Menoufia J. Soil Sci., Vol. 6 September (2021): 253 - 264 https://mjss.journals.ekb.eg/

PEDOLOGICAL STUDIES ON SOILS IRRIGATED FROM DIFFERENT WATER SOURCES IN THE AREA NORTH EAST TANTA CITY, GHARBIA GOVERNORATE, EGYPT

S.A. Radwan, M.S. Amira, E.A. Abu Hussien and Kadria, A. Abdel Moneem
Soil Sci. Dept., Fac. Agric. Menoufia univ.

Received: Aug. 15 , 2021 Accepted: Sep. 12 , 2021

ABSTRACT: ***The current work was performed aiming to study the morphological, physiochemical characteristics as well as classification and capability evaluation for soils irrigated from different water sources in the area north east Tanta city, Gharbia governorate, Egypt. The study area is located in the Middle of Nile Delta between latitudes 30º 45' to 30º 50' N and longitudes 31º 00' to 31º 05' E, covering an area of about 78.97 km^2 (18802.30 fed.). The area has many different irrigation water sources namely, Nile water, agricultural drainage water, waste and sewage water canals. Many industrial factories discharge their waste fluids and remnants into these different canals which intermixed with their waters and could be used for irrigation of the surrounded agricultural land in the area.***

Ten soil profiles were chosen including: three representing the soils use the fresh Nile water, five representing the soils use the agricultural drainage water and two representing the soils use sewage water for irrigation. The land and site features are observed and registered. The soil profiles were dug, morphologically described, and then samples were collected representing the subsequent layers in each profile for integrated physical and chemical analyses. Also, water samples were collected from the different irrigation water resources for chemical analyses.

The studied area has almost flat topography with deep soil profiles and freely well drained. These soils have swelling clay loam to clay texture with moderate medium to coarse angular blocky structure and mostly grayish brown color. There are no clear differences in the morphological characteristics of the studied soils irrigated with different kinds of irrigation waters.

The physiochemical properties revealed that, the studied soils are moderately alkaline and non- to slightly saline. All of the soils using Nile water haven't sodicity effect. While, most of those using drainage or sewage water have moderate sodicity effect. Organic matter (OM) is almost low and decreases with depth. The soils are slightly to moderately calcareous. Some soils from those irrigated with drainage or sewage water have relatively moderate OM and $CaCO_3$ contents especially in the surface layers besides relatively high ESP. This could be ascribed to the interaction of factorial waste fluids and remnants in the irrigation water used for these soils.

Most of the studied soil profiles haven't any diagnostic horizons, therefore they were classified under Entisols order. Some soils from those irrigated with agricultural drainage water or sewage water seem to have Natric horizons and classified under Aridisols up to sub great group level.

The land capability evaluation using ASLE model indicated that, all of the studied soils are considered as a good class (C2).

The quality evaluation of irrigation water samples indicates that, there is a slight restriction upon using the drainage and sewage waters for sensitive crops.

Key words: ***Pedological features, soil classification, land capability evaluation, water quality evaluation.***

INTRODUCTION

The use of marginal quality water for irrigation is becoming more and more widespread across the world. There is not always enough good quality water available to meet demands from agriculture, domestic use and industry. One strategy to increase available water resources is to reuse agricultural drainage water for irrigation. Reuse of drainage water is already extensively practiced in countries such as Egypt, Pakistan and the USA. The reuse of drainage water for irrigation involves the application of water that is inherently of lower quality than fresh water. Water that has passed through the agricultural system may contain increased levels of salts, toxic ions, heavy metals and organic residues. The entry of these pollutants into water courses, and accumulation in soils poses a threat to agricultural production and the environment (Abbott and El Quosy, !996).

The 1959 treaty with Sudan fixed Egypt's share of the Nile water at 55.5 billion m^3/yr. (Amer and De Ridder, 1989). It is currently approaching full utilization of this allocation and demands are high. Drain-water reuse is a major component of the country's water strategy. It is the largest source of irrigation water after the river Nile and contributes an estimated 4 billion m^3/yr. to the agricultural sector. Current policies are based on increasing this figure to 7 billion m^3/yr. (Abdel Dayem and Abu-Zeid, 1991). Drainage water reuse occurs along the Nile Valley because all drains lead back to the main river course. In the southern part of the Nile Delta drain-water is mixed with fresh water and used for irrigation. In the northern Nile Delta, the amount of drain-water increases but the irrigation area is less. Additionally, the soils are heavier and more saline. The national strategy is therefore to use drain-water in the irrigation of reclaimed lands in the eastern and western fringes of the Nile Delta (Abbott and El Quosy, !996).

Gharbia governorate is one from the main governorates in Nile Delta. It is located in the middle of Nile Delta. Tanta city is governorate's capital and Egypt's fifth largest city (the largest in the Delta). The main economic activity in the governorate is cultivation in addition to textile, oil and soap industries. Many main irrigation canals (such as: Bahr Shibin, Al–Qasid, Al – Jafariyyah, Al-Rayyah Al–Menoufi and Tatay), agricultural drainage canals (i.e., Mihalet Rouh and Ikhnaway drains) and general public sewage canals are found around the city. Tanta has cotton ginning factories, textile, soda, oil and soap industries (Elbeih et al., 2013). Many from these factories discharge their waste fluids and remnants into these different canals which intermixed with their waters and could be used as irrigation source for the surrounded agricultural land in the area.

This work was performed to furnish a recent study on pedological features including classification and capability evaluation of the soils irrigated from different water sources in the area north east Tanta city, Gharbia governorate, Egypt. This work could present important information served for promising plans of improvement and management of these soils.

MATERIALS AND METHODS

Study area

The study area is located in the Middle of Nile Delta between latitudes 30º 45′ to 30º 50′ N and longitudes 31º 00′ to 31º 05′ E, covering an area of about 78.97 km^2 (18802.30 feddan), Fig (1). The dominant geologic unit is Quaternary Nile fine silt in the whole governorate (Elbeih et al., 2013). The studied area is characterized by the climate of the Mediterranean Sea with hot arid summer and little rainy winter

(November to March) with a mean 3.8 mm/year. The mean temperature reaches its maximum in June to August and often exceeds 30°C. The mean minimum temperature (11.2°C) usually occurs in January to March. The difference between the average temperature in summer and winter is > 6°C (Climatological Normal for Egypt, 2011). Based on FAO (1977) and USDA-NRCS (1997), the soil temperature regime of the studied area is defined as *Thermic* with *Torric* soil moisture regime.

Maps used for the study area

A topographic map for east Tanta with a scale of 1:25,000 included the study area (Fig, 1) was used to specify the location of selected representative soil profiles for this area. Also, a Landsat 8 (path 177 / row 39) image acquired in 2018 and processed in ArcMap 10.7.1 software to identifying the main land use/land cover classes in the study area according to ESRI (2014) and Richards (1999), Fig (2). The main land use/land cover classes in this area are Agricultural land that covering about 58.75 km^2 (13988.57 fed.), with 74.40% from the study area, and Urban land that covering 20.22 km^2 (4813.74 fed.), with 25.60 %.

Field Work.

Based on the topographic map (Fig, 1), a reconnaissance soil survey was conducted throughout the studied area in order to study and register the land and site features as well as completion the field work.

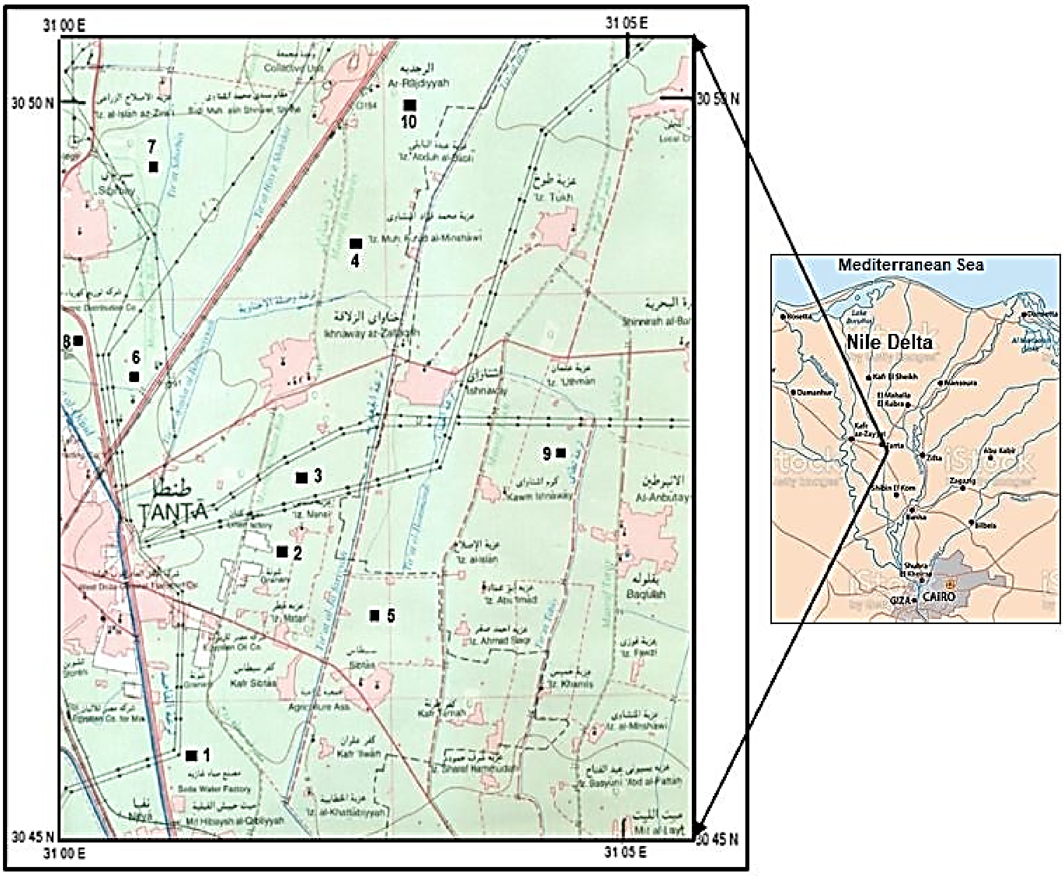

Fig (1): Study area and location of soil profiles.

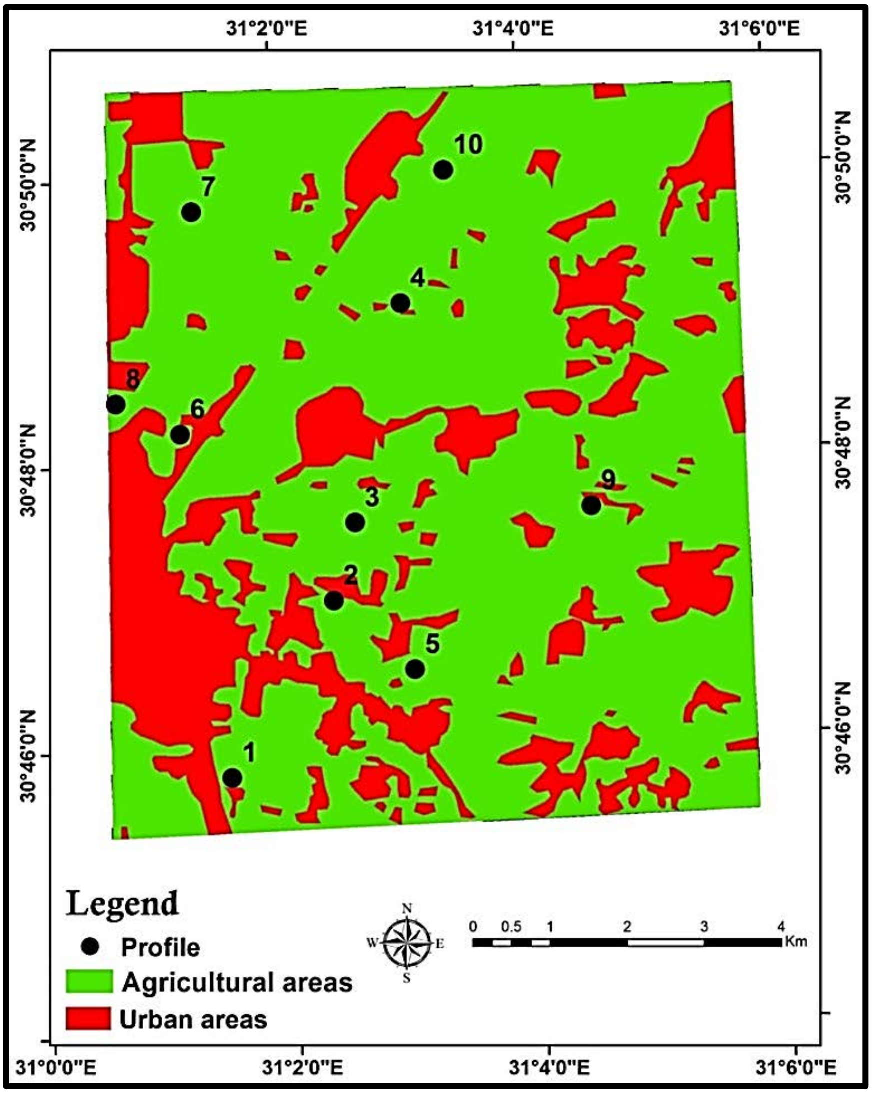

Fig (2): Main Land use/land cover classes in the study area.

Longitudes and latitudes as well as elevation are defined in the field using GPS "System Corporation MAGELLAN"- GPS NAV DLX-10 TM for recognizing soil profile locations within the studied area.

Ten soil profiles were chosen to represent the soils irrigated from the different irrigation water sources. Three profiles were selected representing the soils using the fresh Nile water, five representing the soils using the agricultural drainage water and the other two profiles representing the soils using sewage water for irrigation (Figs, 1 and 2 and Table, 1). The Soil profiles were dug deep up to a depth of 120 cm. The land and soil profiles are morphologically described according to FAO (2006). Soil samples were collected based on the vertical variations of each soil profile for the laboratory analyses of soil physical and chemical properties. Moreover, ten water samples were collected from the different water sources for laboratory analyses to evaluate their suitability for irrigation.

Table (1): Irrigation water types, sources and selected soil profiles.

Irrigation water type	Profile No.	Soils irrigated from	Symbol
Fresh Nile water (NW)	5	Al-Jafariyah canal	N1
	7	Sibirby canal or artesian	N2
	9	Tatay main canal	N3
Agricultural drainage water (ADW)	1	Mihalet Rouh agricultural Drain	A1
	2		A2
	3		A3
	4	Ikhnaway agricultural Drain	A4
	10		A5
Sewage water (SW)	6	Tanta general public swage drain	S1
	8		S2

Laboratory Analyses

Particle size distribution, electrical conductivity (EC), pH, organic matter (OM), calcium carbonate ($CaCO_3$), cation exchange capacity (CEC) and exchangeable Na^+ percentage (ESP), were determined for soil samples according to Burt and Soil Survey Staff (2014). The weighted profile mean (w.p.m.) of each soil property was calculated for the studied profiles. Identify class terms of each soil property was done according to Soil Science Division Staff (2017).

The collected irrigation water samples were chemically analyzed to determine their reaction (pH), salinity (EC), soluble cations and anions as well as sodium adsorption ratio (SAR) according to Burt (2004). The quality of analyzed water samples for irrigation was evaluated according to the guidelines of Ayers and Westcot (1994).

Soil classification

The studied soils were classified up to sub great group level based on Soil Survey Staff (2014).

Land Evaluation

Land capability classification was carried out using the Applied System of Land Evaluation (ASLE model) software developed by Ismail et al. (2005). The determination of the land capability classes was executed according to the suggested capability categories of FAO (2007).

RESULTUS AND DISCUSSION

Soil Morphology

The morphological features of the studied soils presented in Table (2) revealed that, the elevation of the studied soils is between 4.9 m to 7.3 m above sea level (a.s.l.). The soils have almost flat topography. All studied soils are deep and well drained. The main hue notation of studied soil color is around grayish brown degrees (10YR). These soils have mainly clay loam to heavy clay texture throughout their depths with mostly moderate medium to coarse angular blocky structure. They are slightly to moderately calcareous having mostly hard to extremely hard (dry) and firm (moist) consistency. The most studied soils are cultivated with field or horticultural crops. There are no clear differences in the morphological characteristics of the studied soils irrigated with different kinds of irrigation waters.

Table (2): Morphological features of the studied soil profiles.

Water source	Profile No.	Elevation m a.s.l.*	Depth cm	Color		Structure[1]	Consistence[2]		Boundary
				Dry	Moist		Dry	Moist	
Nile water (NW)	5	6.1	0-30	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			30-60	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/2	2/1	2 c to m bk	ex hard	firm	diffuse
			90-120	10YR 3/2	2/1	2 c to m bk	ex hard	firm	-
	7	5.5	0-30	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			30-60	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			90-120	10YR 3/2	2/2	2 c to m bk	ex hard	firm	-
	9	6.4	0-30	10YR 4/2	3/2	2 c to m bk	hard	firm	diffuse
			30-60	10YR 4/2	3/2	2 c to m bk	hard	firm	diffuse
			60-90	10YR 4/2	3/2	2 c to m bk	v hard	firm	diffuse
			90-120	10YR 5/3	3/3	2 c to m bk	hard	firm	-
Agricultural drainage water (ADW)	1	7.3	0-30	10YR 3/2	2/2	2 c to m bk	v hard	firm	diffuse
			30-60	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			90-120	10YR 3/2	2/2	2 c to m bk	ex hard	firm	-
	2	6.1	0-30	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			30-60	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/1	2/1	2 c to m bk	ex hard	firm	diffuse
			90-120	10YR 3/2	2/1	2 c to m bk	v hard	firm	-
	3	6.4	0-30	10YR 3/2	2/1	2 c to m bk	ex hard	firm	diffuse
			30-60	10YR 3/1	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/1	2/1	2 c to m bk	ex hard	firm	diffuse
			90-120	10YR 3/2	2/1	2 c to m bk	v hard	firm	-
	4	4.9	0-30	10YR 3/2	2/2	2 c to m bk	v hard	firm	diffuse
			30-60	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/2	2/2	2 c to m bk	v hard	firm	diffuse
			90-120	10YR 3/2	2/2	2 c to m bk	v hard	firm	-
	10	5.5	0-30	10YR 3/2	2/2	2 c to m bk	v hard	firm	diffuse
			30-60	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			90-120	10YR 3/2	2/2	2 c to m bk	ex hard	firm	-
Sewage water (SW)	6	5.8	0-30	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			30-60	10YR 3/2	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/1	2/1	2 c to m bk	ex hard	firm	diffuse
			90-120	10YR 3/2	2/1	2 c to m bk	ex hard	firm	-
	8	6.1	0-30	10YR 3/3	2/2	2 c to m bk	ex hard	firm	diffuse
			30-60	10YR 3/3	2/2	2 c to m bk	ex hard	firm	diffuse
			60-90	10YR 3/3	2/2	2 c to m bk	v hard	firm	diffuse
			90-120	10YR 3/3	2/2	2 c to m bk	v hard	firm	-

Abbreviations: *Elevation: m a.s.l.= meter above sea level, Structure[1]: 2 = moderate, m = medium, co=coarse, bk = blocky; Consistence[2]: v = very, ex =extremely.

Physiochemical Properties

The results in Table (3) show that, these soils have clay loam to clay texture with > 35% swelling clay content (as w.p.m.). The soils in the northern part have generally heavier texture than those in the southern one. This is typical for the sedimentation pattern of the particles in the Nile Delta. They are non- to very slightly saline as indicated by their EC values (EC > 2 to < 4 dSm^{-1} as w.p.m.). Soil reaction is moderately alkaline as the pH values are between 8 to 8.5 (as w.p.m.). The soils irrigated with Nile water and most of those irrigated with agricultural drainage water haven't sodicity effect (ESP < 15%). Some soils from those irrigated with agricultural drainage or sewage water have moderate sodicity effect (ESP > 15 to < 30%). Most of the studied soils have low organic matter (OM) content (< 2%, as w.p.m.). Some of the soils irrigated with ADW or SW have moderate OM content (> 2% to < 3%) especially in their surface layers and decreased with depth. The cation exchange capacity (CEC) is depending on the fine fractions and organic matter contents.

The studied soils are slightly to moderately calcareous indicating from their $CaCO_3$ contents that ranged from 1.5 to 5.0 % (as wpm).

The relatively high OM and $CaCO_3$ contents especially in the surface layers of some soils irrigated with ADW or SW besides the relatively high ESP in such soils could be ascribed to the interaction of factorial waste fluids and remnants in the irrigation water used for these soils.

Soil Classification.

As presented in Table (4), all soils irrigated with NW (profiles 5, 7 and 9) and some soils from those irrigated with ADW (profile 2) haven't any subsurface diagnostic horizons. Therefore, these soils are affiliated to *Entisols* order and classified as *Vertic Torriorthents*. All layers of profile 1 (that use ADW) and profile 6 (use SW) have sodicity effect (ESP > 15%). Therefore, these soils could be classified as *Sodic Torriorthents*. On the other hand, soils of profiles 3, 4 and 10 (use ADW) and profile 8 (use SW) seem to have *Natric* horizons in their upper boundary within 100 cm of the soil surface. Therefore, these soils could be affiliated to *Aridisols* and classified as *Vertic Natrargids* (Table, 4).

Land Capability Evaluation

The land capability indices and classes for the studied soils were obtained from ASLE model software based on their physical and chemical characteristics. The final land capability indices and classes for these soils are presented in Table (5). Results indicated that, all of the studied soils have a good capability class (C2).

Properties and quality of irrigation water

Determined chemical properties of water samples collected from the different water sources used for irrigation of the studied soils are presented in Table (6). Quality evaluation of these water samples presented in Table (7) indicated that, most of these waters have normal to slight alkalinity reaction (pH) with slight salinity hazard. Most of the Nile water samples have none sodium hazard while, most of agricultural drainage and all sewage waters have a slight sodium hazard. The different water resources varied in their chloride hazard from none in most of ADW and some of Nile water to slight or moderate in Sewage water. This indicates that, there is a slight restriction upon using these waters for sensitive crops.

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

Water source	Profile N°	Depth Cm	Particle size distribution %			Texture Class	pH 1:2.5	EC dSm^{-1}	CEC meq/100 g soil	ESP	$CaCO_3$ %	OM g/kg
			Sand	Silt	Clay							
Nile water	5	0-30	38.17	22.71	39.12	clay loam	8.20	3.75	62.41	13.54	2.32	0.96
		30-60	27.30	30.45	42.25	clay	8.10	4.00	62.52	12.84	1.75	0.81
		60-90	40.64	22.82	36.54	clay loam	8.20	4.31	62.92	12.36	1.21	0.62
		90-120	38.50	23.35	38.15	clay loam	8.30	3.95	61.41	11.92	1.00	0.59
		WPM	36.15	24.83	39.02	clay loam	8.20	4.00	62.32	12.67	1.57	0.75
	7	0-30	39.34	25.35	36.31	Clay loam	7.80	2.50	57.08	5.06	2.12	1.20
		30-60	37.44	23.98	38.58	Clay loam	8.10	3.63	55.96	8.08	1.85	1.05
		60-90	35.85	24.50	39.65	Clay loam	8.20	2.89	52.84	11.18	1.62	0.75
		90-120	38.95	21.84	39.21	Clay loam	8.20	2.92	49.87	12.67	0.85	0.63
		WPM	37.90	23.92	38.44	Clay loam	8.08	2.99	53.94	9.25	1.61	0.91
	9	0-30	37.96	29.45	32.59	Clay loam	8.00	3.55	49.20	9.99	2.17	1.23
		30-60	30.56	30.68	38.76	Clay loam	8.00	3.24	51.17	12.88	1.39	1.00
		60-90	28.62	26.54	44.84	Clay	7.50	3.05	52.36	13.76	1.00	0.73
		90-120	24.48	29.58	45.94	Clay	8.10	3.00	53.27	15.09	0.89	0.52
		WPM	30.41	29.06	40.53	Clay	7.90	3.21	51.50	12.93	1.36	0.87
Agricultural drainage water	1	0-30	33.95	25.33	39.09	clay loam	8.20	2.17	60.16	15.99	4.95	3.91
		30-60	35.11	24.23	40.66	clay	8.40	2.00	61.78	17.45	4.43	2.56
		60-90	31.73	28.35	39.92	clay loam	8.30	2.00	61.75	16.53	3.17	1.88
		90-120	35.05	28.22	36.73	clay loam	8.35	1.93	59.22	15.85	3.22	1.64
		WPM	33.96	26.53	39.10	clay loam	8.31	2.03	60.73	16.45	3.94	2.50
	2	0-30	34.06	26.65	39.29	clay loam	8.50	2.54	57.22	6.32	2.21	2.64
		30-60	34.13	29.71	36.16	clay loam	8.30	2.23	56.31	7.08	1.82	1.36
		60-90	33.16	24.53	42.31	clay	8.40	2.10	58.45	7.38	1.26	1.02
		90-120	33.09	25.58	41.33	clay	8.40	2.00	58.00	9.55	1.05	0.95
		WPM	33.61	26.62	39.77	clay loam	8.40	2.22	57.50	7.58	1.59	1.49
	3	0-30	34.23	26.41	39.36	clay loam	8.20	3.13	54.81	7.90	5.76	2.75
		30-60	33.64	21.22	45.14	clay	8.30	3.10	55.12	12.01	5.29	2.31
		60-90	30.52	22.25	47.23	clay	8.30	2.95	56.80	14.55	4.81	2.00
		90-120	31.30	28.60	40.10	clay	8.20	2.89	55.46	17.27	4.19	1.86
		WPM	32.42	24.62	42.96	clay	8.25	3.02	55.55	12.93	5.01	2.23
	4	0-30	34.23	26.41	39.36	clay loam	8.00	4.50	58.50	11.01	3.62	2.38
		30-60	34.54	25.22	40.24	clay	8.10	3.32	59.79	14.92	3.21	2.07
		60-90	33.52	22.25	44.23	clay	8.10	3.25	60.71	17.55	3.02	1.62
		90-120	30.30	22.45	47.25	clay	8.20	2.91	56.97	18.75	2.88	0.93
		WPM	33.15	24.08	42.77	clay	8.10	3.50	58.99	15.55	3.18	1.75
	10	0-30	33.54	26.23	40.23	clay	8.10	3.20	54.62	8.94	2.15	1.37
		30-60	36.00	21.50	42.50	clay	8.20	3.12	55.85	11.12	1.98	1.00
		60-90	30.21	22.46	47.33	clay	8.20	2.98	56.74	14.80	1.02	0.85
		90-120	27.48	25.60	46.92	clay	8.30	2.88	56.41	15.39	0.85	0.73
		WPM	31.81	23.95	44.25	clay	8.20	3.05	55.91	12.56	1.50	0.99
Sewage water	6	0-30	30.06	29.44	40.50	clay	8.30	2.95	63.24	16.47	4.22	2.19
		30-60	27.04	31.74	41.22	clay	8.20	3.10	65.30	17.12	4.00	1.03
		60-90	29.95	26.18	46.87	clay	8.20	3.22	65.89	17.50	3.15	1.00
		90-120	32.71	22.31	44.98	clay	8.00	3.45	66.17	17.97	3.02	0.75
		WPM	29.94	27.42	43.39	clay	8.18	3.18	65.15	17.26	3.60	1.24
	8	0-30	28.53	30.22	41.25	clay	8.50	3.82	62.11	15.94	2.73	2.22
		30-60	28.09	31.58	40.33	clay	8.30	3.74	60.08	13.02	1.52	1.52
		60-90	26.31	26.18	47.51	clay	8.10	3.68	63.52	10.42	0.93	1.00
		90-120	31.62	22.57	45.81	clay	8.10	3.66	61.00	10.19	0.87	0.87
		WPM	28.64	27.64	43.73	clay	8.25	3.73	61.68	12.39	1.51	1.40

W.P.M = weighted profile means, L= loam

Table (4): Classification of the studied soils.

Order	Sub Great Group	Soils of profiles No.	Soils irrigated with
Entisols	*Vertic Torriorthents*	5, 7, 9	Nile water (NW)
		2	Drainage water (ADW)
	Sodic Torriorthents	1	Drainage water (ADW)
		6	Sewage water (SW)
Aridisols	*Vertic Natrargids*	3, 4, 10	Drainage water (ADW)
		8	Sewage water (SW)

Table (5): Land capability indices and classes for the studied soils.

Soils of Profile	Capability index %	Capability class
1	69.12	C2
2	73.35	C2
3	68.35	C2
4	64.59	C2
5	67.34	C2
6	66.09	C2
7	70.78	C2
8	66.84	C2
9	68.84	C2
10	68.58	C2

Table (6): Chemical properties of water samples.

Water types	Symbol	pH	Soluble cations and anions meq.l^{-1}								EC (ds/m)	SAR
			Na^+	K^+	Ca^{2+}	Mg^{2+}	$CO_3^=$	HCO_3^-	Cl^-	$SO_4^=$		
Fresh Nile water NW	N1	8.30	4.22	0.30	3.22	2.00	0.00	5.00	4.00	0.73	1.10	2.61
	N2	7.15	1.10	0.31	1.28	0.70	0.00	1.75	1.50	0.14	0.21	1.11
	N3	8.72	7.31	0.22	3.15	3.24	0.00	4.00	5.11	4.81	1.20	4.09
	Mean	8.06	4.21	0.28	2.55	1.98	0.00	3.58	3.54	1.89	0.84	2.60
Agricultural drainage water ADW	A1	8.20	4.72	0.23	3.23	2.88	0.00	5.25	3.88	1.93	1.28	0.77
	A2	7.92	1.52	0.22	1.54	1.12	0.00	1.52	0.95	1.93	0.26	1.32
	A3	8.12	3.24	0.25	3.10	2.80	0.00	5.00	3.25	1.14	1.35	1.89
	A4	8.22	6.20	0.21	3.35	2.95	0.00	5.50	4.50	2.71	1.21	3.49
	A5	8.21	6.29	0.18	2.41	2.75	0.00	5.59	3.19	2.85	0.98	3.92
	Mean	8.13	3.93	0.23	2.48	2.28	0.00	4.22	2.80	1.90	0.91	2.47
Sewage water SW	S1	8.75	11.20	0.52	4.95	3.82	0.00	7.00	9.12	4.37	1.85	5.35
	S2	8.40	7.80	0.29	2.59	3.40	0.00	6.50	4.91	2.67	1.55	4.51
	Mean	8.58	9.50	0.41	3.77	3.61	0.00	6.75	7.02	3.52	1.70	4.93

Table (7): Quality of water samples according to Ayers and Westcot (1994).

Water types	Symbol	Salinity hazard	Sodium hazard	Chloride hazard	pH
Nile water	N1	Slight to moderate	None	Slight to moderate	Normal
	N2	None	None	None	Normal
	N3	Slight to moderate	Slight to moderate	Slight to moderate	Slightly alkaline
Agricultural drainage water	A1	Slight to moderate	Slight to moderate	None	Normal
	A2	None	None	None	Normal
	A3	Slight to moderate	None	None	Normal
	A4	Slight to moderate	Slight to moderate	Slight to moderate	Normal
	A5	Slight to moderate	Slight to moderate	None	Normal
Sewage water	S1	Slight to moderate	Slight to moderate	Slight to moderate	Slightly alkaline
	S2	Slight to moderate	Slight to moderate	Slight to moderate	Normal

REFERANCES

Abbott, C. L. and D.E.D. El-Quosy (1996). Soil Salinity processes under drain water reuse in the Nile Delta, Egypt, Report OD/133, HR Wallingford in collaboration with the Water Management Research Institute, Cairo, HR Wallingford Ltd. Howbery Park, Wallingford, OXON OX10 8BA, Registered in England No. 2562099.

Abdel-Dayem, S. and M. Abu-Zeid (1991). Salt Load in Irrigation and Drainage Water in the Nile Delta, In ICID 42nd International Executive Council Meeting Beijing, China.

Amer, M.H. and N.A. De Ridder (1989). Land drainage in Egypt, Drainage Research Inst. (DRI), Cairo, 377p.

Ayers, R.S. and D.W. Westcot (1994). “Water quality for agriculture”. FAO Irrigation and drainage Paper 29, Rev. 1.

Burt, Rebecca, Ed. (2004). Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42, Version 4.0, USDA-NRCS, Lincoln, Nebraska.

Burt, Rebecca and Soil Survey Staff (2014). Kellogg Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report No. 42, Version 5.0, Kellogg Soil Survey Laboratory, National Soil Survey Center, Natural Resources Conservation Service, USDA, Lincoln, Nebraska, USA.

Climatologically Normal for Egypt (2011). The Normal for Gharbia Governorate Station (1960 – 2011), Ministry of Civil Aviation: Meteorological Authority, Cairo, Egypt.

Elbeih, Salwa F., A. A. Shalaby and A. M. Bahy El Deen (2013). Water Management Problems Associated with Urban Sprawl in Gharbia Governorate, Egypt Using Remote Sensing and GIS, International Journal of Advanced Remote Sensing and GIS, 2 (1): 243-259.

ESRI "Environmental Systems Research Institute" (2014): Arc Map Version 10.1 User Manual. ESRI, 380 New York

Street, Redlands, California, 92373-8100, USA.

FAO (1977). Soil map of the world 1: 5 000 000, Volume VI Africa, FAO, UNSCO, Paris.

FAO (2006). Guidelines for soil profile description. Soil Res. Dev. and Co. Serv., Land and Water Dev. Div., Rome, Italy.

FAO (2007). Land Evaluation, towards a revised framework, land and water discussion paper No. 6, Rome, Italy.

Ismail, H.A., M.H. Bahnassy and O.R. Abd El-Kawy (2005). Integrating GIS and modelling for agricultural land suitability evaluation at East Wadi El-Natrun, Egypt. Egyptian J Soil Sci., 45: 297-322.

Richards, J. A. (1999). Remote Sensing digital Image Analysis: An Introduction, Berlin: Springer-Verlag, 240 p.

Soil Science Division Staff (2017). Soil Survey Manual, Handbook No. 1 USDA. 1400 Independence Avenue, SW, Washington, D.C. USA

Soil Survey Staff (2014). Keys to Soil Taxonomy, 11th Ed., USDA, NRCS, Pocahontas Press, Inc., Blacksburg, Virginia, USA.

USDA-NRCS (1997). Soil climate map, Soil Science Division, World Soil Resources, United States Department of Agriculture & Natural Recourses Conservation Service, Washington D.C.

دراسات بيدولوجية على أراضي تروى من مصادر مياه مختلفة في المنطقة شمال شرق مدينة طنطا، محافظة الغربية، مصر

صلاح عبد المجيد رضوان، محمد سمير عراقي عميرة، الحسيني عبد الغفار أبو حسين، قدرية عبد الرازق عبد المنعم

قسم علوم الأراضي – كلية الزراعة – جامعة المنوفية

الملخص:

أجري هذا البحث بهدف دراسة الخصائص المورفولوجية والطبيعية والكيميائية وكذلك تقسيم وتقييم أراضي تروى بمياه من مصادر متنوعة في المنطقة شمال شرق مدينة طنطا بمحافظة الغربية، مصر، وتقع منطقة الدراسة في وسط دلتا النيل بين خطي عرض 45′ 30º إلى 50′ 30º شمالاً، وخطي طول 00′ 31º إلى 05′ 30º شرقاً، بمساحة قدرها 78,97 كم^2 (18802,3 فدان)، ويتواجد في هذه المنطقة عديد من مصادر المياه التي تستخدم في ري الأراضي الزراعية المحيطة مثل قنوات النيل، والصرف الزراعي والصرف الصحي، كما تتواجد عديد من الشركات والمصانع التي تصرف مخلفاتها السائلة والصلبة في تلك القنوات.

ولقد تم اختيار عشر قطاعات أرضية تتضمن: ثلاث قطاعات تمثل أراضي تروى من قنوات مياه النيل، وخمس قطاعات تمثل أراضي تروى من قنوات الصرف الزراعي، وقطاعين تمثل أراضي تستخدم مياه من القناة العمومية للصرف الصحي، ودرست وسجلت الملامح الطبوغرافية والمورفولوجية المميزة لأراضي المنطقة، كما تم حفر القطاعات الأرضية، ووصفت مورفولوجياً وجمعت منها عينات ممثلة لطبقاتها لتقدير الخواص الطبيعية والكيماوية، كما جمعت عينات مياه من المصادر المختلفة لتقدير خواصها الكيميائية في المعمل وتقدير مدى ملاءمتها للاستخدام في الري.

واتضح من الدراسات الحقلية أن الأراضي شبه مستوية، عميقة، جيدة الصرف، وقوامها يغلب عليه الطميي طيني إلى الطيني المتشقق، وبناءها متوسط من النوع الكتلي صعبة المراس، ذات لون بني رمادي، ولم تظهر أي فروق واضحة في الخصائص المورفولوجية بين الأراضي التي تروى من المصادر المختلفة.

اتضح من التحليلات المعملية أن تأثير الأراضي المدروسة يميل إلى القلوية، غير ملحية إلى بسيطة الملوحة، ولم يظهر تأثير صودي واضح في جميع الأراضي التي تروى بمياه النيل، في حين يظهر تأثير صودي متوسط في معظم الأراضي الأخرى، محتوى الأراضي من المادة العضوية غالباً منخفض ويقل مع العمق، ومحتواها من الكربونات الكلية قليل إلى متوسط، وقد يرجع المحتوى المتوسط نسبياً من المادة العضوية والكربونات الكلية في الطبقات السطحية لبعض الأراضي التي تروى بمياه الصرف الزراعي والصرف الصحي بالإضافة إلى التأثير الصودي إلى تأثير المخلفات التي تلقيها المصانع في هذه القنوات.

لم يتضح في معظم الأراضي المدروسة أي آفاق تشخيصية، لذلك تم تقسيمها تبعا للتقسيم الأمريكي الحديث (2014) تحت رتبة الأراضي غير المتطورة Entisols، أما الأرضي المحدودة التي ظهر بها ملامح للأفق الصودي فلقد قسمت تحت رتبة الأراضي الجافة Aridisols حتى مستوى تحت المجموعات العظمى.

ولقد دل تقييم الكفاءة الإنتاجية لهذه الأراضي باستخدام موديل ASLE على أن جميع هذه الأراضي ينتمي إلى رتبة الأراضي الجيدة (C2).

اتضح من تحليل عينات مياه الري أنها ذات تأثير قلوي عادي إلى بسيط، وذات ملوحة محدودة، ومعظم مياه الصرف الزراعي والصرف الصحي ذات مخاطر محدودة من محتواها الصودي ومخاطر محدودة إلى متوسطة من محتواها من الكلوريد، ويجب الحذر في استخدام هذه المياه لري المحاصيل شديدة الحساسية

الكلمات الدالة:

الخصائص المورفولوجية والكيميائية، تقسيم الأراضي، تقييم الأراضي، تقييم مدى ملاءمة المياه للري.

أسماء السادة المحكمين

أ.د/ محمد حسن بهنسى كلية الزراعة – جامعة الأسكندرية ، أ.د/ فوزى الشاذلى أبوعجوة كلية الزراعة – جامعة المنوفية