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Effect of Land Use on some Heavy Metals in the Newly Reclaimed Soils of El-Sharkeya Governorate.

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EIGHT soil profiles representing the newly reclaimed soils of El-Khattara, El-Sharkeya Governorate were selected to study the effect of land use period on both the total and DTPA-extractable contents of Fe, Cu, Pb and Cd. The selected profiles covered a wide range of land use periods, *i.e.*, virgin soil and cultivated to 7, 10 and 14 years. The relationships between the different soil parameters and both the total and DTPA-extractable contents of the studied elements were also examined.

The results indicate that under virgin condition, the average total content was 1770.0, 3.73, 3.87 and 0.036 mg/kg for Fe, Cu, Pb and Cd, respectively. In the soil cultivated for 7, 10 and 14 years, the average total content was 1978.0, 2049.0 and 2116.0 mg/kg for Fe ; 7.04, 6.669 and 8.205 mg/kg for Cu ; 2.640, 1.482 and 2.329 mg/kg for Pb and 0.605, 0.545 and 0.402 mg/kg for Cd, respectively.

Data show that the DTPA-extractable content for the studied elements differed widely between the different periods. Under virgin condition, the DTPA-extractable content averaged at 3.615, 0.495, 0.785 and 0.001 mg/kg for Fe, Cu, Pb and Cd, respectively. In the cultivated soil for 7, 10 and 14 years, the average content was 2.493, 2.863 and 4.668 mg/kg for Fe, 0.320, 0.744 and 0.600 mg/kg for Cu, 0.175, 0.229 and 0.245 mg/kg for Pb and 0.002, 0.012 and 0.017 mg/kg for Cd, respectively.

Applying statistical measures dictates that the weighted mean variations may be ascribed to the parent material itself rather than soil formation or local conditions. The values of the trend for total Fe and Cu and chemically extractable Cu and Pb indicate their highly symmetrical distribution with less symmetrical distribution of the other elements. The specific range variations are mainly attributed to pedogenic processes, sedimentation regime and local conditions.

Keywords: El-Sharkeya Governorate, Heavy Metals, DTPA-extractable.

According to the Land Master plan, the total area suitable for reclamation amounted to about 2.8 million feddan. Out of which the desert sandy soils represent 34%. El-Khattara area represents one of the promising areas for reclamation and addition of new sandy agricultural lands. A number of man's activities in such area may contribute to raising soil heavy metal levels. In agricultural lands, addition of mineral fertilizers, pesticides, organic wastes, industrial effluents and fallout beside the traffic and fuel exhausts, all act together as soil pollutants.

This investigation is mainly carried out to throw light on the effect of land use on the status of some heavy metals in the soils of El-Khattara area.

Materials and Methods

Eight soil profiles representing the newly reclaimed sandy soils at El-Khattara area of El-Sharkeya Governorate were selected for the present study. The selected profiles covered a relatively wide range of land use periods, *i.e.*, virgin soil, soil cultivated for 7, 10 and 14 years. The soil samples were air-dried, ground, passed through a 2.0 mm stainless steel sieve and kept in polyethylene bags for analysis.

The physical and chemical properties of the investigated soil samples were determined in soil extract (1:1) according to Black (1965) and presented in Table (1). Total content of Fe, Cu, Pb and Cd was determined after digestion in a mixture of Conc. HNO_3 + Conc.H_2SO_4+62% perchloric acid as recommended by Hesse (1971). The chemically extractable content was extracted according to Lindsay and Norvell (1978) using a mixture of 0.005 M DTPA(diethyline triamine penta acetic acid), 0.01 M $CaCl_2.2H_2O$ and 0.1 M TEA (Triethanolamine) buffered at a final pH of 7.3.

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The results indicate that under virgin condition. the average total content was 1770.0. 3.73. 3.87 and 0.036 mg/kg for Fe. Cu. Pb and Cd. respectively. In the soil cultivated for 7. 10 and 14 years. the average total content was 1978.0. 2049.0 and 2116.0 mg/kg for Fe : 7.04. 6.669 and 8.205 mg/kg for Cu : 2.640. 1.482 and 2.329 mg/kg for Pb and 0.605. 0.545 and 0.402 mg/kg for Cd. respectively.

Data show that the DTPA-extractable content for the studied elements differed widely between the different periods. Under virgin condition. the DTPA-extractable content averaged at 3.615. 0.495. 0.785 and 0.001 mg/kg for Fe. Cu. Pb and Cd. respectively. In the cultivated soil for 7. 10 and 14 years. the average content was 2.493. 2.863 and 4.668 mg/kg for Fe. 0.320. 0.744 and 0.600 mg/kg for Cu. 0.175. 0.229 and 0.245 mg/kg for Pb and 0.002. 0.012 and 0.017 mg/kg for Cd. respectively.

Applying statistical measures dictates that the weighted mean variations may be ascribed to the parent material itself rather than soil formation or local

TABLE 1. Physical and chemical composition of the studied soils of El-Khattara area.

Profile No.	Depth, Cm	O.M %	$CaCO_3$ %	PH	EC ds/m	Cations (me/l) Na$^+$	K$^+$	Ca^{++}	Mg^{++}	Anions (me/l) $CO_3^=$	HCO_3^-	Cl$^-$	$SO_4^=$	Soil separates (mm) % 2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.125	0.125-0.063	<0.063
Virgin Soil																			
1	0-40	0.086	0.77	7.6	3.10	10.3	1.36	8.9	10.5	-	10.5	13.8	7.3	6.0	56.0	24.5	9.0	3.5	1.0
	40-100	0.086	0.91	7.6	3.10	10.5	1.37	9.1	10.1	-	10.5	13.0	7.2	5.5	56.0	24.0	9.5	3.0	1.5
7 Years Land Use																			
2	0-20	0.41	1.12	7.7	1.93	11.2	0.44	4.6	3.2	-	7.8	9.2	2.4	2.0	26.0	47.0	18.0	5.5	1.5
	20-50	0.18	1.03	7.9	1.47	7.2	0.33	4.2	3.1	-	5.4	7.4	2.1	4.0	60.5	23.0	8.0	3.5	1.0
	50-100	0.11	4.22	8.1	1.27	6.3	0.24	3.6	2.8	-	3.6	7.0	2.3	10.5	30.5	38.0	14.5	5.5	1.0
	100-150	0.08	1.36	8.2	1.16	6.1	0.23	3.1	2.3	-	3.6	5.6	2.5	18.0	38.0	32.0	8.5	3.0	0.5
10 Years Land Use																			
3	0-30	0.79	0.98	8.2	1.56	7.8	0.13	3.7	4.1	-	7.4	5.8	2.5	24.0	41.0	30.0	4.0	1.0	0.0
	30-60	0.21	0.59	8.4	1.08	5.7	0.27	2.3	2.7	-	5.3	3.4	2.3	24.5	42.0	30.0	3.0	0.5	0.0
	60-90	0.09	0.68	8.5	0.76	2.6	0.15	2.2	2.8	-	4.2	2.6	1.0	28.0	48.0	21.5	2.0	0.5	0.0
	90-120	0.09	0.35	8.4	0.87	4.1	0.13	2.5	2.1	-	4.2	3.4	1.2	27.5	44.0	26.0	2.0	0.5	0.0
4	0-25	1.40	0.92	8.0	1.34	7.1	0.39	3.1	3.0	-	6.5	4.6	2.5	30.5	38.0	25.5	4.0	1.0	0.5
	25-70	0.28	5.28	8.3	1.06	5.6	0.26	2.6	2.4	-	4.6	4.2	2.1	21.0	37.5	31.0	7.5	2.0	1.0
	70-100	0.12	0.53	8.6	0.84	3.9	0.26	2.3	2.1	-	4.9	3.6	1.1	18.0	49.5	30.0	2.0	0.5	0.0
	100-150	0.08	0.68	8.4	0.93	4.2	0.22	2.5	2.5	-	3.8	4.0	1.6	24.0	42.0	31.5	2.0	0.5	0.0
5	0-20	0.89	9.44	7.8	1.84	10.6	0.69	3.5	3.8	-	7.2	8.1	3.3	12.5	23.0	44.5	13.0	5.5	1.5
	20-50	0.36	3.98	8.2	1.36	6.3	0.39	3.6	3.2	-	5.6	5.2	2.7	27.0	31.5	30.5	8.5	2.0	0.5
	50-100	0.14	3.04	8.3	1.30	6.0	0.49	3.5	3.2	-	5.9	6.2	1.1	27.0	26.5	39.0	5.5	1.5	0.5
14 Years Land Use																			
6	0-30	1.78	4.51	7.7	1.68	10.2	0.54	3.5	2.6	-	7.6	6.4	2.9	11.5	26.0	40.0	17.0	4.5	1.0
	30-70	0.31	7.52	8.2	1.37	5.1	0.24	4.3	4.2	-	7.1	4.2	2.5	14.0	26.0	41.5	16.0	2.0	0.5
	70-120	0.12	2.89	8.3	1.16	4.9	0.11	3.2	3.5	-	6.2	4.1	1.4	20.0	35.0	35.5	8.0	1.5	0.0
7	0-20	1.24	5.99	8.1	1.38	8.6	0.44	2.3	2.5	-	7.1	5.2	1.6	19.0	31.5	34.5	10.0	4.5	0.05
	20-50	0.27	0.36	8.3	1.31	7.4	0.27	2.7	3.0	-	7.4	4.8	1.2	25.5	34.0	31.0	8.0	1.5	0.0
	50-120	0.11	0.59	8.6	0.96	5.2	0.21	2.1	2.3		5.4	3.5	0.9	16.0	27.0	47.0	8.5	1.0	0.5
8	0-15	0.96	2.66	7.9	1.44	7.2	0.27	3.2	4.0	-	7.2	5.6	1.7	24.0	30.5	32.0	9.0	4.0	0.5
	15-60	0.29	9.06	8.1	1.21	6.2	0.15	3.3	2.6	-	6.3	4.4	1.6	13.0	30.5	45.0	8.0	3.0	0.5
	60-90	0.11	0.56	8.2	0.96	5.1	0.13	2.2	2.3	-	5.4	3.2	1.2	17.5	32.5	39.0	8.5	2.0	0.5
	90-150	0.08	1.03	8.2	0.93	4.9	0.26	2.1	2.2		3.1	5.2	1.2	14.0	37.0	41.0	6.5	1.5	0.0

In all cases, determination of the studied elements in the aforementioned extracts was carried out by nuclear absorption spectrophotometer (Unicam 929) with graphite furnace.

Results and Discussion

Total Fe content:

Table (2) shows that the total Fe content ranged between 1687 and 2321 mg/kg. The lowest content was found in the deepest layer of profile 1 of the virgin soils where soil $CaCO_3$ and O.M. contents were quite low and the soils were saline, while the highest content was recorded in the surface layer of profile 6 of the soil cultivated for 14 years where the soils contain moderate amounts of $CaCO_3$ and O.M. and moderate salinity. These results are in agreement with those of Rabie *et al.* (1989) and Elgala *et al.* (1990). Mineralogical composition of the sandy soils is responsible for their low Fe content due to their siliceous nature and resistance to weathering (Sillanpaa, 1962).

In general, the surface layers possess more total-Fe than the subsurface layers especially in the soils cultivated for 14 years. This could be attributed to the different soil management practices which include the addition of organic matter and pesticides as well as the irrigation water which taken from artesian well rich in its iron content.

With respect to the effect of land use period on the total content of the studied element, data in Table (2) reveal that the increase in the total Fe content of the different cultivated soils relative to the virgin soils differed widely where its content reached to 11.76, 15.75 and 19.54% in the cultivated soils for 7, 10 and 14 years, respectively. This could be attributed to the accumulation of Fe from irrigation water, organic matter, mineral fertilizers and plant residues.

Depthwise distribution pattern of the total Fe (Table 2) shows that the total content decreased with soil depth in all the studied profiles with one exceptional case in profile 2 of the soils cultivated for 7 years where the total Fe content is relatively concentrated in the deepest layers.

TABLE 2. Total content of heavy metals in the studied soil samples (mg/kg).

Profile No.	Depth, Cm	mg/kg			
		Fe	Cu	Pb	Cd
		Virgin Soil			
1	0-40	1854.25	4.30	4.55	0.033
	40-100	1687.00	1.25	3.18	0.038
		7 Years Land Use			
2	0-20	1863.50	5.63	3.28	0.680
	20-50	1861.00	5.55	3.40	0.513
	50-100	2117.25	7.73	1.95	0.588
	100-150	2073.75	9.23	1.93	0.638
		10 Years Land Use			
3	0-30	2053.75	7.65	0.75	0.583
	30-60	1962.00	4.53	2.45	0.640
	60-90	1986.00	4.35	0.45	0.655
	90-120	1838.75	4.85	1.00	0.528
4	0-25	2224.75	11.00	1.35	0.233
	25-70	2143.00	8.10	0.70	0.655
	70-100	1938.00	4.85	0.70	0.528
	100-150	1862.50	3.15	3.10	0.458
5	0-20	2202.00	10.43	1.95	0.425
	20-50	2186.00	7.60	3.35	0.596
	50-100	2147.50	8.75	0.50	0.698
		14 Years Land Use			
6	0-30	2321.75	16.10	1.25	0.603
	30-70	2142.25	6.75	2.20	0.330
	70-120	2026.00	3.93	1.58	0.291
7	0-20	2321.00	17.55	1.93	0.420
	20-50	2124.25	7.80	2.60	0.628
	50-120	1950.25	4.73	1.63	0.325
8	0-15	2238.50	12.98	2.30	0.290
	15-60	2089.00	2.85	2.80	0.218
	60-90	1920.75	3.88	2.05	0.293
	90-150	2031.50	5.48	2.65	0.623

Total Cu content:

Data tabulated in Table (2) reveal that the total Cu content ranged between 1.25 and 17.55 mg/kg. The lowest content was observed in the deepest layer of profile 1 of the virgin soil where its content of both $CaCO_3$ and O.M. was very low and the salinity was moderate. The highest Cu content was found in the surface layer of profile 7 of the soil cultivated for 14 years. Table (2) shows that the common characteristic of Cu distribution in soil profiles is its accumulation in the top layer. This phenomenon is an integrated effect of various factors, but above all, Cu concentration in surface soils reflects the bioaccumulation of the metal and also recent anthropogenic sources of the element. Kabata-Pendias and Pendias (1992) mentioned that the Cu balance in surface soils of different ecosystems in different countries shows clearly that the atmospheric input of this metal may partly replace the removal of Cu by biomass production and in some cases may even exceed the total output of the metal from soils. Contamporarily observed soil contamination with Cu can leads to an extremely high Cu accumulation in top soils.

Table (2) reveals that land use period leads to the increase of the total content of the studied element comparing with the virgin soil, this increase was 88.86, 79.03 and 120.77% in the soil cultivated for 7, 10 and 14 years, respectively. These results are in agreement with those of Kabata-Pendias and Pendias (1992) who mentioned that contamination of soil by Cu compounds results from utilization of Cu-containing material such as fertilizers, sprays and agricultural or municipal wastes as well as from industrial emission.

Depthwise distribution of the total Cu content in the studied soils shows that the highest contents were observed in the surface layers which contain the highest content of O.M., while decreased with soil depth with an exceptional case of profile 2 of the soil cultivated for 7 years where the highest content was found in the deepest layer. These results are in agreement with those of Stevenson and Fitch (1981), who stated that the maximum amount of Cu^{2+} can be bound to humic and fulvic acids. Also, El-Demerdashe *et al.* (1995) found that more than 45% of the total Cu content was related to the organic fraction.

Total Pb content:

Table (2) shows that the total Pb content ranged between 0.45 and 4.55 mg/kg. The lowest content was observed in the 60-90 cm layer of profile 3 of the soil cultivated for 10 years, while the highest content was found in the surface layer of profile 1 of the virgin soil. This could be attributed to the fact that under virgin conditions, there are no soil management, so the accumulation of Pb compounds from the dustfall or the traffics was high, while the transportation of these compounds through the soil depth was very slow. These results are in agreement with those of Kabata-Pendias and Pendias (1992) who mentioned that the total Pb content in the ultramafic rocks and calcareous sediments ranges from 0.1 to 10.0 ppm. They added that the natural Pb content of soil is inherited from parent rocks. However, due to widespread Pb pollution, most soils are likely to be enriched in this metal, especially in the top horizon.

Data tabulated in Table (2) show that in the contrary of Fe and Cu, the land use period leads to decrease in the total Pb content of the studied soil profiles compared to the virgin soils. This decrease reached 31.69, 61.66 and 39.74% for the soils cultivated for 7, 10 and 14 years, respectively. This could be attributed to the different soil management practices and irrigation water which may lead to the leaching of Pb to the deepest layer. Stevenson and Welch (1979) observed that Pb moved from the top soil treated with Pb acetate into the subsoil. This mobility was attributed to the metal leaching as soluble chelated complexes with organic matter.

With regard to the depthwise distribution of total Pb content in the studied soil profiles, data in Table (2) show that the total Pb content was concentrated in the top 50 cm in the studied soil profiles where O.M. content was relatively high and decreased with soil depth with some exceptional cases in profiles 3, 4 and 8 where the total Pb content in the deepest layer was higher than the uppermost layer. These results are in agreement with those of Fleming *et al.* (1968) who reported that the characteristic localization of Pb near the soil surface in most soil profiles is primarily related to the surficial accumulation of organic matter.

Total Cd content:

Data tabulated in Table (2) show that the total Cd content ranged between 0.033 and 0.698 mg/kg. The lowest content was found in the surface layer of profile 1 of the virgin soil where the organic matter content was very low and the soil was saline, while the highest content was observed in the deepest layer of profile 5 of the soil cultivated for content was very low and the soil was saline, while the highest content was observed in the deepest layer of profile 5 of the soil cultivated for 10 years where the content of both organic matter and $CaCO_3$ was relatively high while the salinity was moderate. This could be attributed to the intensive application of farmyard manure and phosphate fertilizers. These results are in agreement with those of Jones *et al.* (1987), Fleischer *et al.* (1974), Williams and David (1973), Street *et al.* (1977), Chaney and Hornick (1977), Von Jung *et al.* (1979) and Anderson and Hahlin (1981) who reported that sewage sludge and phosphate fertilizers were the important sources of Cd.

Table (2) shows that land use period leads to an increase of the total Cd content in the cultivated soils compared to the virgin soils, the increases were 1703, 1536 and 1132% in the soil cultivated for 7, 10 and 14 years, respectively. This could be attributed to the continuous additions of the chemical fertilizers, sewage sludge, pesticides and plant residues.

. With regard to the depthwise distribution of total Cd content in the studied soil profiles, data in Table (2) reveal that the total Cd content tends to increase with soil depth in both the virgin and soil cultivated for 10 years, while decreased with soil depth in the soils cultivated for 7 and 14 years with some exceptional cases in the deepest layer of profiles 5 and 8 where Cd content increased in these layers. These results are in agreement with those of Kabata-Pendias and Pendias (1992), and Merrington and Alloway (1994). They mentioned that within soil profiles, Cd is normally concentrated in the surface horizon due to a combination of factors, it is the zone with the highest organic matter content and metals may be retained in this strongly adsorptive horizon after reaching it as a result of cycling through vegetation, or from application of Cd- containing fertilizers and manure.

Fig. (1) indicates highly significant positive correlations between total Pb content and both EC, soluble Cl, K, Ca and Mg and positive correlation with both soluble HCO_3 and Na, while was highly significant negatively correlated with pH. On the other hand, Fig. (2) shows that total Cd content was highly significant negatively correlated with EC, soluble K, Ca, Mg, HCO_3 and SO_4 and negatively correlated with soluble Cl, while $CaCO_3$ was highly significant positively correlated with total Fe content.

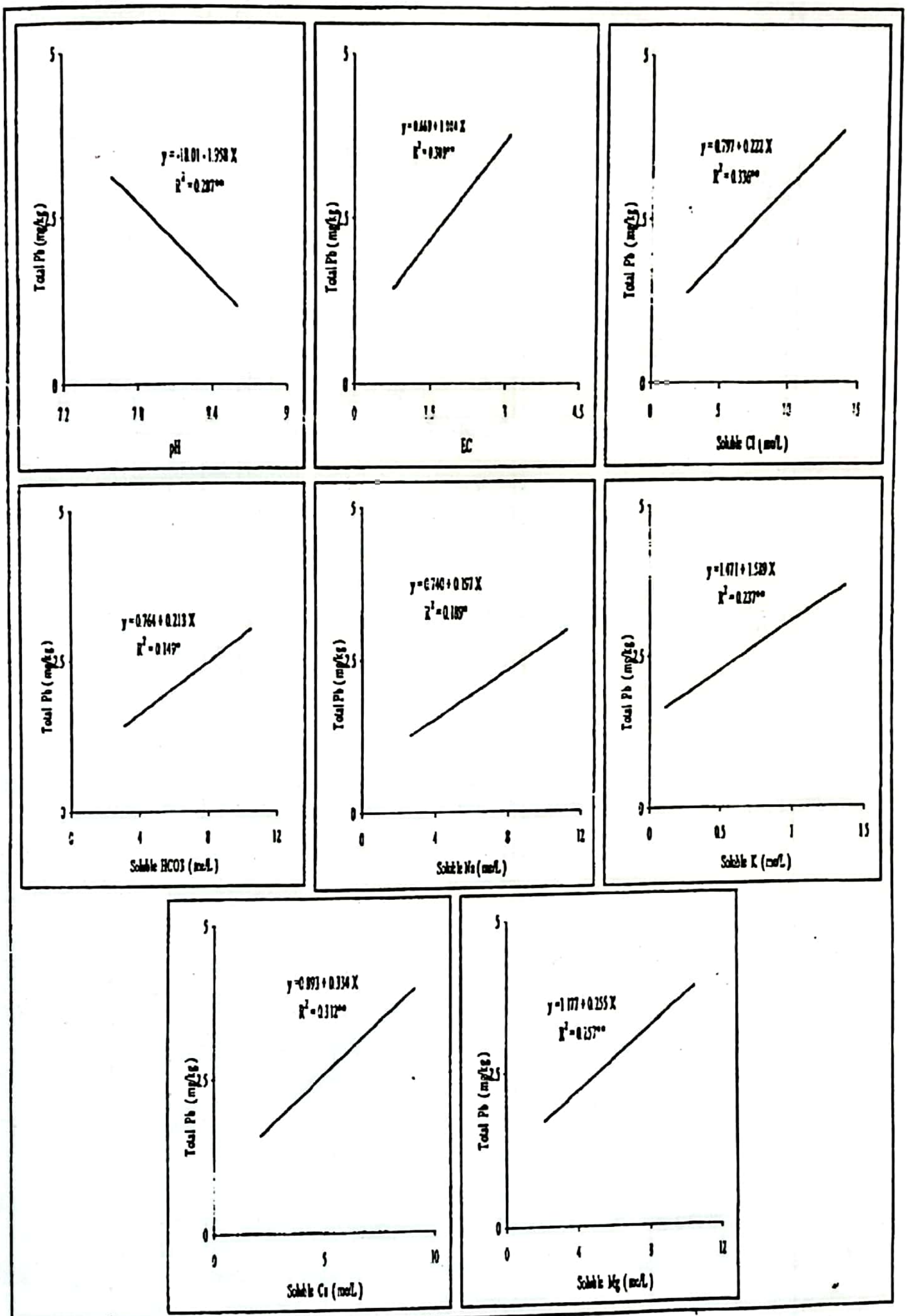

Fig. 1. The relation between total Pb content and some soil variables.

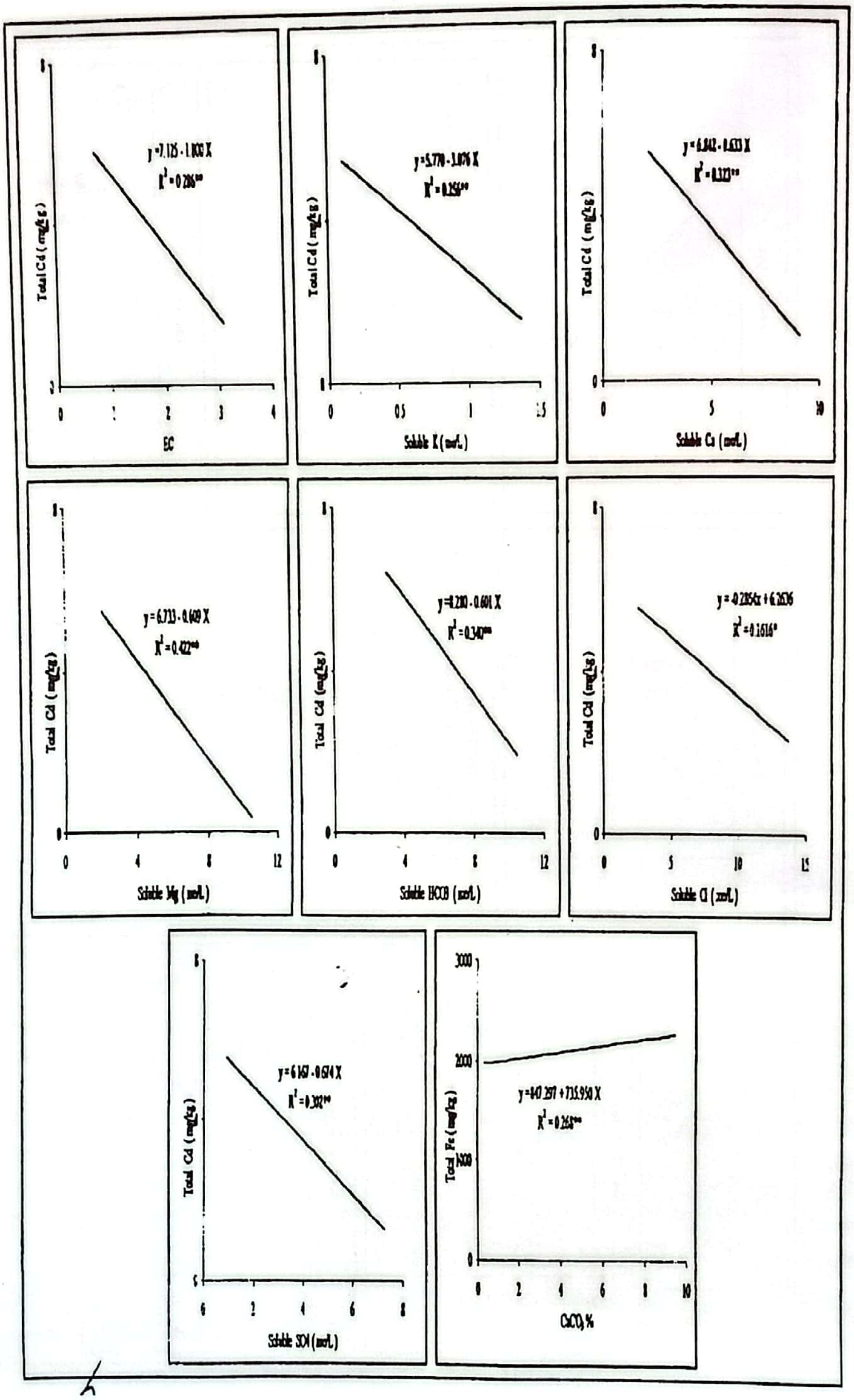

Fig. 2. The relation between total Cd and Fe content and some soil variables.

DTPA-extractable heavy metals:

The DTPA-extractable metals in the studied soil samples were investigated. The maximum, minimum and average as well as their percentage of total content are shown in Table (3). For each metal there was a wide variation in its chemically extractable content. These variations were observed within all the studied soils with one exceptional case in the virgin soil where the variation between its chemically extractable content was relatively narrow.

Moreover, the DTPA-extractable fractions were very small (0.13-4.23%) in the case of Fe and Cd. For Cu and Pb they are 4.55-20.31% of the total content.

From Table (3) it is clearly noticed that the DTPA-extractable content of the studied metals relative to their total content in the virgin soils was relatively high compared to the cultivated soils with two exceptional cases in Fe and Cd where this ratio was higher in the soil cultivated for 14 years. This could be attributed to soil pH which was neutral in the virgin soils while was alkaline in the cultivated soils, it is expected that the chemically extractable content was low under alkali conditions. In other words, the increase in the ratio between DTPA-extractable Cd and its total content in the soil cultivated for 14 years may be due to the extensive use of superphosphate as a fertilizer. In this respect, Williams and David (1973) reported that Cd increased as a result of prolonged applications of superphosphate which contain 38-48 μg Cd/g phosphate. Similar results were obtained by Kandil (1998).

Fig. (3) shows that DTPA-extractable Fe was negatively correlated with pH. Fig. (3) further indicates that DTPA-extractable Pb was highly significant positively correlated with EC, Ca^{++}, Mg^{++}, HCO_3^- , K^+ and Cl^-, while being highly significant negatively correlated with pH.

Factors affecting total and chemically extractable heavy metals:

Data showed that some factors are involved in controlling the studied elements. To work out the relationship between the distribution of elements (Fe, Cu, Pb and Cd) and locality of the studied soil profiles, the three statistical measures suggested by Oertel and Giles (1963) namely; the weighted mean (W) trend (T) and specific range (R) were applied.

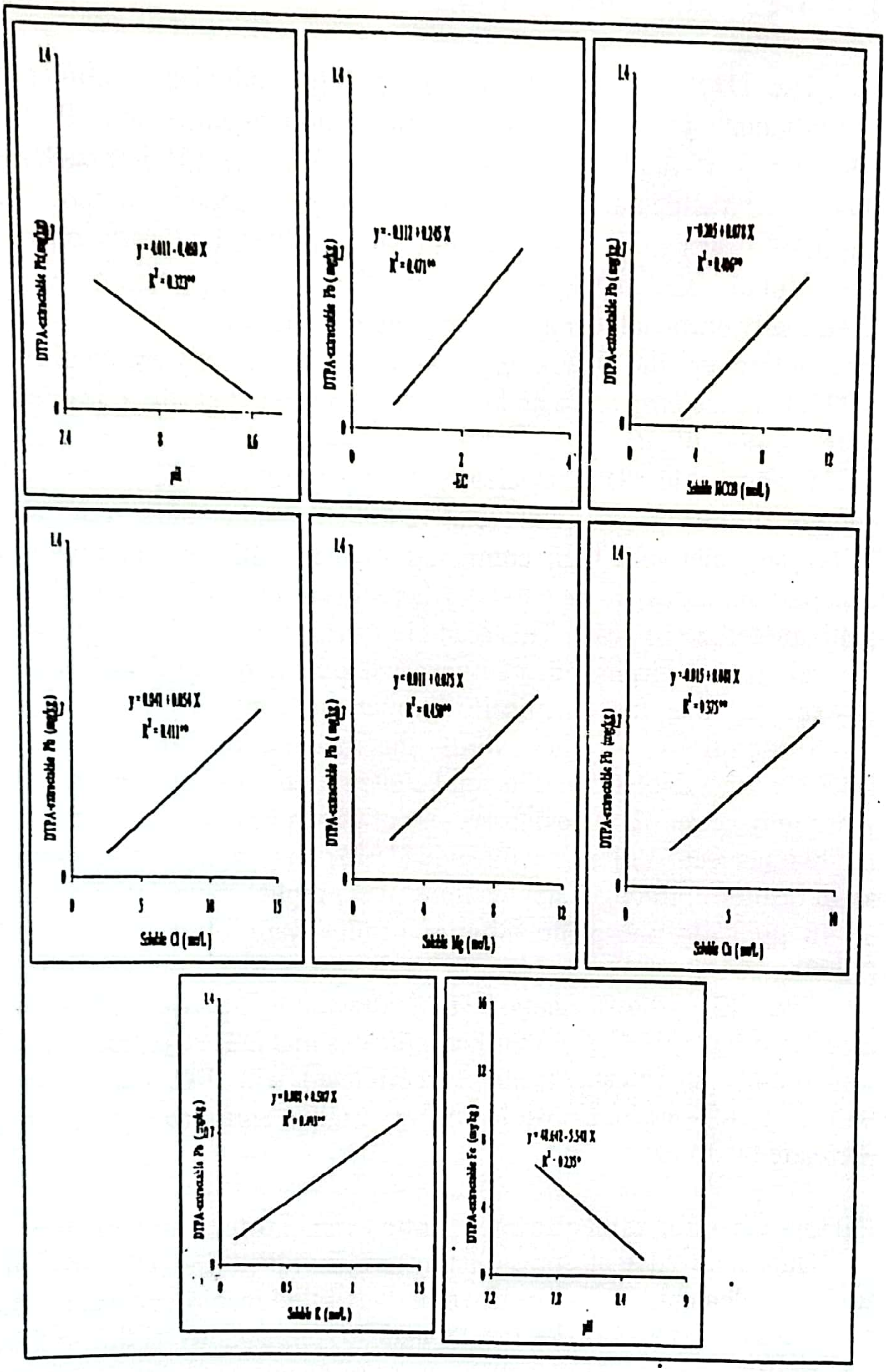

Fig. 3: The relation between DTPA-extractable content of Pb and Fe and some soil variables.

TABLE 3. Maximum, minimum and average values of the DTPA-extractable heavy metals in the studied soils.

	Mg/kg			
	Fe	Cu	Pb	Cd
Virgin Soil				
Maximum	3.78	0.54	1.31	0.001
Minimum	3.45	0.45	0.26	0.001
Average	3.62	0.50	0.79	0.001
% from total	0.20	13.29	20.31	2.81
7 Years Land Use				
Maximum	4.01	0.39	0.26	0.004
Minimum	1.49	0.19	0.14	0.001
Average	2.49	0.32	0.18	0.002
% from total	0.13	4.55	6.63	0.33
10 Years Land Use				
Maximum	6.10	1.92	0.36	0.036
Minimum	1.10	0.20	0.14	0.002
Average	2.86	0.74	0.23	0.012
% from total	0.14	11.16	15.45	2.20
14 Years Land Use				
Maximum	14.93	1.22	0.47	0.062
Minimum	1.16	0.26	0.12	0.002
Average	4.67	0.60	0.25	0.017
%from total	0.22	7.31	10.52	4.23

Considering the weighted mean, data show that total contents of Fe, Cu, Pb and Cd ranged from 1754-2170, 3.61-18.10, 1.16-3.73 and 0.036-0.693 mg/kg, respectively (Table 4), while chemically extractable content of these respective elements ranged from 2.23 to 5.39, 0.32 to 0.64, 0.161 to 0.680 and 0.001 to 0.110 mg/kg, respectively (Table 5).

Comparing the weighted mean of the studied elements (total and chemically extractable) in the identified geomorphic units, data showed that they can be expressed in the order: Fe > Cu > Pb > Cd. The minute variations between the groups of profiles may be ascribed to the chance of variations in the parent material itself rather than to soil formation or local conditions prevailing in each site. It may also be associated with geomorphology which coincides with the sedimentation regime prevailed during soil formation.

Concerning the trend (T) data showed a symmetry of total Fe and Cu among the studied soils as revealed by the small (T) values, while Pb and Cd display relatively less symmetrical relatively high (T) values in the studied soils, whereas, data showed a symmetry of chemically extractable Cu and Pb among the studied soils as revealed by the small (T) values, while Fe and Cd display relatively less symmetrical distribution relatively high (T) values in the studied soils.

Specific range (R) for total elements Fe, Cu, Pb and Cd are generally of widely variable ranges from 0.025 to 0.181, 0.319 to 1.980, 0.295 to 1.830 and 0.139 to 0.817 ppm, respectively. While chemically extractable content of these elements ranged from 0.084 to 3.850, 0.180 to 1.980, 0.680 to 1.540, and 0.00 to 3.140 mg/kg respectively. The variations in the values of specific range (R) are mainly attributed to inherited characteristics modified by pedogenic processes, soil sedimentation regime as well as local condition of each soil profile.

TABLE 4. Weighted mean (W) , trend (T) and specific range (R) for the total contents of the studied elements .

Profile	Fe			Cu			Pb			Cd		
No.	W ppm	T	R	W ppm	T	R	W ppm	T	R	W ppm	T	R
1	1754	-0.054	0.095	3.61	-0.161	0.319	1.70	0.265	0.559	0.036	0.083	0.139
2	2139	-0.079	0.138	18.10	+0.075	0.710	1.34	-0.306	0.734	0.693	0.019	0.241
3	2055	-0.150	0.181	7.63	-0.57	1.68	2.54	0.094	0.295	0.602	0.032	0.211
4	2048	-0.086	0.155	5.12	-0.61	1.98	1.16	0.353	0.473	0.494	0.528	0.854
5	1960	-0.046	0.110	5.35	-0.30	0.62	1.61	0.163	1.43	0.613	0.307	0.445
6	2022	-0.091	0.179	11.30	+0.028	1.18	1.55	0.065	1.83	0.382	-0.579	0.817
7	2170	-0.014	0.025	8.74	-0.354	0.324	2.41	-0.265	0.650	0.417	-0.007	0.727
8	2018	+0.076	0.127	7.51	+0.249	0.490	3.73	-0.180	0.37	0.402	0.279	1.01

TABLE 5. Weighted mean (W) , trend (T) and specific range (R) for DTPA-extractable contents of the studied elements .

Profile	Fe			Cu			Pb			Cd		
No.	W ppm	T	R	W ppm	T	R	W ppm	T	R	W ppm	T	R
1	3.58	+0.05	0.084	0.50	+0.10	0.18	0.68	-0.481	1.54	0.001	0.00	0.00
2	5.39	-0.64	2.42	0.64	-0.47	1.47	0.250	-0.46	1.27	0.021	-0.45	0.286
3	2.91	+0.71	3.85	0.48	-0.61	1.98	0.221	-0.456	1.01	0.006	-0.45	1.33
4	2.23	-0.77	3.85	0.46	-0.23	0.61	0.184	-0.43	1.01	0.009	0.483	2.07
5	2.24	-0.219	0.723	0.37	-0.196	0.84	0.190	-0.331	0.716	0.011	-0.476	1.54
6	2.53	-0.403	1.24	0.37	-0.59	1.92	0.216	-0.531	1.50	0.110	0.872	3.14
7	2.93	-0.521	1.531	0.54	-0.426	1.093	0.249	-0.303	0.68	0.005	-0.676	2.62
8	3.58	-0.443	1.126	0.32	-0.158	0.625	0.161	-0.39	0.77	0.003	-0.25	0.667

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تأثير استخدام الأرض علي بعض العناصر الثقيلة في الأراضي المستصلحة حديثا بمحافظة الشرقية .

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أختير ثمانية قطاعات أرضية تمثل الأراضي المستصلحة حديثا بمنطقة الخطارة بمحافظة الشرقية لدراسة تأثير استخدام الأرض علي كل من المحتوي الكلي والميسر لكل من الحديد ، النحاس ، الرصاص ، الكادميوم . ولتحقيق ذلك كانت القطاعات المختارة تمثل الأراضي تحت الاستخدام لفترات متباينة (أرض بكر، ٧ ، ١٠ ، ١٤ سنة استخدام) .

أوضحت النتائج المتحصل عليها تحت ظروف الأراضي البكر أن متوسط المحتوي الكلي كان ١٧٧٠,٠ ، ٣,٧٣٠ ، ٣,٨٧٠ ، ٠,٣٥٥ ملليجرام/كجم لكل من الحديد ، النحاس ، الرصاص ، الكادميوم ، علي التوالي . في الأراضي المستخدمة لفترة ٧ ، ١٠ ، ١٤ سنة ، فكان متوسط المحتوي الكلي ١٩٧٨,٠ ، ٢٠٤٩,٠ ، ٢١١٦,٠ ملليجرام/ كجم للحديد ، ٧,٠٤٠ ، ٦,٦٦٩ ، ٨,٢٠٥ ملليجرام/كجم للنحاس ، ٢,٦٤٠، ١,٤٨٢، ٢,٣٢٩ ملليجرام/كجم للرصاص ، ٦,٠٤٨ ، ٥,٤٥٤ ، ٠,٤٠٢ ملليجرام/كجم للكادميوم ، علي التوالي .

كذلك أوضحت النتائج المتحصل عليها أن المحتوي الميسر من العناصر المدروسة قد أظهر تباينا ملحوظا في الفترات المختلفة، ففي الأراضي البكر كان متوسط المحتوي الميسر ٣,٦١٥ ، ٠,٤٩٥ ، ٠,٧٨٥ ، ٠,٠٠١ ملليجرام/كجم لكل من الحديد ، النحاس ، الرصاص ، الكادميوم ، علي التوالي. أما بالنسبة للأراضي المستخدمة لفترات ٧، ١٠ ، ١٤ سنة فكان متوسط المحتوي الميسر ٢,٤٩٣ ، ٢,٨٦٣ ، ٤,٦٦٨ ملليجرام/كجم للحديد ، ٠,٣٢٠، ٠,٧٤٤ ، ٠,٦٠٠ ملليجرام/كجم للنحاس ، ٠,١٧٥ ، ٠,٢٢٩ ، ٠,٢٤٥ ملليجرام/كجم للرصاص ، ٠,٠٠٢ ، ٠,٠١٢، ٠,٠١٧ ملليجرام/كجم للكادميوم ، علي التوالي.

وبتطبيق المعاملات الإحصائية تبين أن اختــلاف المتوســط الوزني للعناصر المدروسة يرجع أساسا لمادة الأصل وقيم الاتجـاه تعبر عن توزيع متماثل للحديـــد والنحـــاس الكلـــي ، والنحـــاس والرصاص المستخلصين كيميائيا مع توزيع أقل تماثلا للعنـــاصر الأخرى كما أن اختلافات النطاق النوعي ترجع أساسا للعمليـــات البيدولوجية ونظام الترسيب والظروف المحلية للقطاعات.