exchangeable capacity (CEC) at the surface (A) and subsurface samples (B)) of the studied area.

Table 6. Cation exchangeable capacity classification for the studied area.

CEC	Low (6-12 Cmol$_c$kg^{-1})	Moderate (12 - 24 Cmolckg−1)	High (24 - 40 Cmol$_c$kg^{-1})	Very high (> 40 Cmol$_c$kg^{-1})	Reference
Surface layers	2.33%	55.81%	34.88%	6.97%	**Metson, (1961)**
Subsurface layers	9.09%	70.45%	11.36%	9.09%	

Exchangeable sodium percentage (ESP)

ESP is one of the best criteria for assessing soil sodicity (**Gharaibeh *et al.*, (2021**). The ESP varied from 0.58 to 93.49% with an average value of 16.55% at surface soil samples in the studied area. While, they were 0.50 to 88.57 %, with an average of 10.14 % at the subsurface layers **(**Table 2**).** Most of the soil samples have ESP values of less than 15 %. Were 79.07 to 77.27 % of the samples had ESP values less than 15% at surface and subsurface soil samples, respectively (Table 7 and Fig. 7).



A   **B**

Fig. 7. Spatial distribution of Exchangeable sodium percentage (ESP) at the surface (A) and subsurface layers (B) of the studied location.

A low ESP showed a low sodicity risk and the highest ESP values are related to high salinity and dominance of soluble sodium in the soil solution. Therefore, most of the soil profiles under study are coarse textured, which facilitate the potential to decrease the ESP if an efficient drainage system is established. These findings agree with those reported by **(Gameh *et al.*, 2020).**

Table 7. Exchangeable sodium percentage (ESP) classification for the studied area.

ESP %	No Sodicity <15	Sodicity >15	Reference
Surface	79.07%	20.93%	**Richards, (1954)**
Subsurface	77.27%	22.73%	

Organic matter content

With regard to soil organic matter (SOM) values, our results showed that, the SOM varied from 0.15 to 2.91% and 0.20 to 2.36% with an average of 1.64 and 1.34% with the surface and subsurface layers, respectively as presented in Table 2**.** These results are matched with those found by **Ali *et al.*, (2018),** however they reported that the SOM in Abu Suberia Valley- Aswan, ranged from 0.02 to 2.47 %. It is noted that the SOM content in the surface soil layers was higher than its content in the subsurface layers. This variation between both layers could be explained due to the accumulation of plant residues and microorganisms activity in the surface soil layers (**Hobley and Wilson, 2016**; **Awad and Sweed, 2020**). Based on the values obtained from our study, the soil tested was classified into into low (<0.86%), medium (0.86-1.29 %) and high (> 1.29) **Kumar *et al.*, (2014)**. While, in the subsurface layer was divided into 22.73 % (low), 25.00 % (medium) and 52.27% (high) Where, the low content of SOM was associated with coarse soil texture and high-temperature. These results were also similar to those found by **Patil *et al.*, (2016)**.

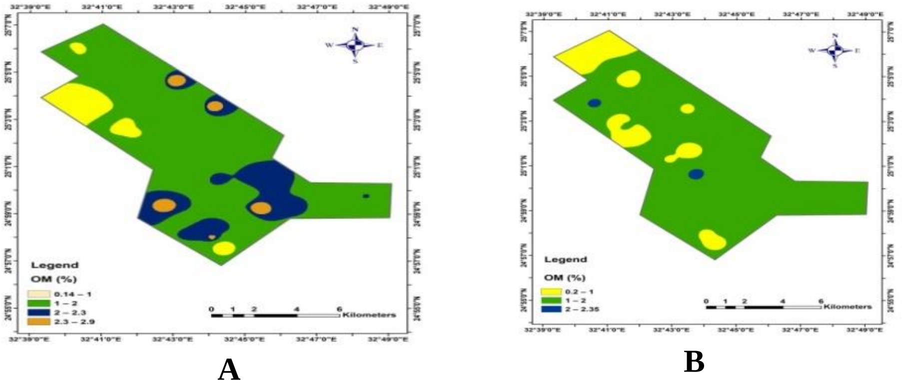


Fig. 8. Spatial distribution of soil organic matter (SOM) at the surface (A) and subsurface layers (B) of the studied location.

Table 8. Soil organic matter classification for the studied area.

SOM*	**Low**	**Medium**	**High**	**Reference**
(%)	**(< 0.86 %)**	**(0.86- 1.29 %)**	**(> 1.29 %)**	
Surface layers	11.63%	18.60%	69.77%	**Kumar *et al.*, (2014)**
Subsurface layers	22.73%	25%	52.27%	

Correlation between the studied properties

The data listed in Table 9 showed a remarkable correlation between PSD and some chemical properties of the studied soil in surface layers (0–30 cm) and subsurface layers (30–60 and 200 cm). Silt content has a significant positive correlation with CEC **(r = 0.681)**, (**r = 0.793**) at surface and subsurface soil samples, respectively. While, clay has a significant positive correlation with CEC (r=**0.597**) at only subsurface soil. And another significant positive correlation between sand content with soil pH **(r = 0.407)** at only subsurface soil layers**,** but there are a significant negative correlation between silt and pH **(r= -0.434)**. But, significant negative correlation was found for surface and subsurface soil between sand and clay **(r = -0.339)**, (**r = -0.643**), respectively.

Furthermore, there were a significant negative correlation between silt and sand content (**r = -0.885**), (r = **-0.872**) in both soil layers, respectively. In general, sand content has a significant negative correlation with CEC **(r = -0.781)**, (**r = -0.915**) at the surface and subsurface soil layers respectively **(**Table 10**).** Regarding the correlations of soil pH, the results indicated that soil pH had a positive correlation with ESP (r = 0.353) in surface soil samples. While, it has a negative correlation with CEC (r = -0.346), (**Table 2**). The high pH values would be attributed to the high ESP. These results are consistent with those **Abd El-Azem (2020).**

Table 9. Correlation coefficients between particle size distribution and chemical properties of studied soils

Parameter	Clay	Silt	Sand	pH	ECe	$CaCO_3$	CEC	ESP	SOM
Surface layers (0-30 cm)									
Clay	**1**								
Silt	-0.137	**1**							
Sand	**-0.339**	**-0.885**	**1**						
pH	-0.268	-0.032	0.156	**1**					
ECe	-0.013	-0.297	0.288	0.115	**1**				
$CaCO_3$	0.265	-0.125	-0.006	-0.018	0.159	**1**			
CEC	0.287	**0.681**	**-0.781**	0.002	0.304	0.092	**1**		
ESP	0.034	-0.181	0.156	**0.353**	**0.738**	0.171	**0.344**	**1**	
SOM	-0.027	-0.215	0.217	-0.077	0.139	0.066	-0.059	0.185	**1**
Subsurface layers (30-60 and 200 cm)									
Clay	**1**								
Silt	0.187	**1**							
Sand	**-0.643**	**-0.872**	**1**						
pH	-0.137	**-0.434**	**0.407**	**1**					
ECe	-0.056	-0.126	0.126	-0.074	**1**				
$CaCO_3$	0.053	0.164	-0.154	-0.120	0.148	**1**			
CEC	**0.597**	**0.793**	**-0.915**	**-0.346**	0.145	0.159	**1**		
ESP	0.041	-0.066	0.031	0.141	**0.866**	0.184	0.240	**1**	
SOM	-0.105	0.076	-0.008	-0.145	-0.107	0.071	-0.079	-0.074	**1**

Also, data showed the correlation between ECe and the soil chemical properties studied in the surface (0–30 cm) and subsurface layers (30–60 and 200 cm). ECe has a significant positive correlation with ESP **(r = 0.738)**, (**r = 0.866**) at surface and subsurface soil samples, respectively. It seems from correlation relationship that EC_e attributed with high sodium content from soluble salts anions in soil extract.

While, CEC has a significant positive correlation with ESP **(r = 0.344)** at only surface soil samples. Correlation relationship showed that CEC increases with increase of fine fractions such as silt and clay in the soil samples and this rise in CEC values is due to the fine fractions (silt and clay) have high surface area and negative surface charges are many. There was a significant positive correlation in the surface and subsurface soil samples between ESP and ECe (r = 0.738), (r = 0.866). This is because the value of ESP is calculated on the basis of the percentage of sodium relative to the total cations on the exchange complex. Only in the surface layers was found a significant positive correlation between ESP with pH (r = 0.353), and CEC (r = 0.344). These results were accorded with results of **Abd El-Azem, (2016).**

CONCLUSION

This study was conducted at small scale, in a total area of about 23,820 acres 24° 57' and 25° 6' and32° 39' and 32° 48' E in Wadi El-Saida (24° 57' and 25° 6' and32° 39' and 32° 48' E), Edfu ditrict, Egypt in order to evaluate their soil chemical properties to determine the suitable crops for cultivation, an 87 soil samples were collected from 43 selected sites to assess the chemical properties of the soil. The results indicated that the studied area had undesirable properties, such as high soil pH, and ECe. Moreover, a wide variation was observed in the $CaCO_3$, SOM, and ESP values. The correlation coefficient values fluctuated between negative and positive. From these results, we recommend improving agricultural practices and improving agricultural drainage. So we can grow a lot of crops and you are not restricted to planting salt tolerant types of crops in the study area. In general, it can be concluded from the obtained results that, these soils are suitable for growing salinity-tolerant crops with the implementation of appropriate cultivation strategies, including the addition of soil conditioners to reduce salinity in soil, in addition to the use of organic fertilizers.

REFERENCES

Abd El-Azem, A.H. (2016). "Land Evaluation of West Kom Ambo. Area Aswan Governorate, Egypt, Using GIS and Remote Sensing". M.Sc. Thesis, Faculty of Agriculture, Assiut, Assiut University, Egypt.

Abd El-Azem, A.H. (2020). "Multidisciplinary studied to evaluate the agricultural sustainability of desert fringes soils, West Edfu, Aswan, Egypt". Ph.D. Thesis, Fac. of Agri., and Natural Resources, Aswan Univ., Egypt.

Abd El-Hady, A.M. and Abdelaty, E.F. (2019). "GIS-comprehensive analytical approach for soil use by linking crop soil suitability to soil management and reclamation". Alex. Sci. Exch. J., **40**, 60–81.

Abdel-Hamid, M.A.; Ismail, M.; Nasr Y.A.; and Kotb, Y. (2010). "Assessment of Soils of Wadi El-Natrun Area, Egypt Using Remote Sensing and GIS Techniques". Journal of American Science, **10** (6), 195 -206.

Abrol, I.P.; Yadav, J.S.P.; and Massoud, F.I. (1988). "Salt-affected soils and their management". FAO soil bulletin No. 39, FAO, Rome, Italy.

Ali, A. I. A., Mahgoubb, S., Bahnasawy N. M., and Tahoun, S. (2018). "Soil Properties and Their Effect on Some Biological Activities in Abu Suberia Valley-Aswan, Egypt". Egyptian Journal of Soil Science, **58**(2), 221-232.

Ali, M.E.; El-Husseiny, O.H.M.; Rashed, H.S.A.; Mohamed, E.S.; and Salama, O.H.E. (2015). "Assessment of soil quality using remote sensing and GIS techniques in some areas of North-East Nile delta, Egypt". Egypt. J. Soil Sci., **55**, 621–638.

Awad, A. A. M. and Sweed, A. A A. (2020). "Influence of Organic Manures on Soil Characteristics and Yield of Jerusalem Artichoke". Communications in Soil Science and Plant analysis. **51**(7), 1-13.

Awad, A.A.M.; El-Taib, A.B.A.; Sweed A.A.A.; and Omran, A.A.M. (2022). "Nutrient contents and productivity of *Triticum aestivum* plants grown in clay loam soil depending on humic substances and varieties and their interactions". *Agronomy*, ***12***, 705.

Awad, A.A.M.; Rady, M.M.; Semida, W.M.; Belal, E.E.; Omran, W.M.; Al-Yasi H.M.; and Ali, E.F. (2021). "Foliar Nourishment with Different Zinc-Containing Forms Effectively Sustains Carrot Performance in Zinc-Deficient Soil". Agronomy, **11**, 1853.

Bannari, A. and Al-Ali, Z.M. (2020). "Assessing Climate Change Impact on Soil Salinity Dynamics between 1987–2017 in Arid Landscape Using Landsat TM, ETM+ and OLI Data". Remote Sens., **12**, 2794. ; doi:10.3390/rs12172794.

Bashour, I. and Sayegh, A. (2007). "Methods of Analysis for Soil in Arid and Semi-Arid Regions". FAO, Roma, p: 119.

Brevik, E.C.; Cerdà, A.; Mataix-Solera, J.; Pereg, L.; Quinton, J.N.; Six J.; and Van-Oost, K. (2015). "The interdisciplinary nature of soil". Soil. **1**:117–129.

Corbishley, J. and Pearce, D. (2007). "Growing trees on salt-affected land". ACIAR Impact Assessment Series Report No. **51**, ACIAR, July 2007. CIHEAM – Options.

Cottenie, A.; Verloo, M.; Kikens, L.; Velghe, G.; and Camerlynck, R. (1982). "Analytical Problems and Methods in Chemical Plant and Soil Analysis". Hand book Ed. A. Cottenie, Gent, Belgium; 1982.

El-Sayed, M.A.; Abd El-Aziz, S.H.; El-Desoky A.I.; and Selmy, S.A.H. (2016). "Pedomorphic features and soil classification of

Gharb El-Mawhob area, El-Dakhla Oasis, Western Desert, Egypt". Middle East J. Agric. Res., **5**, 247–257.

Elwa, A.M.; Abou-Shady, A.M.; Sayed A.; and Showman, H. (2021). "Impact of physical and chemical properties of soil on the growing plant in El Mounira-El Qattara New Valley". Egypt. J. Appl. Sci., **36**, 148–175.

ESRI, (2019). "Arc-GIS spatial analysis: Advanced GIS spatial analysis using raster and vector data". ESRI, 380, New York, CA923728100 USA.

FAO, (2006). "Guidelines for soil description". Food and Agriculture Organization of the United Nations. Rome, Italy.

Faragallah, M.E.A. (1995). "Relative Distribution of Certain Nutrients in Soils of the Nile Valley-Desert Interference Zone, East of Assiut city". Master’s Thesis, Faculty of Agriculture, Assiut University, Assiut, Egypt.

Gameh, M.A.; Abdalazem, A.H.; Khozyem H.M.; and Mohamed, A.G. (2020). "Assessment of some Physical and Chemical Properties of Soils in West Edfu Area, Aswan Governorate, Egypt". Assiut Journal of Agricultural Sciences, **51**(1), 150-170.

Gharaibeh, M.A.; Albalasmeh, A.A.; Pratt C.; and El-Hanandeh, A. (2021). "Estimation of exchangeable sodium percentage from sodium adsorption ratio of salt-affected soils using traditional and dilution extracts, saturation percentage, electrical conductivity, and generalized regression neural networks". Catena **205**, 105466.

Goovaerts, P. (1998). "Geostatistical tools for characterizing the spatial variability of microbiological and physio-chemical soil properties. Biol Fert Soils". **27**:315–334.

Hamarashid, N.H.; Othman M.A.; and Hussain, M.A.H. (2010). "Effects of soil texture on chemical composition, microbial populations and carbon mineralization in soil". Egyptian Journal of Experimental Biology, **6**(1), 59–64.

Hamed, M.H. and Khalafallh, M.Y. (2007). "Available nutrients and some soil properties of El-Qasr soils, El-Dakhla Oasis, Egypt". Int. J. Environ. Agric. Biotechnol. **2**; 4243–4249.

Hendershot, W.H.; Lalande H.; and Duquette, M. (2008). "Ion exchange and exchangeable cations". p. 197-206. In: Carter, M.R and E.G. Gregorich (eds.) Soil sampling methods of analysis, 2nd ed. Canadian Soc. of Soil Sci.

Hobley, E. U. and Wilson, B. (2016). "The depth distribution of organic carbon in the soils of eastern Australia". Ecosphere. **7**(1): 1-21.

Ismail, M.; Nasr Y.A.; and Kotb, Y. (2010). "Assessment of Soils of Wadi El- Natrun Area, Egypt Using Remote Sensing and GIS Techniques". Journal of American Science, **6** (10), 195- 206.

Jackson, M.L. (1967). "Soil Chemical Analysis". Prentice-Hall., Inc., Englewood Cliffs, New Jersey, USA.

Jackson, M.L. (1973). "Soil Chemical analysis". Prentice-Hall of India private Limited New Delhi.

Kiflu, A. and Beyene, S. (2013). "Effects of different land use systems on selected soil properties in South Ethiopia". J. Soil Sci. Environ. Manag. **4**, 100–107.

Klute A. (1986). "Methods of Soil Analysis". Hand book Ed. Madison, Wisconsin USA.

Kumar, A.; Mishra, V. N.; Srivastav L. K.; and Banwasi, R. (2014). "Evaluations of soil fertility status of available major nutrients (N, P & K) and micro nutrients (Fe, Mn, Cu & Zn) in vertisol of

Kabeerdham district of Chhattisgarh, India". International Journal of Interdisciplinary and Multidisciplinary Studies, **1**(10):72-79.

Kumar, R.; Sarkar, A. K.; Singh, K. P.; Agarwal B. K.; and Karmakar, S. (2009). "Appraisal of available nutrients status in Santhal Paraganas region of Jharkhand". J. Indian Soc. Soil Sci. **57**(3): 366-369.

Machado, A.A. and Conceicao, A.R. (2007). "WinStat - Sistema de analise estatistica para Windows". Pelotas, Universidade Federal de Pelotas.

Mesfin, S.; Taye, G.; Desta, Y.; Sibhatu, B.; Muruts H.; and Mohammedbrhan, M. (2018). "Short-term effects of bench terraces on selected soil physical and chemical properties: Landscape improvement for hillside farming in semi-arid areas of northern Ethiopia. Environ". Earth Sci., **77**; 399.

Metson, A.J. (1961). "Methods of chemical analysis for soil survey samples". New Zeland Dep. Sci. Ind. Res. Soil. Bur. Bull., 12 Govt. Printer, Wellington, New Zeland. (Booker, C. F. tropical soil manual by London, J. R. 1984: 126-138.

Moe, N.N.; Mar, S.S.; Myint. A.K.; Toe K.; and Ngwe, K. (2019). **"**The spatial variability of soil chemical properties in a selected area of Myanmar". International Journal of Environmental and Rural Development, 2-10.

Mohamed, M.A.; Elgharably G.A.; and Rabie, M.H. (2019). "Evaluation of Soil Fertility Status in Toshka, Egypt: Available Micronutrients". World J. Agric. Sci, **15**, 1–6.

Moursy, A.R.; Abd El-Galil, A.; Ibrahim, M.S.; Abd El-Hady A.A.; and Mhalla, B. (2020). "Characterization and classification of soils of Wadi Qena,Eastern Desert, Egypt". Indian Journal of Agricultural Sciences **90** (8): 1544–54.

NajafiGhiri, M.; Abtahi, A.; Jaberian F.; and Owliaie, H.R. (2010). "Relationship between soil potassium forms and mineralogy in highly calcareous soils of southern Iran". Aust. J. Basic Appl. Sci., **4**, 434–441.

Opeyemi, A.O.; Adewunmi B.I.; and Oluwas, A.I. (2020). "Physical and chemical properties of soils in gambari forest reserve near ibadan, south western Nigeria". J. Bioresour. Manag., **7**, 57–67.

Patil, P.L.; Kuligod, V.B.; Gundlur, S.S.; Katti, J.; Nagaral, I.N.; Shikrashetti P.; and Dasog, G.S. (2016). "Soil fertility mapping in Dindur sub-watershed of Karnataka for site specific recommendations". J. Indian Soc. Soil Sci., **64**, 381–390.

Piper, C.S. (1950). "Soil and Plant Analysis". Inter. Soc. Publ. Inc., New York, USA.

Rhoades, J.D., (1982). "Cation exchange capacity". P. 149-157 In: Page, A.L, R.H. Miller and D.R. Keeny (eds.) Methods of soil analysis. Part 2: Chemical and microbiological properties 2nd edition. Agronomy Soil Sci. Soc. Am. Inc., Madison, WI, USA.

Richards, L.A. (1954). "Diagnosis and Improvement of Saline and Alkaline Soils". United States Dept. of Agric., Handbook No. 60.

Sayed, A.S.A. (2013). "Evaluation of the land resources for agricultural development-case study: El-Hammam Canal and its extension NW coast of Egypt". Ph.D. Thesis, Hamburg Univ., Egypt.

Scott Bechtold, J. and Naiman, R.J. (2006). "Soil texture and nitrogen mineralization potential across a riparian toposequence in a semi-arid savanna. Soil Biology and Biochemistry, **38**(6), 1325–1333.

Shahid, S.A. (2013). "Irrigation-induced soil salinity under different irrigation systems – assessment and management, short technical note". Clim Chang Outlook Adapt: Int J **1**(1):19–24.

Stavi, I.; Thevs N.; and Priori, S. (2021). "Soil Salinity and Sodicity in Drylands: A Review of Causes, Effects, Monitoring, and Restoration Measures". Frontiers in Environmental. **9**, 1-17.Science.http://doi: 10.3389/fenvs.2021.712831.

Sweed, A.A.A. and Awad, A.A.M. (2020). "Effect of potassium humate and micronic sulfur on the chemical properties of some soils of Toshka, Egypt". Asian Journal of Soil Science and Plant Nutrition. **6**(2), 1-9.

Tanji, K.K. (1990). "Nature and extent of agricultural salinity. In: Tanji KK (ed) Agricultural salinity assessment and management, ASCE manuals and reports on engineering practice No 71". ASCE, New York, USA, pp 1–17.

Thakor, K.M.; Dharaiya, N.; Singh, V.; Patel, A.; Mehmood, K.; Kalubarme, M.H. (2014). "Soil resources information system for improving productivity using geo-Informatics technology". International Journal of Geosciences, **5**, 771-784.

Thangasamy, A.; Naidu, M.V.S.; Ramavatharam N.; and Raghava, R.C. (2005). "Characterization, classification and evaluation of soil resources in Sivagirimi crowatershed of Chittoor district in Andhra Pradesh for sustainable land use planning". J. Indian Soc. Soil Sci., **53**, 11–21.

Tomasic , M.; Zgorelec, Z.; Jurisic A.; and Kisic I. (2013). "Cation exchange capacity of dominant soil types in the republic of Croatia". Central European Agriculture J. **14**(3),937-951.

USSL Staff (1954). "Diagnosis and improvement of saline and alkali soils". USDA Handbook No 60 Washington DC, USA, 160 pp.

Walky, A. and Black, I.A. (1934). "An examination of the degtiareff method for deteming soil organic matter and proposed modification of the chromic acid titration method". Soil Science, **63**, 29-38.

J. Agric. & Env. Sci. (Damanhour University) 2023, 22(1): 309-337
Print: ISSN 1687-1464 Online: 2735-5098

تقييم تباين الخواص الكيميائية للتربة باستخدام تقنية نظم المعلومات الجغرافية في منطقة وادي صيدا - أسوان – مصر

عاطف عبد العزيز سويد[1], أحمد غلاب محمد[1], محسن عبد المنعم[2] وحسناء ناصر حسن[1]

[1] قسم التربة والموارد الطبيعية ، كلية الزراعة ، جامعة أسوان ، مصر.

[2] قسم التربة والمياه ، كلية الزراعة ، جامعة اسيوط ، مصر.

المستخلص:

يعد التقييم الدقيق لخصائص التربة عاملاً مهمًا لتقييم خصوبة التربة ، خاصة في الأراضي المستصلحة حديثًا. تعتبر منطقة وادي الصيدا (خط عرض 24 ° 57′ و 25 ° 06′ شمالا و 32 ° 39 ° و 32 ° 48′) من أهم مجالات الاستثمار الزراعي التي تتبناها الحكومة المصرية من أجل تحقيق أهداف التنمية الزراعية المستدامة في مصر. محافظة أسوان. لهذا الغرض ، تم جمع 87 عينة من التربة من الطبقات السطحية والتحت سطحية باستخدام نظام المعلومات الجغرافية. أشارت النتائج التي تم الحصول عليها إلى أن pH التربة تراوح بين 7.18 (متعادل) و 9.05 (شديدة القلوية). بينما أشارت النتائج ان ECe تراوح بين 2.23 الي dS/m, 281.1 ومحتوي كربونات الكالسيوم بالتربة بين 0.09 الي 13.57 % , حيث ان التربة قيد الدراسة متفاوتة بين الطفيفة إلى شديدة الملوحة وغير الجيرية إلى شديدة الملوحة ، على التوالي. في الوقت نفسه ، تراوحت سعة التبادل الكاتيوني (CEC) ونسبة الصوديوم القابلة للتبادل (ESP) من 8.22 إلى 53.51 Cmolckg-1 و 0.50 إلى 93.49٪ على التوالي. علاوة على ذلك ، فإن محتواها من المادة العضوية في التربة (SOM) ، حيث لم تتجاوز قيمها 2.91٪. تراوح معامل الارتباط بين جميع الصفات المدروسة بين الموجب والسالب. باختصار ، فإن المنطقة المدروسة تحتاج إلى جهود مضنية لاستعادتها وجعلها صالحة للزراعة من خلال تعديل خصائصها.