Long-Term Cropping System Impacts on Some Physical and Chemical Properties and Fertility Status in Alluvial Soils of Egypt

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ABSTRACT

Development or identification of cropping systems that conserve soil properties and improve soil productivity is a high research priority. The main objective of this work is to recognize and compare the impacts of different cropping systems for twenty years on some chemical and physical properties and fertility status of some alluvial soils at El-Behera Governorate, North West of Nile delta. Fourteen soil profiles were selected in the alluvial soils to represent variations in cropping system, the present cropping patterns include vegetables and field crops.

The studied soils are generally characterized by clay and clay loam texture, and bulk density (Db) ranging from 1.18 to 1.35, 1.45 to 1.62 and 1.26 to 1.39 Mg m^{-3}, hydraulic conductivity (K_s) values ranged from 0.58 to 0.73, 0.29 to 0.39 and 0.55 to 0.62cm/hr in surface, subsurface and deep horizons, respectively. Subsurface layer (25-50cm) in the studied soil profiles have relative higher values of clay% and bulk density (Db) while it have lower values of hydraulic conductivity (K_s) comparing with those of the upper and deeper horizons. These soils are characterized also by low to moderate values of salinity, it ranged from 1.38 to 4.39 dS/m, moderate values of sodium adsorption ratio (2.54 to 7.30), low organic matter content (0.56–2.30 %). In addition, the studied soils have moderate contents of available macro and micro nutrients.

As for the effect of cropping systems on soil properties, data exhibited that soils cultivated with vegetables showed a relatively higher values of fine fractions percentage, hydraulic conductivity (Ks), soluble salts, organic matter content, available macro nutrients (K and N) and micronutrients (Fe, Mn, Cu and Zn) at the surface horizon than those cultivated with field crops, while it has relatively lower bulk density and SAR values. It can be concluded that, intensification of vegetables cultivations lead to improve soil physical properties and increase OM content and available macro and micronutrients in the surface horizons.

Key words: Cropping system, physical and chemical properties, alluvial soils.

INTRODUCTION

Land use and management practices impact the direction and degree of soil changes. Therefore, the proper land use and management can be useful for improving soil characteristic, reducing soil degradation and in turn achieving the agricultural sustainability.

Humberto et al. (2009) assessed the impacts of 33-yr cropping systems on near-surface soil structural, compaction, and hydraulic properties and their relationships with soil organic carbon concentration on a nearly level Crete silty clay loam in the central Great Plains and concluded that cropping systems significantly impacted soil properties.

Singh et al. (2009) studied the changes in status of organic carbon, phosphorus, potassium, pH, EC and bulk density after an interval of about three decades in some soils of arid ecosystem dominantly under pearl millet (pm)-pearl millet (pm) cropping sequence and under alternate land use systems. Depletion of soil organic carbon and available potassium was highest in the sandy soils, followed by coarse loamy soils, while phosphorus reduction was highest in the loamy-skeletal soils.

Shreenivas et al. (2010) studied the Physico-chemical properties of soil as influenced by different tree species after 16 years of planting and they reported that after an initial decrease of the soil salinity, it started building up after 5–6 years of planting. The same trend continued after 16 years of planting in all the species except in *Acacia nilotica*, where a slight decrease in salinity was observed.

Brock et al. (2011) suggested that short-term field experiments are not suitable for the quantitative assessment of cropping-systems impact on soil organic matter (SOM) levels in arable soils, as expectable temporal changes are very small compared to a large spatial variation of SOM background levels.

Risikesh et al. (2011) studied the status of nutrients depletion and build-up in soil after thirty-six years of intensive cropping under continuous use of various inorganic fertilizers and organic manure in a Vertisol. They found that conjoint use of FYM with 100% NPK substantially improved the organic carbon status by 3.9 g kg^{-1}, as well as available N, P and S by 126.8, 25.5 and 28.5 kg ha^{-1} in soil over its initial values, thereby indicating significant contribution towards sustaining the soil health. They also concluded that the balanced use of fertilizers continuously either alone or in combination with organic manure is necessary for sustaining soil fertility and productivity of crops.

Lemke et al. (2012) reported that the SOC (0–15 cm depth) in unfertilized fallow-wheat (F-W) and F-W-W have no changes from the assumed starting level, even after 20 yr of no-till. They found also that SOC in unfertilized continuous wheat (Cont W) after 30 yr as well as after 20 yr of no-till increased slightly (but not significant). No-till plus proper fertilization for 20 yr increased the SOC of F-W, F-W-W and Cont W in direct proportion to cropping frequency.

Balloli et al. (2000) reported that continuous practicing of rice-wheat rotation has resulted in formation of hard pan in subsurface layers (0.15–0.30m), build-up of available phosphorus and DTPA-extractable micronutrients and depletion in available potassium status in soils.

Pouyat et al. (2007) related the differences in soil properties, particularly P, K, pH and BD, to differences in land use and cover. Bowman et al. (1999) found that a pronounced decline in soil organic matter is usually associated with intensive cropping, summer fallow or absence of crop rotations with soil-building crops. Soils with low organic matter content are almost inevitably lacking in nutrients and also become more susceptible for more erosion, compaction, crusting and runoff.

Several studies have demonstrated the importance of soil management and its effect on alluvial soil characteristics. Abou Hussien (1999) showed that the contents of both total and available N, P, K, Fe, Mn, Zn and Cu were increased with increasing cultivation period in some alluvial soils of Kalioubiya. Beshay and Sallam (2001) found that the different land management practices affect root zone depth, soil texture, salinity and alkalinity, organic matter content and nutrient availability in the area lying between Ismailia canal and Cairo-Suez desert road. Rabie et al. (1988) reported that addition of clay materials, organic matter and mineral fertilization through manipulation bears much to small changes in physical, chemical and mineralogical properties of the soils. Labib et al. (2001) recommended that changing the crop rotation and the system of cultivation every few year is beneficial for improving the structure of heavy clay soils.

The current study is an attempt to compare and evaluate the long-term (about 20 years) impact of two cropping systems (field crops and vegetables) on some physical and chemical properties and nutritional status of alluvial soils at El-Behera Governorate, North West of Nile delta.

MATERIALS AND METHODS

The studied area is located in El-Behara Governorate at the north-western part of the Nile Delta, which represents soils developed from alluvial deposits.

Fourteen soil profiles were selected in the alluvial soils to represent variations in cropping patterns under the same irrigation method (surface) and irrigation water source (Nile water). The present cropping patterns included field crops and vegetables.

Profiles 1, 2, 3, 4, 5, 6 and 7 represented soils cultivated with field crops and profiles 8, 9, 10, 11, 12, 13 and 14 represented soils cultivated with vegetables.

Forty two soil samples were collected from 14 soil profiles (0-25, 25-50 and 50-80cm) for laboratory analysis. These samples were air-dried, ground and passed through 2-mm sieve. The main physical and chemical properties of soils were determined according to the methods outlined by Jackson (1958), FAO (1970) and Page et al. (1982). Soil bulk density was determined by using core method according to Black and Hartge (1986). Organic matter was determined according to Walkely and Black method as described by Hesse (1971).

Available nitrogen was extracted using 2M KCl and determined by the micro-kjeldahl method, available phosphorus was determined in sodium bicarbonate extract, according to Olsen and Watanabe (1965), available potassium was determined by flame photometer using the NH_4OAC method. The trace elements (Fe, Mn, Zn and Cu) were extracted using DTPA, as recommended by Lindsay and Norvell (1978) and measured using Atomic Absorption Spectrophotometer.

RESULTS AND DISCUSSION

Effect of cropping systems on soil properties

Physical properties

Data of some physical properties of the investigated soil profiles are presented in Table (1). The data showed that soil texture is generally fine through the entire horizons with high clay and silt contents. It ranges from clay to clay loam. The variations in soil texture among the different profiles are relatively slight.

Sand, silt and clay % in the surface horizon (0-25cm) of the studied profiles ranged from 20.0 to 28.0, 25.0 to 34.0 and 39.50 to 49.75 %, while it ranged from 17.5 to 27.5, 21.5 to 30.0, 45.0 to 58.5 in subsurface layers (25-50cm) and 19.50-33.75, 21.25-34.50, 40.5-52.0 in deep layers (50-80cm), respectively as shown in Table (1). However, the subsurface layers in most studied profiles have highest values of clay content comparing with surface or deep layers. This may be due to the migration processes of fine particles from surface horizons to the subsurface layers.

Table 1: Some physical properties of alluvial soils as influenced by cropping system

profile No	depth cm	Db Mg m^{-3}	Sand %	Silt %	Clay %	Ks cm/hr
			soils cultivated with field crops			
1	0-25	1.28	26.25	32.50	41.25	0.66
	25-50	1.57	20.00	26.50	53.50	0.35
	50-80	1.29	24.00	34.50	41.50	0.58
2	0-25	1.30	20.75	33.50	45.75	0.63
	25-50	1.48	21.25	26.25	52.50	0.37
	50-80	1.26	27.50	30.50	42.00	0.56
3	0-25	1.35	22.50	30.50	47.00	0.67
	25-50	1.62	20.00	21.50	58.50	0.38
	50-80	1.32	28.75	28.75	42.50	0.60
4	0-25	1.28	21.75	32.50	45.75	0.58
	25-50	1.46	22.50	25.00	52.50	0.35
	50-80	1.32	19.50	30.50	50.00	0.57
5	0-25	1.30	20.00	30.25	49.75	0.61
	25-50	1.58	20.50	26.25	53.25	0.38
	50-80	1.30	21.25	26.75	52.00	0.56
6	0-25	1.29	24.00	34.00	42.00	0.65
	25-50	1.60	17.50	26.50	56.00	0.36
	50-80	1.39	21.47	28.31	50.25	0.60
7	0-25	1.24	28.00	32.50	39.50	0.64
	25-50	1.62	22.50	30.00	47.50	0.36
	50-80	1.26	26.75	30.75	42.50	0.55
Mean	0-25	1.29	23.32	32.25	44.43	0.63
	25-50	1.56	20.61	26.00	53.39	0.36
	50-80	1.31	24.17	30.01	45.82	0.57
Mean	0-80	1.39	22.70	29.42	47.88	0.52
			soils cultivated with vegetables			
8	0-25	1.20	24.00	29.50	46.50	0.72
	25-50	1.52	25.00	25.00	50.00	0.32
	50-80	1.26	24.00	31.50	44.50	0.61
9	0-25	1.30	25.00	27.50	47.50	0.70
	25-50	1.45	19.00	29.00	52.00	0.31
	50-80	1.28	29.00	27.50	43.50	0.58
10	0-25	1.18	25.00	30.50	44.50	0.68
	25-50	1.46	27.50	27.50	45.00	0.29
	50-80	1.33	31.50	28.00	40.50	0.56
11	0-25	1.23	21.00	31.50	47.50	0.73
	25-50	1.52	20.00	27.50	52.50	0.37
	50-80	1.31	22.25	30.00	47.75	0.62
12	0-25	1.28	25.50	25.00	49.50	0.70
	25-50	1.55	21.50	24.00	54.50	0.32
	50-80	1.32	33.75	21.25	45.00	0.60
13	0-25	1.22	26.50	30.00	43.50	0.69
	25-50	1.48	25.25	27.16	47.59	0.39
	50-80	1.36	20.50	32.50	47.00	0.59
14	0-25	1.20	24.50	30.50	45.00	0.71
	25-50	1.46	18.00	29.75	52.25	0.36
	50-80	1.26	24.00	33.50	42.50	0.59
Mean	0-25	1.23	24.50	29.21	46.29	0.70
	25-50	1.49	22.32	27.13	50.55	0.34
	50-80	1.30	26.43	29.18	44.39	0.59
Mean	0-80	1.34	24.42	28.51	47.08	0.54

The data show that soils cultivated with vegetables have higher content of fine fractions at the surface horizons than those cultivated with field crops. Mean value of clay% in surface horizon of profiles cultivated with vegetables was 46.29, while it 44.43 in profiles cultivated with field crops as shown in Table (1). This may be related to the continue application of organic manure in case of vegetables cultivation.

Bulk density is influenced by soil texture, organic matter content and cultivation practices (Biswas and Mukherjee, 1987). Table (1) indicates that bulk density (Db) in the studied area ranged from 1.20 to 1.62 Mg m^{-3}. The Db values at the subsurface layer (25-50cm) in the most studied profiles were higher (1.45 -1.62 Mg m^{-3}) than those surface horizons (1.18 to 1.35 Mg m^{-3}) or deep layers (1.26-1.36 Mg m^{-3}). The lower values of Db at surface horizons in the studied profiles may be a result of plowing effect, as well as the relative increase of soil organic matter.

Concerning the effect of cropping systems on the bulk density (Db), results in Table (1) indicate that the mean values of bulk density at the surface, subsurface and deep layers were 1.29, 1.56 and 1.31 Mg m^{-3}, respectively in soils cultivated with field crops. While in soils cultivated with vegetables they were 1.23, 1.49 and 1.30 Mg m^{-3}, respectively. This data exhibited that soils cultivated with vegetables have relative lower bulk density values than those cultivated with field crops.

Data in Table (1) indicated that the hydraulic conductivity (K_s) values in the studied soils ranged from 0.58 to 0.73, 0.29 to 0.39 and 0.55 to 0.62cm/hr in surface, subsurface and deep layers respectively. This data show that the hydraulic conductivity values in the surface (0-25cm) or deep (50-80cm) layers in the studied soils was about two times higher than their values in the subsurface (25-50cm) layers.

Regarding the effect of cropping systems on the hydraulic conductivity data in Table (1) showed that mean values of K_s are 0.63, 0.36 and 0.57 cm/hr in surface, subsurface and deep layers in soils cultivated with field crops. While it 0.70, 0.34 and 0.59 cm/hr in soils cultivated with vegetables. This indicates that the surface horizons in soils cultivated with vegetables have relatively higher hydraulic conductivity values comparing with those cultivated with field crops. Such an increase in hydraulic conductivity in case of vegetables may be a result of the continual plowing effect, as well as the relative increase of soil organic matter content in case of vegetables system.

From the above results, it can be stated that the subsurface layers (25-50cm) in the studied soil profiles have relative higher values of clay% and bulk density (Db), while it have lower values of hydraulic conductivity (K_s) comparing with those of the upper and deeper layers. This phenomenon indicates that the investigated soils tend to formation compact layer (hard pan layer) in subsurface layers (25-50cm). These results are in harmony with those obtained by Balloli et al. (2000), they studied the effect of duration of rice-wheat cropping system on some physical and chemical properties and reported that continuous practicing of rice-wheat rotation has resulted in formation of hard pan in subsurface layers (0.15–0.30m).

Chemical properties

Data of total soluble salts, as expressed by the electrical conductivity (dS/m) of the soil saturated extract, indicated that the studied soils are characterized by low to moderate salinity. It ranged from 1.38 to 4.39 dS/m, as shown in Table (2). This could be due to low soluble salts content of the parent material and the irrigation water, presence an efficient drainage system in the studied area as well as the high irrigation efficiency for surface leaching any soluble salts accumulated in the surface horizons.

Regarding the effect of crop pattern on the soluble salts content, the mean value of EC in soils cultivated with vegetables (2.81 dS/m) was slightly higher than those cultivated with field crops (2.24dS/m), as illustrated in table (2). Also, the data indicate that soils cultivated with field crops attain lower EC values (1.38–2.75 dS/m) at the surface horizon than those cultivated with vegetables (2.59–4.39 dS/m). This may be attributed to continuous additions of chemical fertilizers as well as the organic manures in vegetables cultivated soils comparing with those of field crops. Similar results and conclusions were reported by Tiwari et al. (1995).

Values of sodium adsorption ratio (SAR) ranged from 2.54 to 7.30 in the studied soils, as shown in Table (2). Under the same irrigation method and irrigation water source, the variations in crop pattern have responsibility for such variation in SAR values. The data indicated that the values of SAR in the profiles which representing soils cultivated with vegetables ranged from 2.54 to 5.78 while those in the field crop cultivated soils ranged from 3.32 to 7.30 as shown in Table (2). These data indicate that the SAR values in the soils cultivated with field crops relatively higher than those in case of vegetables.

The above results showed that the soils cultivated with vegetables have relatively lower SAR values, and higher EC values comparing with those cultivated with field crops. This may be attributed to the use of high amount of irrigation water in case of vegetables and consequently,

Table 2: Some chemical properties of alluvial soils as influenced by cropping system

profile No	depth cm	pH	EC dS/m	Cations (meq/L)				anions (meq/L)			SAR
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Cl^{-}	HCO_3^{-}	SO_4^{--}	
				soils cultivated with field crops							
1	0-25	7.47	1.82	5.00	6.00	9.82	0.17	5.00	5.50	7.70	4.19
	25-50	8.00	2.01	3.50	4.00	12.73	0.14	7.75	5.00	7.35	6.57
	50-80	7.33	1.94	3.50	3.00	10.88	0.10	6.00	6.65	6.75	6.04
2	0-25	7.82	2.60	7.00	11.00	9.96	0.28	5.00	7.25	13.75	3.32
	25-50	8.04	2.55	3.50	7.00	16.72	0.21	6.25	8.00	11.25	7.30
	50-80	7.82	1.38	5.50	3.50	6.86	0.15	4.00	4.3	5.50	3.23
3	0-25	8.10	2.75	7.50	5.00	12.76	0.24	8.25	7.45	11.80	5.10
	25-50	8.03	3.35	7.50	6.50	18.93	0.18	6.00	8.25	19.25	7.15
	50-80	7.37	1.64	4.00	3.50	5.95	0.08	5.00	5.25	6.15	3.07
4	0-25	7.40	2.03	5.50	4.00	8.45	0.21	5.00	6.00	9.30	3.88
	25-50	7.29	3.91	7.00	12.00	20.19	0.15	12.00	11.25	15.85	6.55
	50-80	7.86	1.80	4.50	5.00	7.64	0.07	5.00	4.20	8.80	3.51
5	0-25	7.90	2.30	8.00	7.00	10.82	0.26	7.75	6.45	8.80	3.95
	25-50	7.88	3.00	6.00	8.50	15.94	0.17	8.75	10.00	11.25	5.92
	50-80	7.93	1.82	4.00	5.50	10.82	0.17	5.00	9.55	3.65	4.96
6	0-25	7.82	1.38	4.00	3.00	6.86	0.15	4.00	4.25	5.55	3.67
	25-50	7.95	2.31	6.50	5.50	11.82	0.19	4.75	6.85	11.50	4.83
	50-80	7.33	1.94	5.50	3.00	8.88	0.10	6.00	5.50	7.90	4.31
7	0-25	7.52	1.67	3.50	4.00	8.39	0.10	4.00	5.65	7.05	4.33
	25-50	7.96	2.33	3.50	6.00	13.44	0.15	5.50	7.50	10.30	6.17
	50-80	8.04	2.55	5.50	7.00	14.72	0.12	6.25	8.55	10.70	5.89
	0-25	7.72	2.08	5.79	5.71	9.58	0.20	5.57	6.08	9.14	4.06
Mean	25-50	7.89	2.69	5.36	6.86	14.80	0.18	7.61	8.01	11.33	6.06
	50-80	7.67	1.87	4.64	4.36	9.39	0.11	5.32	6.29	7.06	4.43
Mean	0-80	7.76	2.24	5.26	5.71	11.55	0.16	6.06	6.46	9.53	4.95
				soils cultivated with vegetables							
8	0-25	7.09	3.62	15.50	9.50	9.60	0.58	12.50	9.25	14.45	2.72
	25-50	7.55	1.50	2.50	3.50	7.01	0.32	4.50	6.00	4.50	4.05
	50-80	8.03	2.00	7.50	5.00	8.10	0.17	5.00	4.50	10.50	3.24
9	0-25	7.39	4.39	17.70	11.50	11.00	0.61	5.25	12.25	26.40	2.88
	25-50	7.67	2.03	7.00	5.50	8.55	0.25	5.00	6.20	9.10	3.42
	50-80	7.42	1.67	2.50	5.50	5.83	0.22	3.75	4.50	8.45	2.92
10	0-25	7.29	3.73	15.50	11.00	10.00	0.41	10.50	11.25	15.55	2.75
	25-50	7.85	2.04	5.00	6.00	8.11	0.21	6.25	4.00	10.15	3.46
	50-80	7.39	1.73	5.00	4.50	7.01	0.17	5.50	5.20	6.60	3.22
11	0-25	7.22	2.57	10.00	8.00	7.89	0.58	12.50	12.50	0.70	2.63
	25-50	7.42	3.73	10.00	11.00	15.33	0.41	10.50	8.50	18.30	4.73
	50-80	7.39	1.73	5.00	4.50	7.01	0.21	5.50	5.20	6.60	3.22
12	0-25	7.31	3.72	16.50	12.00	9.93	0.46	10.50	12.35	14.35	2.63
	25-50	7.63	2.05	6.00	4.00	9.90	0.24	7.50	9.00	4.00	4.43
	50-80	7.10	3.02	10.50	6.00	13.33	0.19	11.00	9.50	9.70	4.64
13	0-25	7.44	3.70	14.50	12.50	11.21	0.38	10.00	8.50	18.50	3.05
	25-50	7.60	3.62	9.00	8.50	17.10	0.28	12.50	10.00	13.70	5.78
	50-80	7.09	3.45	12.50	8.50	10.51	0.61	14.25	7.50	12.75	3.24
14	0-25	7.45	3.02	13.50	7.50	8.22	0.59	11.00	6.50	12.70	2.54
	25-50	7.46	2.20	4.50	5.50	10.55	0.32	5.50	7.00	9.50	4.72
	50-80	7.14	3.57	12.50	10.50	13.21	0.18	11.25	11.2	13.25	3.90
Mean	0-25	7.26	3.54	14.74	10.29	9.69	0.52	10.32	10.37	14.66	2.74
	25-50	7.60	2.45	6.29	6.29	10.94	0.29	7.39	7.24	9.89	4.37
	50-80	7.42	2.45	7.93	6.36	9.29	0.25	8.04	6.80	9.69	3.48
Mean	0-80	7.43	2.81	9.65	7.64	9.97	0.35	8.58	8.14	11.42	3.53

leaching of sodium salts more rapidly due to their higher solubility and mobility than calcium and magnesium salts. Moreover, continuous applications of manures and fertilizers in vegetable cultivated soils which have higher Ca and Mg concentrations and consequently lowering SAR value.

The data presented in Table (2) showed that the pH values of the studied soils varied in a limited range. Also, the data indicated that pH at the surface as well as the mean values are relatively lower in the soils cultivated with vegetables than those cultivated with field crops. This could be assigned to application of organic matter is relatively higher in the case of vegetable than field crops cultivated soils and cause of depressive effect of pH.

Soil fertility status

Organic matter

Data in Table (3) indicated that the organic matter contents were low and varies from 1.28 to 2.30 and 0.56 to 1.15% in the surface and subsurface layers of the studied profiles, respectively. These results are expected in arid climatic conditions, which encourage organic matter decomposition.

Concerning the influence of cropping pattern on the organic matter content, data revealed that the soils cultivated with vegetables tended to have relative higher organic matter content than field crops cultivated soils; i.e. organic matter percent is ranged between 1.64 and 2.30% in the surface horizon of profiles represent soils cultivated with vegetables while it was ranged from 1.28 to 1.62% in profiles represent field crops cultivated soils and have the same management practices as illustrated in Table (3). This could be assigned to the heavier manure application in case of vegetable than field crops cultivation. Moreover, plant residues accumulation is higher in the soils cultivated with vegetables than field crops cultivated soils. In addition, the relative high content of fine fractions in soils cultivated with vegetables supports favored conditions for organic matter maintenance (Millar et al., 1965). These results are in harmony with those obtained by Fathi et al. (1971), Rabie et al. (1988) and Abou Hussien (1999).

Available nutrients

The status of available macronutrients was studied after twenty years of different cropping systems and consequently continuous use of various inorganic fertilizers and organic manure in the studied alluvial soils. Data, presented in Table (3) showed wide variations in the available macronutrients in the studied soil profiles. Contents of available nitrogen, phosphorus and potassium in the surface horizons are in the range of 48.50 – 79.00, 1.55 – 3.12 and 345.00 – 652.00 ppm, respectively. According to Hamissa et al. (1998), Egyptian soils are considered to be deficient in macronutrients when the available contents are less than 40 ppm for nitrogen, 10 ppm for phosphorus and 200 ppm for potassium. Thus, most of the investigated soils exhibit adequacy of available nitrogen and potassium in the surface horizons, while it inadequacy of available phosphorus was observed.

Regarding the distribution of available macronutrients with depth, data indicate that the highest values of available N and P are found in the surface horizons in most profiles. This was expected, since these horizons received the fertilizers and organic manures as well as most of the biological activities, which cause release the available forms, take place mainly in the top horizons.

Concerning the influence of cropping systems on the available macronutrients, data revealed that the soils cultivated with vegetables tended to have relative higher content of available N, P and K at the surface horizons than those cultivated with field crops. Available N, P and K ranged from 62.00 to 79.00, 2.15 to 3.12 and 448.50 to 652.00 ppm, respectively at the surface horizon of profiles represent vegetables cultivated soils. While it was 48.50 to 68.50, 1.55-2.11 and 345.00-455.00 ppm in profile represent soils cultivated with field crop as shown in Table (3). The variations in macronutrients under different crop patterns may be attributed to the different amount of NPK fertilizers application and organic manures. These results are in agreement with those obtained by Soliman (1982). However, the relative higher available K content in vegetables cultivated soils than field crops may due to the application of K fertilizers to former soils.

As for the content of available micronutrients (Fe, Mn, Cu and Zn) in the studied soils, the data presented in Table (3) showed that the values of extractable Fe, Mn, Cu and Zn varied widely between 1.45–3.42, 1.08–2.05, 0.42–1.12 and 0.28–1.10 ppm at the surface horizons, respectively. While it ranged from 0.80-1.26, 0.22-1.14, 0.09-0.39 and 0.08-0.38 ppm in subsurface layers, respectively. According to Lindsay and Norvel (1978), soils showed deficiency in micronutrients when their extractable Fe, Mn, Cu and Zn were less than 2.5, 1.0, 0.2 and 0.5 ppm, respectively, On the other hand, Hamissa et al. (1998) refereed that this levels under Egyptian soil conditions is 2.0, 1.2, 0.5 and 1.0 ppm, respectively. Thus, it can be stated that most of the investigated soils show sufficiently in available Fe, Mn, and Cu, while it show deficiency in available Zn. The vertical distribution of available Fe, Mn, Cu and Zn in most profiles revealed a tendency for accumulation in the surface soil layers, as shown in Table (3).

Table 3: The amounts of available macro and microelements as influenced by cropping system

profile No	depth cm	Available (ppm)			Available (ppm)				OM
		N	P	K	Fe	Mn	Cu	Zn	%
soils cultivated with field crops									
1	0-25	56.00	1.62	419.50	2.49	1.22	0.85	0.52	1.35
	25-50	41.50	0.85	365.00	0.96	0.45	0.21	0.15	0.56
2	0-25	68.50	1.55	348.50	2.75	1.14	0.55	0.56	1.45
	25-50	48.00	0.65	348.50	1.05	0.45	0.12	0.12	0.82
3	0-25	52.50	2.11	432.00	2.90	1.38	0.42	0.46	1.62
	25-50	36.00	1.08	345.00	0.80	0.28	0.24	0.10	0.65
4	0-25	58.50	2.04	352.00	1.82	1.32	0.85	0.54	1.48
	25-50	44.50	0.88	294.00	0.85	0.32	0.18	0.17	0.55
5	0-25	68.00	1.82	415.00	1.88	1.20	0.52	0.53	1.32
	25-50	42.50	1.45	352.50	0.98	0.60	0.09	0.09	0.58
6	0-25	60.00	1.95	345.00	2.22	1.45	0.55	0.62	1.34
	25-50	45.00	0.75	298.00	1.04	0.45	0.26	0.20	0.92
7	0-25	48.50	1.65	455.50	1.45	1.08	0.50	0.28	1.28
	25-50	35.00	0.82	385.50	0.90	0.22	0.18	0.08	0.64
Mean	0-25	58.86	1.82	395.36	2.22	1.26	0.61	0.50	1.41
	25-50	41.79	0.93	341.21	0.94	0.40	0.18	0.13	0.67
Mean	0-50	50.32	1.37	368.29	1.58	0.83	0.39	0.32	1.04
soils cultivated with vegetables									
8	0-25	74.50	2.85	625.50	2.84	1.86	0.75	0.72	1.72
	25-50	61.50	1.35	475.00	1.22	0.52	0.18	0.12	1.02
9	0-25	76.50	2.22	529.00	2.65	1.52	1.02	0.95	1.64
	25-50	68.00	0.88	422.50	1.08	0.45	0.19	0.26	1.12
10	0-25	62.00	2.53	448.50	3.05	1.80	0.89	0.84	1.80
	25-50	43.00	0.45	430.50	0.94	1.14	0.26	0.32	0.95
11	0-25	70.50	2.15	512.00	2.88	0.98	0.62	1.10	1.66
	25-50	48.00	0.98	448.50	1.03	0.48	0.27	0.38	0.85
12	0-25	79.00	2.98	596.00	3.42	1.65	1.12	0.41	2.30
	25-50	68.80	1.12	532.50	1.26	0.74	0.39	0.12	1.15
13	0-25	65.00	2.32	645.00	3.02	1.82	0.80	0.34	1.92
	25-50	62.50	1.17	492.50	1.10	0.42	0.31	0.08	0.88
14	0-25	77.50	3.12	652.00	2.95	2.05	0.51	0.47	1.88
	25-50	62.00	0.98	486.50	0.86	1.12	0.15	0.12	0.79
Mean	0-25	72.14	2.60	572.57	2.97	1.67	0.82	0.69	1.85
	25-50	59.11	0.99	469.71	1.07	0.70	0.25	0.20	0.97
Mean	0-50	65.63	1.79	521.14	2.02	1.18	0.53	0.45	1.41

Data presented in table (3) reveal that the soils cultivated with vegetables had higher values of micronutrients. The mean concentration of available Fe, Mn, Cu and Zn were 2.22, 1.26, 0.61 and 0.50 ppm, respectively in surface horizon of soils cultivated with field crops, while values reached to 2.97, 1.67, 0.82 and 0.69 ppm, respectively, in vegetables cultivated soils. This may be attributed to occurrence of these elements as traces and impurities in organic manures and most NPK fertilizers, especially phosphates (Donahue, et al., 1990 and Abd El-Aal, 1994). Also, relative higher of fine fractions content in soils cultivated with vegetables supports favored conditions for micronutrients content (Abbas et al., 2003). This shows the decrease in the amounts of available micronutrients under the field crops conditions, and therefore, much care for their status must be given to increase the levels of available micronutrients of field crops cultivated soils.

CONCLUSIONS

It can be concluded from the obtained data that cropping systems may influence the content and distribution of soluble salts, organic matter, available macro and micronutrients in the studied area through fertilization systems and organic manure application. Also, it can be stated that the different cropping systems had affected on some physical properties. Soils cultivated with vegetables have higher values for hydraulic conductivity, OM, fine fractions, available macro and micronutrients and lower values of bulk density and SAR comparing with those cultivated with field crops. The subsurface layers in the studied soil profiles have relative higher values of clay% and bulk density (Db), while it have lower values of hydraulic conductivity (K_s) comparing with those of the upper and deeper layers. This indicates that the investigated soils may leads to compact layer formation (hard pan layer) in subsurface layers (25-50cm).

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الملخص العربى

تأثير النظام المحصولى على الخصائص الطبيعية والكيميائية وحالة الخصوبة فى بعض أراضى الترسيبات النهرية المصرية

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الهدف من هذه الدراسة هو معرفة ومقارنة التغيرات التى تحدث فى بعض الخصائص الكيميائيـة والفيزيائيـة للتربة وكذلك محتواها من العناصر الغذائية على المدى الطويل نتيجة الاختلاف فى النظام المحصولى وذلـك فـى بعض الترسيبات النهرية بمحافظة البحيرة.

تم اختيار أربعة عشر قطاعا أرضيا فى بعض الترسيبات النهرية فى محافظة البحيرة لتمثل الاختلافـات فـى النظام المحصولى الذى يشمل المحاصيل الحقلية والخضروات. تم أخذ ٤٢ عينة أرض (ثلاث عينات لكـل قطـاع صفر–٢٥، ٢٥–٥٠، ٥٠–٨٠سم) لأجراء التحليلات المعملية لبعض الخواص الفيزيائية والكيميائية و الخصوبة.

يمكن تلخيص النتائج المتحصل عليها فى الآتي:

تتميز الأراضي المدروسة عموما بقوام طيني فى معظم الأفاق، نسب الرمل، السلت والطين تراوحت مـن ٢٠–٢٨، ٢٥–٣٤، ٣٩,٥–٤٩,٧٥% فى الطبقات السطحية، بينما تراوحت مـن ١٧,٥–٢٧,٥، ٢١,٥–٣٠,٠، ٤٥,٠–٥٨,٥% فى الطبقة التحت سطحية ومن ١٩,٥–٣٣,٧٥، ٢١,٢٥–٣٤,٥، ٤٠,٥ – ٥٢,٠% فى الطبقـات العميقـة على التوالى. الكثافة الظاهرية تراوحت قيمها بين ١,١٨–١,٣٥ ، ١,٤٥–١,٦٢، ١,٢٦–١,٣٩ طن/م٣ بينمـا قـيم التوصيل الهيدروليكى تراوحت بين ٠,٥٨–٠,٧٣، ٠,٢٩–٠,٣٨، ٠,٥٥–٠,٦٢ سم/ساعه فـى الطبقـة السـطحية وتحت السطحية والعميقة على التوالى. هذه النتائج توضح أن الطبقة التحت سطحية (٢٥–٥٠سـم) فـى منطقـة الدراسه بها أعلى نسبه مئوية للطين وكذلك أعلى قيم للكثافة الظاهريه وأقل قيم للتوصيل الهيدروليكى مقارنة بالطبقة السطحية (٠–٢٥سم) أو العميقة (٥٠–٨٠سم)، هذا يدل على أن هذه الأراضى تتجه الى تكوين طبقه طينية مندمجه (طبقه صماء) فى العمق ٢٥–٥٠سم.

أيضا تميزت هذه الأراضى بمحتوى قليل الى متوسط من الأملاح الذائبة يتراوح من ١,٣٨٠الى ٤,٣٩ ديسى سيمنز/م، قيم متوسطة من نسبة ادمصاص الصوديوم SAR (٢,٥٤-٧,٣٥)، محتوى منخفض من المادة العضوية (٠,٦٤-٢,٣٠%) وقيم متوسطة من المحتوى الصالح من المغنيات الكبرى والصغرى نتروجين، فوسفور وبوتاسيوم، حديد، منجنيز، نحاس وزنك والتى تراوحت قيمها فى الأفق السطحى من ٤٢-٧٩، ١,٥٥-٣,١٢، ٣٤٥-٦٥٢، ١,٤٥-٣,٤٢، ١,٠٨-٢,٠٥، ٠,٤٢-١,١٢ و٠,٢٨-١,١٠ جزء فى المليون على التوالى.

وفيما يختص بتأثير النظام المحصولى على الخصائص الطبيعية والكيميائية للتربة بالاضافة الى العناصر الغذائية المختلفة، فقد أظهرت النتائج أن الأراضى التى تم زراعتها بالخضروات لفترات طويلة تميزت بمحتوى أعلى من المكون الناعم للتربة(السلت والطين) والمادة العضوية والمحتوى الصالح من العناصر الكبرى (النتروجين والبوتاسيوم) وكذلك العناصر الغذائية الصغرى(الحديد، المنجنيز، النحاس والزنك) وأيضا الأملاح الكلية الذائبة بالاضافة الى زيادة قيم التوصيل الهيدروليكى، بينما أظهرت قيما أقل للكثافة الظاهرية ونسبة الصوديوم المدمص فى الأفاق السطحية وذلك بمقارنتها بالأراضى التى تم زراعتها بالمحاصيل الحقلية لنفس المده تقريبا. الاختلاف فى محتوى الأرض من المادة العضوية ومحتواها من العناصر الغذائية تحت اللأنظمة المحصولية المختلفة قد يرجع الى الكميات المضافة من الأسمدة العضوية والمعدنية والتى تحتلف من نظام محصولى لأخر. مما سبق يتضح أن زراعة الأرض بالخضروات لمدة طويلة أدى الى تحسين بعض خواصها الكيميائية والطبيعية بلاضافة الى زيادة خصوبتها.