EVALUATING AND CHANGES MONITORING OF SOIL PROPERTIES IN NEWLY RECLAIMED LANDS, EGYPT.

Journal

Eid, M. A. M., Khadr, M. Y. A., and Mubarak, D. M. F.[1]

[1]*Department of Soil Science, Faculty of Agriculture, Ain Shams Univ., Shobra El-Kheima, Cairo, Egypt.*

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ABSTRACT

Soil profiles and plant samples from Typic Torripsamments (Dina agricultural project) and Calcids (Matco farm) were collected to evaluate and monitor changes in soil properties with focus on the status of some nutrients after different agriculture production periods. Soil ECe, $CaCO_3$, ammonium acetate extractable K, Ca, Mg and Na significantly decreased with increasing period of cultivation. Generally the levels of total soil N were low. Nitrogen, Ca and Mg contents of plant in most cases were lower than the optimum levels, while the plant K contents were within optimum levels for most crops. Results showed that organic and mineral N fertilizers must be added to correct the deficiency levels. Also Ca and Mg application is required in addition to K dressings to maintain the nutrient levels at favorable values.

Key words: Newly reclaimed soil – Torripsamments – Calcids – Organic matter – Calcium carbonate – Macronutrients availability – Cultivation period –Plant tissue analysis.

INTRODUCTION

Agricultural area in the Nile valley and Delta in Egypt could not keep up with food and fiber requirement increasing rate of the increased population. Consequently, cultivation of desert soils making up more than 95 % of the total area became a must to increase the agricultural production.

Agricultural security in Egypt depends largely on the horizontal extension of sandy and calcareous soils. These soils are poor with respect to their physical, chemical and biological characteristics (e. g. nutrient availability). The productivity of sandy and calcareous soils are directly related to the development of soil properties as a result of cultivation.

As soon as the soil is put under intensive cropping, many changes in its properties usually do occur. The magnitude and character of the changes taking place depend largely on the crop and soil management practices.

To bring soil under successful agriculture production, different packages of operations concerning soil and water management are performed. These agricultural practices have direct and indirect influence on soil quality.

Accordingly, the main objectives of this work were to evaluate and monitor changes in the soil properties with focus on the status of some nutrients when sandy (Torripsamment) and calcareous (Calcid) soils are put under different agriculture production systems.

Results will help the users of sandy and calcareous soils to establish proper soil and fertilization management practices (in addition to water courses programs).

MATERIALS AND METHODS

Two sites were selected for sampling to represent those fields put under different soil characteristics and periods of cultivation. The first site lies west of the Nile Delta at 80 km of Cairo – Alexandria desert road (Dina farm, Torripsamment) and the second site is located in El-Nobariya area in the northwestern part of the Nile Delta, about 150 km along Cairo – Alexandria desert road, (Matco farm, Calcid), Egypt.

Five soil profiles were selected to represent different periods of cultivation from Dina farm, and two profiles were selected from Matco farm. The selected areas covered a wide range of cultivation periods, different irrigation systems and soil management practices. Soil profiles of Virgin soil, 7 and 9 years of cultivation in Dina farm cultivated by apple (Malus sylvestris, cv. Anna) under drip irrigation and maize (Zea maize) under sprinkler irrigation. But profiles of

Matco farm were taken from virgin and 4 years soil cultivated with potato (Solanum tuberosum cv. Necola) under drip irrigation system.

Samples of irrigation water were collected from Dina and Matco farms. The irrigation was run by using well water characterized by pH 7.7 and 8.0 and EC 0.34 and 0.67 $mScm^{-1}$ for Dina farm and Matco farm respectively. Samples of drainage water from Matco farm was also collected and characterized by pH 8.6 and EC 4.37 $mScm^{-1}$.

The practice cultures management of fertilization for the first location based on the use of organic and mineral fertilizers. For soil planted with trees, 0.01 m^3 of cow manure was mixed with 200 g ammonium sulfate, 750 g super phosphate and 200 g potassium sulfate then applied to subsoil around each tree for only the first four years. Mineral fertilizer was added as fertigation. The yearly total amount was 63 kg N as ammonium nitrate, 63 kg K as potassium sulfate and 8.4 kg P as phosphoric acid/fed. Foliar micronutrients were applied as 1 kg of mixed Fe, Mn and Zn as chelated form in 600 l/fed 3 times yearly for apple trees. For the soil planted with field crops, mineral fertilizers generally were added at rates of 100 kg/fed ammonium sulfate, 100 kg/fed potassium sulfate and 200 kg/fed super phosphate with culture practice and 100 kg/fed ammonium nitrate during growing season. The crop rotation in the cultivated soil 7 years was maize, clover and barley and in the soil cultivated for 9 years was alfalfa, maize, potato, maize, barley and maize.

The profiles chosen from second location were from field crops cultivated farm. The cultivation management was the addition of cow manure as organic fertilizer at rate of 20 m^3/fed with culture's practice. The crop rotation includes vegetable crops. The mineral fertilizers, generally, were similar the mineral fertilizers management which previously mentioned in the first location. Foliar micronutrients were applied as 1 kg of mixed Fe, Mn and Zn as chelated form in 600 l/fed. Foliar fertilization was applied depending on the deficiency symptoms appearance on plants.

The collected soil samples were air dried ground and sieved through a 2 mm stainless steel sieve and stored in plastic vials for different analysis.

All soil chemical properties were determined according to Page *et al*., (1982). Calcium carbonate content was measured volumetrically by using Collin's Calcimeter. Organic matter was determined by oxidizing the organic carbon with potassium dichromate and back titration with ferrous sulfate. Soil pH values were determined in the soil paste by using a glass electrode pH – meter. Electrical conductivity (ECe) was determined for a saturated extract by using standard conductivity bridge at 25^{o}C. Total N was extracted by wet digestion and determined with micro Kjeldahl method. Soluble and exchangeable K, Ca, Mg and Na (chemically available) were extracted by 1 N ammonium acetate puffer solution adjusted at pH 7.0. Potassium and Na were measured by flame emission and Ca and Mg by atomic absorption spectroscopy.

Particle seize distribution was carried out by Baruah and Barthakur, (1997) for the coarse – textured soils.

Plant samples of apple (Malus sylvestris cv. Anna), onion (Allium sp.), potato (Solanum tuberosum cv. Necola) and barley (Hordeum vulgare) were collected from the areas where soil samples had been obtained. Plant samples were collected according to the recommended parts by Jones (1977). Leaves apple samples were near base of currently year's growth, potato, onion and barley samples were suitable part sample in early mature stages.

The plant samples were dried at 70 ^{o}C till constant weight, ground in stainless steel mill to pass through 1 mm sieve and kept in plastic containers for analysis.

Plant tissue contents of N, K, Ca, Mg and Na were determined after 0.5 g samples were wet ashed in H_2SO_4-H_2O_2 mixtures and the digests were brought to 50 ml. Total N was determined with micro Kjeldahl method. Calcium and Na were measured by flame emission and K and Mg by atomic absorption spectroscopy.

Matrix correlation coefficients were conducted between all characteristics of studied soil samples according to Steel and Torrie (1980), using statgraph computer program.

RESULTS AND DISCUSSION

Soil pH:

Soil pH is the major factor determining the behavior of the different nutrients in soil, because it affects all adsorption mechanisms and the status and ratio of elements in the soil solution. Data in table (1) show that the pH values ranged between 7.0 and 8.1. In general pH values for the soil Typic Torripsamment, (Dina farm) were lower than Calcid soil samples, (Matco farm).

In the different profiles of Typic Torripsamment and Calcid soil samples data showed that neither vegetation type, nor irrigation system clearly affected pH values of the soil. This may be due to the soil buffering action. Also the period of vegetation especially in short period had no effect on the soil pH values, were the maximum period for the investigated soil samples was only 9 years. On the other hand the values of soil pH varied with the soil depth. Soil pH for the surface horizon was always lower than the subsurface horizons in all studied soil profiles. Matrix correlation in table (4) shows the soil pH values had highly significant with soil depths and highly negative correlation with the OM in the soil samples. These results showed that the soil pH decreased clearly with the increase of the organic matter content in the soil. El-Gala *et al*., (1976) reported that the pH values were almost the same in the different layer of virgin soil, but a pronounced decrease was noticed after cropping. The greater decrease in pH was attained after one year of cropping, which could be mainly attributed to the decrease in soluble and exchangeable Na^+ and partially to organic matter decomposition. Also Haraga *et al*., (1979) reported that the increase in organic matter in the surface layers affected their pH values, where pH generally decreased as the cultivation period increased up to 10 years.

Total soluble salts:

Virgin soil had high amounts of soluble salts as shown in table (1). In surface soils ECe were 12.3 dS/m and 7.4 dS/m for Typic Torripsamment and Calcid respectively in surface layer of virgin soil profile. These contents of soluble salts are not suitable for cultivation. The first and important step of reclaiming these soils is salt leaching. For this reason ECe in the cultivated soil samples were low compared with the virgin soil samples. These values decreased to 2.9 dS/m and 1.7 dS/m for the same Typic Torripsamment and Calcid surface soil samples respectively (table 1). Also table 4 showed highly significant negative correlation between soil ECe and the time of cultivation.

In most cases ECe decreased with the soil depth for both Typic Torripsamment and Calcid soils as shown in table (1) due to the up movement of capillary water in arid region. Only profile No. 7 for Calcids had higher ECe values in the subsurface soil horizon compared with surface soil (table 1), may which possibly due to soil sampling directly after irrigation.

The soil irrigated with sprinkler system had a higher contents of soluble salts compared with drip system. Data in table 1 showed that the mean value of ECe in Typic Torripsamment horizons with drip irrigation system was 1.93 dS/m. While the mean value of ECe for the same soil location horizons with sprinkler irrigation system was 4.39 dS/m. This result demonstrates the differences between drip and sprinkler irrigation systems. Where drip irrigation system was more efficient in leaching salts from plant root zone. But this system had a big defect, sometimes with heavy rain the soluble salts moved to root zone and caused salt problems for growing plants. The irrigation during and after rains is the best recommendation for leaching salts away from root zone.

Organic matter:

Data in table 1 showed that OM increased in soil with increasing the period of cultivation of the sandy soil. The mean increases were 38 % and 855 % for the surface and the subsurface horizons respectively after 9 years of vegetation compared with the virgin soil . Data also showed that the organic matter contents in most soil profiles decreased with increasing the soil depth for the profiles of the two locations. These increases caused by the annual application of compost or organic manure as soil amendment. Significant positive correlation between soil organic matter content and the period of cultivation is shown in table 4. Haraga *et al*., (1979) showed that there are remarkable increases in the organic matter content with the increases of land use period in the surface layer after 18 years. El-Gala *et al*., (1976) reported that the organic matter content gradually increased as cropping period increased, due to the accumulation of plant residues and the activity of soil microorganisms. Also they found that no change in the organic matter content of the deep layers. Fathi *et al*., (1971) showed that the organic matter content generally increases gradually with the increase in the land use period, due to the accumulation of plant residues, soil microorganisms and organic manuring. They also mentioned that the organic matter content gradually decreased with depth. Also Ussiri *et al*., (2006) study sites were surface mined for coal, reclaimed and managed as pasture and then converted into woodland 10 years before. They found that this practices decreased soil pH, and EC and increased soil organic matter.

It is interesting to note that there was high increase of OM in profile 4 at about 40 cm of soil depth (table 1) in the first location with 9 years apple cultivation, which could be due to mixing of organic fertilizers with soil in ditches near the trees. But in the sprinkler irrigation system organic fertilizers was mixed with the soil surface by plowing. This observation was not found for the different profiles irrigated with drip system especially for the calcareous soil (table 1) which may be due to the poor organic fertilizers application or the soil sampling did not include organic fertilizer ditches soils.

Calcium carbonate:

Table (1) showed that the $CaCO_3$ content in Typic Torripsamment was ranged between 0.7 and 9.8 % and in Calcid ranged between 12.3 and 34.9 %. These differences were attributed to soil formation processes.

Statistical analysis showed that there is a very highly significant negative correlation between soil $CaCO_3$ content and the progress of the vegetation time (table 4). This decrease in $CaCO_3$ with the increasing period of cultivation could be attributed as to the dissolution and leaching of $CaCO_3$ from the soil profile. The decomposition annually applied organic fertilizers produces organic acids as well as root exudates from growing plants may reduces soil pH, forming soluble $Ca(HCO_3)_2$ that can be leached out. Data in Table 4 showed that very highly positive and negative correlations between soil$CaCO_3$, clay and coarse sand contents respectively. This indicates that the particle seize of $CaCO_3$ fall in the clay fraction. Very fine particles of $CaCO_3$ react easily, fast and actively with acid agents in the soil.

The previous result are agree with those found by Omar *et al*., (1990), Abdel-Aal *et al*., (1990) and Rabie *et al*., (1988). They showed that this reduction of $CaCO_3$ soil content with the period of vegetation was due to the effect of application of irrigation water and organic manuring which lead to dissolution of carbonates. Haraga *et al*., (1979) indicated that, carbon dioxide formed from root system respiration and decomposition of organic matter, reacts with the sparingly soluble calcium carbonate to form soluble bicarbonate. This reaction was evidenced from the slight decrease of $CaCO_3$ content by continuous cultivation.

Table (1): Soil reaction (pH), saturation percent (SP), ECe, organic matter percent (OM) and calcium carbonate percent of different soil profiles.

No	Irrigation system	Veget -ation	Depth (cm)	pH S. paste	SP %	ECe dS/m	OM %	$CaCO_3$ %
Soil profiles of Torripsamment (Dina farm)								
Virgin soil								
1	Non	Non	0-20	7.3	28	12.3	0.83	9.1
			20-40	7.4	27	10.7	0.05	9.2
			40-60	7.5	23	11.7	0.10	3.5
Soil cultivated for 7 years								
2	Drip	Apple	0-10	7.5	29	2.90	0.64	4.2
			10-20	7.6	31	0.87	0.29	9.8
			20-50	7.8	36	0.55	0.11	6.5
			50-75	8.1	41	0.51	0.08	3.8
3	Sprink -ler	Maize	0-20	7.0	25	4.21	0.86	4.2
			20-30	7.5	24	3.00	0.17	2.5
			30-65	7.6	26	2.40	0.04	1.9
			>65	7.6	25	2.78	0.03	1.0
Soil cultivated for 9 years								
4	Drip	Apple	0-10	7.4	31	6.57	1.43	8.6
			10-20	7.3	33	1.60	1.55	6.9
			20-40	7.2	40	1.66	3.65	5.9
			40-60	7.7	26	0.79	0.14	2.8
5	Sprink -ler	Maize	0-10	7.5	27	4.70	0.86	2.5
			10-20	7.4	24	6.52	0.32	1.3
			20-30	7.8	23	2.50	0.03	0.8
			30-50	8.0	26	2.12	0.01	0.7
			50-70	7.5	24	2.80	0.01	1.0
			70-90	7.6	22	2.86	0.02	1.4
Soil profiles of Calcid (Matco farm)								
Virgin soil								
6	Non	Non	0-30	7.6	33	7.41	0.25	12.3
			30-60	7.7	48	8.25	0.12	21.6
			60-80	7.9	49	3.58	0.11	24.6
			80-100	8.1	64	2.56	0.12	25.3
Soil cultivated for 4 years								
7	Drip	Potato	0-30	7.8	41	1.7	0.19	17.9
			30-60	7.6	45	6.53	0.18	34.9
			60-80	7.8	50	6.35	0.07	25.7
			80-100	7.7	65	5.12	0.07	27.5

Soil texture:

Soil texture results of soil mechanical analyses showed that the texture for all soil samples of Typic Torripsamment and Calcid ranged between sand to sandy loam (table 2). The matrix correlation coefficient analysis showed a very highly negative significant correlation between the soil clay content and the time of vegetation (table 4). In the same time there is a very highly positive significant correlation between the time of vegetation and the course sand contents (table 4). Which possible due to the clay migration with the drainage water especially in the light texture soils. Ismail (1978) showed that the clay + silt fraction increased with increasing of land use period from 6 to 18 years in subsurface layers. The same result was found by Fathi *et al*., (1971).

Status of some macronutrients in new reclaimed soils:

Table (3) illustrated the total N content for the investigated soil samples. These contents ranged between 0 and 728 mg/kg with the exception of a sample at 40 cm deep in profile 4 where it reached 2284 mg/kg, due to higher content of soil OM (tables 1 and 3). The total N range mentioned above represent the very low and low broad rating soil N measurements respectively according to Landon (1991). This mean that the seasonal nitrogen fertilization is very important for cultivating these soils. Correlation coefficient between total soil N and different soil characteristics (table 4) showed that the total N significantly increased with increasing period of cultivation, and decreased with the increasing soil depth. The same effects of time and the soil depth on soil organic matter content were found. This indicates that the total N content and organic matter are associated. The correlation between total N and soil organic matter is very highly significant (r = 0.93***). This result indicate that the OM is not only an important source of soil N but also it save the mineral N fertilizer from leaching. El-Gala *et al*., (1976), reported that the total nitrogen was gradually increased in the 0 – 30 cm layer as cropping period increased due to the increase in organic matter accumulation. Blevins *et al*., (1977) found that the soil organic matter and organic nitrogen significantly increased in the top 5 cm of soil under no-tillage management. Sharifi *et al*., (2008) found that the organic matter was the best predictors of field-based indices of soil N supply. The high significant negative correlation between total N and soil pH was attributed to the effects of soil organic matter on the soil pH.

Generally C/N ratio (table 3) for 26 from 29 studied soil samples not exceed than 15. This refer to their was an equilibrium between soil C and N contents as reported by Landon, 1991.

The exchangeable and soluble K, Ca, Mg, and Na as extracted by ammonium acetate at pH 7 are widely regarded as available to plants (Page *et al*., 1982 and Landon, 1991). Table (3) showed that the available K, Ca, Mg, and Na in the different soil samples ranges are 3.9 – 45.6, 184 – 862, 3.7 – 53.2 and 9.9 – 89.1 g/ 100g respectively. These wide ranges reached about 10 fold indicating that there are many factors affecting the available K, Ca, Mg and Na contents in the new reclaimed soils. Matrix correlation coefficients in table (4) demonstrate some of these factors. Significant negative correlation between the period of cultivation and available K, Ca, Mg and Na refer to the decreasing of these nutrients with the increasing of the period of cultivation. This effect is due to leaching out of these elements with derange water and plant depletion. Significant and very highly significant correlation between ECe and available K and Na content respectively (table 4) indicating the above results. The ECe for soil samples had a very highly negative correlation with the period of cultivation (table 4) due to the leaching of soil salts and continuous irrigation. (El-Gala *et al*., 1976 and Nelisen *et al*., 1995).

Significant and highly significant correlation between available K, Ca, Mg and Na with $CaCO_3$ content as shown in table 4 indicated that available K, Ca, Mg and Na in Calcid soil were higher than in Typic Torrepsimment soils. This difference could be attributed to the nature of the minerals and rock formation of these soils.

Available K, Ca, Mg and Na were correlated significantly with the silt and clay contents. Whereas these elements had a negative significant correlation with coarse sand fraction as illustrated in table (4). This proved that K, Ca, Mg and Na cations are adsorbed on the negative charge of silt and clay particles as exchangeable forms (Eisa, 1993).

Matrix correlation coefficients between available K, Ca, Mg and N are significant as shown in table (4), and confirm the behavior of these elements in the studied soils.

Table (2): Contents of coarse sand (CS), fine sand (FS), silt, clay and soil texture for different soil profiles.

No	Irrigation system	Veget -ation	Depth (cm)	CS	FS	Silt	Clay	Texture
				◄	%		►	
Soil profiles of Torripsamment (Dina farm)								
Virgin soil								
1	Non	Non	0-20	47.9	27.8	12.1	12.2	S.L.
			20-40	67.2	12.0	0.9	18.9	S.L.
			40-60	78.1	10.4	0.1	11.4	L.S.
Soil cultivated for 7 years								
2	Drip	Apple	0-10	77.0	14.0	7.0	2.0	Sand
			10-20	56.5	25.0	1.6	16.9	S.L.
			20-50	76.9	15.4	6.0	1.7	Sand
			50-75	78.5	15.2	5.3	1.0	Sand
3	Sprink -ler	Maize	0-20	64.9	20.1	2.9	12.1	L.S.
			20-30	79.0	10.2	0.1	10.7	Sand
			30-65	84.5	6.5	0.0	9.0	Sand
			>65	72.5	21.6	4.3	1.6	Sand
Soil cultivated for 9 years								
4	Drip	Apple	0-10	53.2	29.0	2.5	15.3	L.S.
			10-20	61.0	21.0	1.2	16.8	S.L.
			20-40	69.7	18.0	0.5	11.8	L.S.
			40-60	80.2	10.5	0.2	9.1	Sand
5	Sprink -ler	Maize	0-10	71.7	23.0	3.3	2.0	Sand
			10-20	71.0	23.6	3.6	1.8	Sand
			20-30	72.3	22.6	3.8	1.3	Sand
			30-50	72.5	23.5	3.0	1.0	Sand
			50-70	71.8	22.6	3.3	2.3	Sand
			70-90	72.2	22.0	4.1	1.7	Sand
Soil profiles of Calcid (Matco farm)								
Virgin soil								
6	Non	Non	0-30	48.7	37.2	1.2	12.9	L.S.
			30-60	46.6	23.6	10.3	19.5	S.Cl.L
			60-80	45.9	20.5	16.0	17.6	S.L.
			80-100	40.6	22.0	18.5	18.9	S.L.
Soil cultivated for 4 years								
7	Drip	Potato	0-30	56.0	32.0	0.7	11.3	L.S
			30-60	52.1	31.7	0.6	15.6	L.S
			60-80	49.2	20.8	14.5	15.5	S.L.
			80-100	54.5	25.8	0.1	19.6	S.L.

S. L. = Sandy loam
L. S. = Loamy sand
S. Cl. L. = sandy clay loam

Table (3): Contents of total nitrogen (N), C/N ratio, available K, Ca, Mg and Na (NH_4OAC-extractable) for different soil profiles.

No	Irrigation system	Veget -ation	Depth (cm)	N mg/ kg	C/N Ratio	K	Ca	Mg	Na
						◄—— mg/100g			——►
Soil profiles of Torripsamment (Dina farm)									
Virgin soil									
1	Non	Non	0-20	519	9.3	45.6	676	44.8	89.1
			20-40	44	6.8	24.9	644	33.1	69.9
			40-60	43	14.0	23.8	546	33.5	86.5
Soil cultivated for 7 years									
2	Drip	Apple	0-10	387	9.6	25.4	588	38.6	21.1
			10-20	159	10.7	21.4	600	30.5	16.6
			20-50	55	10.9	9.4	600	19.7	12.9
			50-75	26	1.2	46.4	622	18.6	13.6
3	Sprink -ler	Maize	0-20	430	11.6	24.2	686	29.6	22.0
			20-30	109	9.2	8.2	862	17.5	15.9
			30-65	23	8.7	3.9	610	11.8	11.9
			>65	6	33.3	4.7	184	7.3	9.9
Soil cultivated for 9 years									
4	Drip	Apple	0-10	728	11.4	37.8	578	48.4	43.0
			10-20	89	10.1	14.8	622	48.8	23.9
			20-40	2284	9.3	18.3	578	49.7	10.6
			40-60	88	9.1	5.5	244	17.5	14.5
5	Sprink -ler	Maize	0-10	643	7.8	25.7	436	32.8	28.8
			10-20	240	7.9	36.3	404	30.2	35.6
			20-30	56	3.6	32.0	188	21.8	28.5
			30-50	14	7.1	24.2	622	16.6	23.9
			50-70	0	-	25.7	284	25.3	18.2
			70-90	15	6.7	24.9	314	28.9	19.8
Soil profiles of Calcid (Matco farm)									
Virgin soil									
6	Non	Non	0-30	68	22.1	32.4	644	41.8	55.9
			30-60	221	3.2	40.5	644	48.6	69.0
			60-80	98	6.1	42.1	644	48.1	51.3
			80-100	107	6.5	47.2	644	57.7	55.9
Soil cultivated for 4 years									
7	Drip	Potato	0-30	112	9.8	28.9	632	34.2	26.9
			30-60	93	10.8	21.1	654	43.8	49.2
			60-80	117	3.4	31.6	654	53.2	52.2
			80-100	67	6.0	37.8	664	49.4	41.6

Table (4): Matrix correlation coefficients between the studied soil characteristics for 29 samples.

	Depth	Time	pH	ECe	OM	$CaCO_3$	N	K	Ca	Mg	Na	CS	FS	Silt
Time	-	-												
pH	0.57**	-0.18	-											
ECe	-0.13	-0.64***	-0.34	-										
OM	-0.40*	0.28	-0.57**	-0.07	-									
$CaCO_3$	0.37*	-0.61***	0.31	0.22	-0.13	-								
N	-0.32	0.21	-0.48**	-0.01	0.93***	-0.09	-							
K	0.13	-0.46*	0.27	0.37*	-0.06	0.43*	0.02	-						
Ca	-0.14	-0.47**	-0.02	0.22	0.12	0.47**	0.08	0.23	-					
Mg	0.13	-0.50**	-0.01	0.32	0.33	0.70***	0.29	0.61***	0.42*	-				
Na	0.04	-0.83***	-0.03	0.90***	-0.15	0.47**	-0.10	0.56**	0.32	0.56**	-			
CS	-0.11	0.61***	-0.12	-0.34	-0.03	-0.80***	-0.02	-0.63***	-0.39*	-0.81***	-0.58***	-		
FS	-0.16	-0.16	0.03	0.17	0.05	0.43*	0.03	0.47**	0.02	0.40*	0.24	-0.69***	-	
Silt	0.35	-0.45*	0.41*	0.11	-0.16	0.42*	-0.08	0.57**	0.15	0.52**	0.37*	-0.55**	0.09	-
Clay	0.11	-0.62***	-0.11	0.37*	0.13	0.72***	0.07	0.26	0.58***	0.69***	0.54**	-0.72***	0.18	0.18

*, ** and *** significant at P< 0.05, 0.01 and 0.001 respectively.

The results of available K, Ca, Mg and Na in the sandy and calcareous soils show that the level of available K in most soil samples were within the medium levels (100 – 200 mg/kg) to high levels (> 200 mg/kg) as recorded by Landon (1991). He also points out that these values are only approximate and will vary with the environment crop and production level. Available Ca is usually in sufficient levels when the soil has a pH > 7 as the case in soil samples studied. Westerman *et al*., (1990) concluded that Ca-deficiency symptoms are observed on plants growing in soils having pH values below 4.5 and containing exchangeable Ca < 400 mg/kg. Also available Mg is at a high level for all soil samples. The high available Mg levels were not less than 60 mg/kg as recorded by Landon (1991). Exchangeable Ca : Mg ratio ranged between 8.9 : 1 and 50.7 : 1 for Typic Torripsamment and 8.5 : 1 and 18.5 : 1 for Calcid soils. Magnesium becomes increasingly unavailable with increasing Ca. With high pH, P availability may be reduced when Ca : Mg ≥ 5 : 1 (Landon 1991). He also recorded that this ratio decreases with cultivation.

The ratio of K : Mg for all soil samples ranged between 0.1 : 1 and 1.5 : 1. These ratios are suitable for plant growth. London (1991) mentioned that Mg uptake was inhabited if the K : Mg ratio exceeds values 2 : 1. Generally he reported that for soils with low cation exchange capacity values, Ca and Mg applications may be required in addition to K dressings to maintain the balances at favorable values.

Concentrations of some macronutrients in selected growing crops:

Plant samples were taken from the growing crops in the region, where soil samples were collected. The growing crops were apple, potato, onion and barley. Data in tables (5) and (6) show that there is general low values of N in apple, onion and barley, where values were 1.79 to 2.03, 1.15 and 1.15% respectively. These values are lower than the normal ones (2 – 2.4, 1.5 – 2.5 and 1.7 – 3.0% for apple, onion and barely respectively) according to Reisenauer (1978), Westerman *et al*., (1990), and Marschnar (1995). The concentration of N in potato fall in the sufficient range (3 – 5%) as mentioned by Westerman *et al*., (1990).

Generally, the contents of K in the all tested plants ranged between 0.68 and 4.96%. These values are within optimum levels for most crops as shown in tables 5 and 6. The high value of K content in potato (13.7 %) attributed to the early season of sampling time, where Reisenauer (1978) and Westerman *et al.*, (1990) noted that the K concentration in early season potato reached to 12 % for sufficient level.

Calcium and magnesium contents of plant in most cases were lower than the normal ranges. The level of Ca in apple leaf samples ranged between 0.55 to 0.65% and in potato and onion were 0.93 and 0.54% respectively. Whereas Mg content in two apple samples were 0.19 and 0.21% and in potato, onion and in barley values were 0.43, 0.01 and 0.04% respectively (table 5). These values of Ca and Mg are lower than the sufficient levels of these elements as shown in table (6). Only Ca content of barely and Mg content of apple in one sample fall within the sufficient range as shown in tables (5) and (6).

Table (5): Some macronutrients contents of selected growing crops in new reclaimed lands.

Sample	Soil type	Cultivation time	N	K	Ca	Mg	Na
			←		%		→
Apple	Torrepsamment	7 years	1.79	4.96	0.65	0.21	0.29
pple	Torrepsamment	7 years	1.81	4.22	0.62	0.19	0.26
Apple	Torrepsamment	9 years	2.03	3.40	0.55	0.42	0.21
Potato	Calcid	4 years	3.28	13.70	0.93	0.43	0.55
Onion	Calcid	4 years	1.15	3.59	0.54	0.01	0.33
Barley	Calcid	4 years	1.15	3.56	0.61	0.04	0.83

Table (6): Optimum levels of nutrient for tested plants.

Plant Sample	Reference	N	K	Ca	Mg	Na
		←		%		→
Apple	Reisenauer 1978	2.0 - 2.4	1.2	1.0	0.25	0.1 - 0.2
Potato	Westerman 1990	3.0 – 5.0	4 – 8* 6 – 12**	2 – 4	0.5 – 0.8	-
Onion	Westerman 1990	1.5 – 2.5	4	-	-	-
Barley	Westerman 1990	1.7 – 3.0	1.5 – 3.0	0.3 – 1.2	0.1 – 0.5	-

*: Early stage **: Late stage

Concentrations of Na in the tested plants ranged between 0.21 and 0.83%. This range was higher than the normal range of Na in plants according to Reisenauer (1978). He also reported that excess Na levels in plants > 0.25 – 0.30% reduced growth. Leaf burn may or may not occur when levels are higher and confirm salinity problems with soil samples.

In conclusion it appears that the decreasing of available K, Ca and Mg with land use periods suggests the necessity of periodical fertilization of mineral K, Ca and Mg before and through plant growth season particularly for sandy soil. In addition to regular application of suitable amounts of organic matter yearly to help in improving the physical, chemical and biological properties of the soil beside insuring the continuous supply of these elements.

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تقييم و رصد التغيرات في بعض صفات أراضي الاستصلاح الحديثة بمصر

محمد عبد الفتاح محمد عيد – محمد يس عبد الرحيم خضر – داليا محمد فهمي مبارك

قسم الأراضي – كلية الزراعة – جامعة عين شمس – شبرا الخيمة – القاهرة

يهدف هذا البحث الي دراسة و تقييم ورصد التغيرات في بعض صفات اراضي الاستصلاح الحديثة بمصرو مدي تاثير فترة الاستزراع علي ذلك. و من اجل تحقيق هذا الهدف تم جمع عينات من قطاعات التربة و النباتات من نوعين من الاراضي أراضي Typic Torripsamments (مشروع دينا الزراعي) واراضي Calcids (مزرعة ماتكو) المستخدم بها انظمة استزراع مختلفة. وقد اظهرت النتائج انخفاض معنوي مع زيادة زمن الاستزراع لكل من الأملاح الذائبة بالتربة و نسبة الجير و كميات البوتاسيوم و الكالسيوم والمغنسيوم والصوديوم المستخلصة بخلات الأمونيوم. و لوحظ ان محتوي التربة من النيتروجين عموما منخفض. و محتوي النبات من النيتروجين و الكالسيوم و المغنسيوم في معظم العينات اقل من الحدود الطبيعية. بينما محتوي البوتاسيوم بالنباتات في المستوي الأمثل. ومن نتائج الدراسة يتضح انه يجب الاهتمام بالتسميد العضوي و المعدني للمحافظة علي مستويات التيسر من النيتروجين. و أيضاً يجب التسميد بالكالسيوم و المغنسيوم بالإضافة إلي البوتاسيوم للمحافظة علي توازن العناصر الغذائية بالنبات.