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Determination of macro and micronutrients levels in organic manure soils and irrigation water

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Abstract

The organic fertilization is cornerstone to raise production value of agricultural land and reduce environmental pollution resulting from the excessive use of chemical fertilizers. Therefore, recycling is important factor that lead to the provision of large quantities of organic fertilizers that meet the needs of agricultural land, especially sandy soils that are poor in organic matter. The study includes estimating the concentration of selected chemical elements and heavy metals in agricultural soils fertilized with organic matter and recycled irrigation water in some areas of the Wadi-Al shati including (Ashkeda , Qyra, Dabdab, Qaqum , Tamazawa , Aqar , and Mahruqa), where the soil physical and chemical properties are analyzed here.

The results showed that the studied soils consistency range from sandy to loamy sand, which has an important role in determining the ability of the soil to retain nutrients. Organic matter played a role in increasing the productivity of sandy soils by 0.63% and improved the cation exchange capacity to reach 39.36 million equivalent / 100 g soil in sandy soils textures. Also, the study showed that the clay minerals and organic matter and pH are the most important factors that influence the content of the soil of heavy elements in addition to the clay minerals which originated the soil.

The results showed that irrigation water has direct effect on the properties of physico-chemical properties of soil where accumulation of salts like sulfates of calcium, magnesium and sodium chloride , calcium, Bicarbonate calcium in the soil. Results showed that the concentration of the elements manganese, chromium, and cadmium in irrigation water was higher than the maximum limits by the FAO standard. Also, the results show that levels of zinc, nickel and iron were within the allowable limit, and the elemental lead and copper are below detection limits.

Keywords: Fertilization, Environmental pollution, Recycling, Nutrients, Production value, Physico-chemical properties.

1. Introduction

Fertile soil provides plants with all of its microelements necessary for growth including iron (Fe), manganese (Mn), Zinc (Zn), boron (B), copper (Cu) , nickel (Ni) and chloride (Cl). These micronutrients may exist in small quantities or present in insoluble form which is not available for absorption by plants. On the other hand if these elements are found in the soil at high concentrations it may be toxic to plants and micro-organisms , and the elements that may be present in concentrations toxic to plants include mercury (Hg) , lead (Pb) , cadmium (Cd) , copper (Cu) , nickel (Ni) , cobalt (Co). The first three elements can be toxic to animals in particular, while the elements copper (Cu) , nickel (Ni) , cobalt (Co) are toxic to plants (Phytotoxic), and toxic to human health especially at long-term exposure including arsenic (As), chromium (Cr), nickel (Ni), zinc (Zn), beryllium (Be), copper (Cu), selenium (Se), lead (Pb) , cadmium (Cd) , mercury (Hg).

The content of the soil elements reflects the degree of weathering experienced by the soil and also the original clay minerals. Also, knowing the total concentration of the elements in the soil is not a precise indication of the dynamics and availability of elements for the plant.

The increase in the concentration of an element in the soil beyond allowable limits is an indication of the pollution events. Whether increasing the concentration of the element in the soil is due to human or natural activity, estimating the validity of the element in the soil will be more important because it reflects the ability of the plant to be absorbed as well as the ability to extract this element chemically , so the soil testing is useful in predicting the occurrence of toxicity or deficiency in plants growing in these soils but does not provide information about the interactions of the elements in the soil, however , extracting the different elements depends on the properties of these elements, such as the ability of these elements to bind with organic matter in complexes , adsorption to clay minerals, precipitation after binding with carbonate, phosphate and sulfate or oxides.

Utilizing organic fertilizer is appropriate option to enhance sandy soil nutrients availability, organic matter content, and stability of sandy soils. However, organic matter can not be used without primary treatment. Some

farmers tend to apply row sewage water and solids which may include contaminants that need treatment prior to application.
The organic matter has a direct impact on the physical, chemical, and biological properties. The organic matter is responsible for a nearly 50% of the Cation Exchange Capacity of the land as well as their impact on the acidity of the soil and its organizational capacity and fertility and supply of plant nutrients liberated from organic compounds during decomposition and the supply of micro-organisms energy and building elements of their bodies .

2. Study Objective
This research aims to study the concentration of chemical elements and heavy metals (lead, cadmium, zinc, nickel, manganese, copper, iron, chromium) in agricultural soils that had organic matter applied as animal waste (cow dung, sheep) and determine the origin of these elements and their relationship with other aspects such as organic matter and soil acidity and alkalinity in addition to the strength of the soil.

3. Study Location
The study area is located in the south of Libya , specifically in the area of Wadi-Al shati including the locations of (Ashkeda , Qiyra , Dabdab , Tamazawa , Qaqum , Aqar, Mahruqa) . The study location is surrounded by Fezzan from the north , including Hamada and others, which is one of the areas with late appearing for communities where it was a resting point for bedouin caravans moving north.
Wadi Al Shati is very low for some areas of Fezzan as well as the level of life or the natural gradient has always towards the south until it reaches the Ramlet Zlav where the remnants of local lakes and palm trees along the sand and is located in an arc around this valley .

4. Research Material and Methods
Seventeen soil samples where taken from the study locations at depth ranging from 0 to 30 cm. Also, 17 water samples where taken from irrigation wells in the study area. Selected physical and chemical properties of soil and water samples are analyzed in addition to the heavy metals concentrations. The considered physical and chemical analyses are as follows: -

4.1. Determine physical and chemical properties of the soil.
The soil acidity (pH) and electrical conductivity (EC) was measured in (1:1) water extract (1 soil : 1 water) using a device Meter-pH and EC-Meter and according to the (1973, Jackson). The soil texture was determined using USDA textural triangle.

4.1.1 Cation Exchange Capacity (CEC)
CEC was estimated by taking 5 grams of soil and adding 33 ml sodium acetate 1N, then sample was shacked for 10 minutes and then centrifuged for 15 minutes. and run centrifuge the mixture. Then liquid extract was poured out and sample is re-washed with 33 ml of Isopropyl Alcohol to remove excess sodium. Then same steps are used to wash sample with 33 ml of Ammonium Citrate replacing Sodium citrates. The wash out is collected to reach 99 mls then 1 ml of distilled water is added to reach 100 ml of extract. Then the extract was analyzed with Flam photometer.
CEC = sodium concentration meq. / * 100/10 * weight of the soil sample.
4.1.2 Organic Matter (OM)
OM was estimated using the method of Jackson Walkely and black (1949)
Determination of Cations and Anions of Soil: Saturated paste extract is utilized according to the method of Richards (1954) to estimate the cations and anions in soil extracts. Sodium and potassium were measured using the Flam photometer. Calcium and magnesium were analyzed according to Richards (1954) using titration with EDTA solution and indicator EBT-MUREXIDE. Chloride (Cl^-) was analyzed by titration with silver nitrate. Phosphate ($PO4^{-3}$) was measured in saturated soil extract using color absorption at 882 mm using spectrophotometer. Carbonate and bicarbonate were measured using titration with sulfuric acid (H_2SO_4). Sulfate (SO_4^-) was analyzed in saturated soil extract by precipitation with barium sulfate in the presence of barium chloride then light absorption was measured using Spectrophotometer at wave length 420 nm.

4.1.3 Heavy Metals Concentration
MCGrath and Cunliffe (1984) method was used to estimate the heavy metals. A 1 gm grinded soil sample was taken from each sample in digestion tube and 20 ml of acids mix (HCL: HNO_3) by (1:3) and set for 24 hours. Ised to 150 C^o for 2 hours and then to 250 C^o for 1 hour. After cooling, the sample is filtered using Whatman No. 542 paper. The filtered solution is completed to 100 ml with diluted HNO3 (1.5%). Then samples were measured using atomic absorption spectrophotometer.

4.2. Characterization and chemical elements of water the irrigation water quality analysis was carried following the Standard Methods for Examination of water. The pH was measured in water using a pH meter. Electrical conductivity (EC) was measured in water using an Electrical Conductivity meter. Sodium ion (Na^+) was measured in water using a Flam photometer. Potassium ion (K +) was measured in water using a Flam photometer. Calcium and magnesium ions have been estimated in the water by titration with EDTA solution in the presence of the two indicators Eriochrome Black T and Murexide. Phosphate ($PO4^{-3}$) was measured using spectrophotometer and light absorption at wavelength 882 nm. Carbonate and bicarbonate were analyzed using water titration with hydrochloric acid in the presence of the two indicators phenol and naphthalene methyl orange. Chloride ion (Cl^-) was measured by titration with solution of silver nitrate a until pinkish yellow color is reached. Sulfate ion ($SO4^{-2}$) was measured in water by precipitation in presence of barium chloride and then was measured by spectrophotometer at wavelength of 420 nm.

Concentration of Heavy Metals in Water samples: Water samples were preserved by adding concentrated nitric acid (HNO_3) and then filtered with Whatman paper No.50 and the samples were measured by Atomic Absorption Spectrophotometer according to the Standard Method for Examination water and waste water.

5. Results and Discussion

The results of the physical analysis of soil samples summarized in Table (1) show that the proportion of organic matter ranged between 0.10% - 0.63 %, and the difference is attributed to the amount of compost added to the soil and continuous agriculture. This is consistent with the findings of the majority of studies on the soils of arid and semi-arid areas which are considered poor in organic matter. Organic matter played an important role in improving the CEC of the soil, especially soils with textures of sandstone ranged CEC between 18.82 -36.36 which is not high, but much higher than in sandy soils poor in organic matter. Table (1) shows the texture of the soil samples, where the results showed that the majority of soils were sandy to loamy sand except for Ashkedah which is silty sand. Soil texture plays an important role in improving CEC of the soil, and therefore capacity to hold major and minor nutrients.

Table 2 show the chemical characteristics of water samples, the results show that the pH values of the water ranged between 5.95 - 7.95 , while the electrical conductivity were between 239-9698 , which indicates that irrigation water has high percentage of ions . Cations analysis showed that the elements Mg^{+2}, Ca^{+2}, K^{+2}, and Na^+, are present at high levels in most of the samples, for instance, calcium concentration ranges from 60 ppm in the sample Qaqum and 720 ppm in the sample Aqar 1, while the magnesium concentration ranges from 12ppm in the sample Qaqum a and 156ppm for Aqar 1, while sodium concentration ranged from 35.6ppm in Ashkida and 72.7ppm Qaqum. Potassium concentration range from 9.8 ppm for Qaqum 2 and 21.5 for Mahruqa 2.

Table (1) Cation Exchange Capacity and Organic Matter and Soil Texture of the Soil Samples

Study Area	OM%	CEC meq 100 g $Soil^{-1}$	Soil Composition			
			Sand %	Silt %	Clay %	Soil Type
Ashkeda 1	0.22	35.08	96.19	1.18	2.63	Sandy
Ashkeda 2	0.27	25.66	98.48	0.85	0.67	Sandy
Ashkeda 3	0.31	29.94	55.77	34.76	9.48	Sandy silt clay
Ashkeda 4	0.10	23.10	96.64	0.96	2.4	Sandy
Qiyra1	0.35	26.53	82.44	9.41	8.15	Silty Sandy
Qiyra2	0.40	38.51	91.28	2.42	6.3	Sandy
Qiyra3	0.24	22.25	84.69	5.65	9.66	Silty Sandy
Dabdab 1	0.27	35.08	90.58	1.4	8.02	Sandy
Dabdab 2	0.32	33.37	85.41	6.93	7.66	Silty Sandy
Qaqum 1	0.35	31.66	95.62	3.31	1.07	Sandy
Qaqum 2	0.29	34.23	97.02	2.41	0.57	Sandy
Aqar 1	0.43	39.36	97.48	1.85	0.67	Sandy
Tamazawa 1	0.44	27.38	85.79	4.90	9.31	Silty Sandy
Tamazawa 2	0.40	18.82	93.17	5.25	1.58	Sandy
Tamazawa 3	0.50	33.37	93.69	3.71	2.6	Sandy
Mahruqa 1	0.63	31.66	96	0.81	3.19	Sandy
Mahruqa 2	0.48	29.94	91.21	7.16	1.63	Sandy

The results of the ions analysis for water sample show that the sulfate ion is the prevalent in most samples with levels from 4302 ppm in the Qiyra 1 to 1865 ppm in Qiyra 3, while the chloride ranges between ppm50 in a sample Ashkeda 2 and ppm 1236.35 in Qiyra 3. The concentration of bicarbonate ranged from 85.4 ppm for Dabdab 1 and 244 ppm for Tmazawa 1. Phosphate in water had a concentration of 0.002 ppm in Mahruqa 2 and 0.11 ppm in Ashkendah 2. All water sample show carbonate ion below detection limit. Hence, we can see that the increase in the value of conductivity due to the presence of salts of calcium , magnesium sulfate , sodium chloride and sodium bicarbonate and potassium in water samples .

Table (2) Properties of the chemical elements studied of water samples

Study Location	Chemical Properties		Chemical Elements							
			Cations				Anions			
	pH	EC_s μ	Na^+	K^+	Ca^{++}	Mg^{++}	PO_4^{---}	$Cl^{—}$	HCO_3^-	SO_4^{--}
Ashkeda 1	6.53	1938	35.6	16.4	200	48	0.0043	85	183	816.3
Ashkeda 2	7.09	239	38.5	13.5	120	84	0.11	50	158.6	625
Ashkeda 3	7.13	958	44.5	16.4	340	96	0.0068	85	158.6	932.4
Ashkeda 4	7.12	738	41.5	14.2	80	24	0.011	95.10	183	490.6
Qiyra1	5.96	2310	44.5	12	120	48	0.0034	85	109.8	430.2
Qiyra2	6.91	9698	62.3	16.4	380	84	0.036	110.12	146.4	1112.7
Qiyra3	7.14	4632	41.5	12	600	132	0.039	1236.35	183	1865
Dabdab 1	7.10	3465	41.5	16	480	156	0.013	360.39	85.4	1231.3
Dabdab 2	6.93	1953	41.5	16.4	600	120	0.014	635.69	244	1523.2
Tamazawa 1	7.21	2632	50.4	13.8	320	120	0.0023	235.25	244	780.8
Tamazawa 2	6.96	295	44.5	16.7	480	72	0.0057	360.39	170.8	1135
Tamazawa 3	7.95	1993	86	14.9	360	120	0.015	285.31	207.4	685.1
Qaqum 1	6.89	2132	66.4	10.5	80	12	0.00452	260.28	219.6	744.7
Qaqum 2	7.33	3194	72.7	9.8	60	36	0.010	60.06	195.2	113.8
Aqar 1	6.73	3381	69.6	10.8	720	156	0.00339	1036.13	122	613.5
Mahruqa 1	7.20	1021	38.5	12	640	48	0.00339	385.42	195.2	977
Mahruqa 2	5.95	4193	80	21.5	540	84	0.00226	285.31	146.4	595.9
FAO Standard	8-6.5	2400	920	1.98	400	60	----	1065	610	960

Results of Table 3 show chemical elements for soil samples. When comparing soil chemical properties (Table 3) with water chemical properties (Table 2) we find that soil has high CEC which is consistent with irrigation water high CEC levels. Soil samples CEC ranged from 205 for Ashkenda 4 and 14700 for Qiyra 2. Soil pH ranged from 6.87 for Mahruqa 2 to 8.09 for Tamazawah 3. The soil chemical analysis show that cations Mg^{+2}, Ca^{+2}, K^{+1}, Na^{+1}, are prevalent in most of the samples , respectively , where the Ca^{+2} concentration range from 60 ppm in a sample Qaqum 1 and 840 ppm in a sample Qiyra 3. The sodium cation concentration was between 60.12 ppm in sample Qaqum 1 and 395.5 ppm in Aqar 1. The potassium concentration was between 7.11 ppm in Qaqum 1 and 66.10 ppm in a sample Qira 3, while the magnesium concentration ranged between 36 ppm in the sample Qaqum 2 and 372 ppm in the sample Aqar 1. The results of the analysis of ions $PO4^{-3}$, $HCO3^{-2}$, Cl^{-1}, and SO_4^{-2} are ions prevailing in most of the samples. Sulfate concentration ranges from 513.8 ppm in the sample Ashkeda 4 and 2556.9 ppm in Tamzawa 2. Also, the analysis show a significant increase in the concentration of chloride ranging between 110.12 ppm in sample Ashkeda 4 and 1736.90 4 ppm in Qiyra 3. As far as bicarbonate concentration between 146.4 ppm in Dabdab 1 and 549 ppm in Tamazawa 1, while we find that the phosphate concentration ranged between 0.0033 ppm Tamzawa 1 and 0.14 ppm in Ashkenda 2. Also, none of the soil samples contained carbonates.

The results show that the soil pH has a big role in determining the availability of the nutrients in the soil, where we find that the potassium, calcium and magnesium are available to a great extent at neutral pH, and that the basic pH lead to reduced availability of certain nutrients because they are deposited in the form of salts calcium, magnesium sulfate, sodium chloride and calcium chloride, sodium bicarbonate and calcium.

Table (3) Properties of the chemical elements studied of soil samples

Study Location	Chemical Properties		Chemical Elements							
			Cations ppm				Anions ppm			
	pH	EC_s μ	Mg^{++}	Ca^{++}	K^{+}	Na^{+}				
Ashkeda 1	7.85	335	60	260	37.9	180.3	873.8	366	155.17	0.147
Ashkeda 2	7.71	442	48	140	14.9	60.12	1830.7	183	160.17	0.011
Ashkeda 3	7.63	250	108	400	32.5	117	513.8	427	110.12	0.019
Ashkeda 4	7.75	205	72	80	8.13	82.2	572.3	134.2	135.14	0.00678
Qiyra1	7.60	4330	36	120	9.4	85.4	2131.2	256.2	160.17	0.059
Qiyra2	7.78	14700	120	400	57.6	94.9	2240	341.2	1736.90	0.071
Qiyra3	7.69	5760	276	840	66.10	405	2072.3	146.4	585.64	0.019
Dabdab 1	7.75	6430	144	300	59.3	129.7	1983.6	366	1386.52	0.019
Dabdab 2	7.60	2577	168	720	57.2	246.8	1323	549	685.75	0.00339
Tamazawa 1	7.62	3660	60	300	19.3	110.7	2556.9	305	585.64	0.010
Tamazawa 2	7.74	350	108	320	57.6	253.16	1516	280.6	485.53	0.020
Tamazawa 3	8.09	2290	60	400	15.9	129.7	169.2	268.4	585.64	0.00791
Qaqum 1	7.79	3790	36	60	7.11	60.12	147.6	366	135.14	0.022
Qaqum 2	8.03	4980	36	80	8.4	66.4	1580.1	366	1586.74	0.00565
Aqar 1	7.93	4560	372	700	63.3	395.5	1925	378.2	535.58	0.00452
Mahruqa 1	7.45	1134	192	480	27.4	107.5	1793.8	195.2	360.39	0.046
Mahruqa 2	6.87	6360	132	560	23.7	139.2	1959.9	305	135.14	0.022

The results of the heavy metals analysis of water samples are summarized in Table 4. The concentrations of chromium, cadmium and manganese elements were higher than the maximum limits suggested in FAO. The analysis showed that the samples are free of lead element and copper is reported in one sample which is Ashkeda 4 with the concentration of copper at 0.01 ppm. As for the zinc element its concentration is 0.019 ppm for Qaqum 2 and 0.7 ppm in Ashkeda 2. Nickel concentration ranged between 0.20 ppm for Ashkeda 1 and 0.51 ppm for Aqar 1 and iron concentration ranged between 0.35 ppm in Tamzawa 3 and 4.48 ppm in Mahruqa 1. Also, the results showed that the concentration of cadmium was between 0.087 ppm in Ashkeda 1 and 0.10 ppm in Mahruqa 1. Manganese concentration was between 0.23 ppm in Dabdab 1 and Sample 1.25 ppm in Tamzawh 1. Manganses concentration was below detection limit in Tamzawa 3.

Table (4) Heavy elements of the studied samples of irrigation water

Study Locations	Heavy Metals (ppm)							
	Zn	Ni	Cr+3	Fe	Cd	Mn	Pb	Cu
Ashkeda 1	0.685	0.078	0.205	2.35	0.087	0.255	/	/
Ashkeda 2	0.706	0.086	0.296	2.55	0.088	0.254	/	/
Ashkeda 3	0.020	0.093	0.255	3.21	0.092	0.322	/	/
Ashkeda 4	0.028	0.090	0.316	3.14	0.089	0.311	/	0.001
Qiyra1	0.035	0.093	0.454	0.84	0.092	1.131	/	/
Qiyra2	0.050	0.102	0.371	0.98	0.092	1.119	/	/
Qiyra3	0.073	0.094	0.271	0.36	0.099	1.058	/	/
Dabdab 1	0.053	0.091	0.307	1.48	0.094	0.2317	/	/
Dabdab 2	0.075	0.091	0.395	1.22	0.096	0.241	/	/
Tamazawa 1	0.048	0.099	0.308	2.06	0.098	1.256	/	/
Tamazawa 2	0.046	0.093	0.282	2.32	0.099	1.109	/	/
Tamazawa 3	0.038	0.112	0.394	0.35	0.097	/	/	/
Qaqum 1	0.029	0.097	0.416	0.795	0.097	0.047	/	/
Qaqum 2	0.019	0.096	0.503	1.15	0.101	0.240	/	/
Aqar 1	0.024	0.090	0.516	1.49	0.096	0.250	/	/
Mahruqa 1	0.034	0.091	0.503	4.48	0.105	0.335	/	/
Mahruqa 2	0.041	0.153	0.477	4.08	0.104	0.312	/	/
FAO Standard	2.0	0.20	0.10	5.00	0.01	0.20	5.0	0.20

The results of heavy metal analysis are shown in Table 5. The results show many heavy elements are at low concentrations. The concentration of Zn ranged from 0.087 ppm for Ashkendah 2 and 2.56 ppm for Mahruqa 1

which is consistant with findings of Al-Khatib (1998). The average concentration of zinc in the soil between 17-125 ppm.

The decrease in zinc concentration in soil samples is related to the lower solubility of zinc at neutral pH. The results show that the lowest concentration of nickel in the sample was Ashkeda 2 at 0.13 ppm and a high concentration in the sample was Dabdab 1 at 0.52 ppm. This result is attributed to neutral and basic pH soils; acidic soils show more Nickel availability. While chromium concentration range from 0.53 ppm for Ashkeda 2 to 1.14 ppm in Tamzawa 1 due the high proportion of clay minerals and organic matter in the soil which led to the availability of this element when pH is neutral. The results showed that the iron has various concentrations between 30.75 ppm in a sample Ashkeda 2 and 63.95 in the sample Dabdab 1 , the low iron in the sample Ashkeda 2 is attributed to deposition of iron in the form of iron phosphate , and this situation occur largely in neutral soils and soils rich with limestone. As for the high concentration in Dabdab 1 it is linked to the high proportion of clay minerals and the high cation exchange capacity for soil. The cadmium concentration is ranging between 0.005 ppm in Tamzawa 2 and 0.13 ppm in Qiyra 2 and this is attributed to it low solubility in neutral and basic Soils. While the manganese concentration ranged between 1.93 ppm in Tamzawa 3 and at 11.85 ppm at Mahruqa 1.

The higher manganese in this soil is related to the high proportion of organic matter that affected the solubility of manganese in the soil. The decreased concentration in Tamzawa 3 is due to adsorption of to manganese on the surfaces of the organic matter and clay minerals at pH higher than 7 and therefore less soluble. The results summarized in Table (5) show that all samples do not contain any element of the concentration of lead except for sample Dabdab 1 , where the lead concentration was 0.39 ppm which can be related to external source.

The concentration of copper in the soil samples varied between 0.007 ppm in Ashkeda 4 and 0.575 ppm in Dabdab 1. The lower the concentration of copper in the soil is due to low movement in soils with pH close to neutral also the content of the soil organic matter and soil texture and the proportion of clay affect the availability of the copper in the soil which led to a decline in concentration in a sample Ashkeda 4 .Results also show that there is no significant concentration of copper in the samples Ashkeda 1 and 2 and Tamzawa 2.

Table (5) Heavy elements to the soil samples studied

Study Location	Heavy Metals mg/Kg							
	Zn	Ni	Cr^{+3}	Fe	Cd	Mn	Pb	Cu
Ashkeda 1	0.277	0.224	0.625	46.73	0.096	7.14	/	0.016
Ashkeda 2	0.087	0.134	0.538	30.75	0.097	8.23	/	/
Ashkeda 3	0.1309	0.159	0.580	34.59	0.101	9.11	/	/
Ashkeda 4	0.161	0.170	0.596	52.52	0.098	9.23	/	0.007
Qiyra1	1.006	0.245	0.859	57.37	0.135	7.27	/	0.028
Qiyra2	0.740	0.355	0.946	62.91	0.136	8.18	/	0.095
Qiyra3	0.309	0.298	0.839	57.31	0.131	11.66	/	0.056
Dabdab 1	2.256	0.526	0.985	63.95	0.060	9.82	0.39	0.575
Dabdab 2	0.977	0.383	0.899	61.27	0.009	5.27	/	0.055
Tamazawa 1	0.610	0.447	1.147	61.45	0.030	11.67	/	0.112
Tamazawa 2	0.215	0.156	0.853	47.38	0.005	3.74	/	/
Tamazawa 3	0.290	0.205	0.822	50.20	0.015	1.93	/	0.030
Qaqum 1	0.268	0.204	0.718	50.47	0.128	4.10	/	0.26
Qaqum 2	0.273	0.190	0.771	55.08	0.014	6.43	/	0.059
Aqar 1	0.260	0.253	0.863	58.01	0.016	6.22	/	0.021
Mahruqa 1	2.560	0.328	0.971	63.04	0.013	11.85	/	0.07
Mahruqa 2	0.325	0.222	0.863	57.23	0.013	6.86	/	0.015

6. Conclusion

Based on the results of this research we conclude the following:

1) The concentrations of the chromium, cadmium and manganese in water samples of were above the maximum limit suggested in the FAO standard, also, the irrigation water increased salts concentration in the soil.

2) Organic fertilizers have a positive effect on soil that is, they did not increase the concentration of heavy metals in the soil. OM supplied the soil with zinc and manganese.

3) The detected lead in the sample Dabdab 1 may be related to air pollution in the area or prior use of pesticides.

4) The differences in the concentrations of the considered elements is due to the difference in the sources of these elements.

5) Many of the considered elements were available with low concentrations because of the deposition in the form of salts at neutral to basic pH. The solubility of considered chemicals may change if soil pH is changed.

Recommendation:

1) Using organic matter in the form of (animal manure) is appropriate because of to the abundance of nutrients and small proportion of heavy elements which does not lead to damages to the plant.
2) Quality of irrigation water has significant impact on the soil physical and chemical properties.
3) The chemical analysis of soil is important to determine its nutrients availability and to define need for fertilizers.
4) Develop programs of scientific thought to fertilize and add organic fertilizers in quantities suitable to the conditions of the soil and plants.
5) Soil and water chemical analysis is important to evaluate nutrients in plants, and so to study the concentration of elements in plants and how it relates to concentrate in the soil.
6) Following a crop rotation can improve soil productivity with out depletion of its capacity.

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