Study of iron formulas in rice-grown soils in Diwaniyah governorate

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Abstract
The study included the selection of a site from the soil of Diwaniyah governorate (shanafiya) located between the latitude 44o37'877"-44o35'4966" East and longitude 31o35'2990"-31o36'045" North. In order to study some soil characteristics, surface samples were taken with a depth of 0-30 cm , the results of the volumetric distribution of the studied soil separations showed the predominance of the silt separations, while the sand and clay separations alternated in terms of dominance. The values of electrical conductivity in the study soil range from 120.44 - 3.90 ds m-1. Samples were taken from previously unexploited and exploited soils (beginning of the season, mid-season and after the end of the agricultural season), as the dissolved iron values in unexploited soils ranged from 0.00-0.001 C moll-1, and the ready-made iron values ranged from 0.021 - 0.058 CM Mol kg - 1, while the total iron values ranged from 1.064-1.284 Cmol kg-1. In the exploited soils, the dissolved iron values for the three stages ranged between 0.00-0.001 Cmol kg-1, while the ready - made iron content increased by increasing the growth stages 0.059-0.112, 0.069-0.125 and 0.104 - 0.136 Cmol kg-1 for the three stages in succession, and the total iron values reached 1.281 - 1.644, 1.386-1.596 and 1.385-1.612 Cmol kg-1 for each of the three stages in succession, through the results of a study, it was found that the ready and total iron values are higher in cultivated soils than uncultivated soils, due to the exposure of the soil during the growth stages of a plant to immersion, which leads to a reduction of iron and an increase in the ready and total iron values in cultivated soils.

Keywords: iron formulas, dissolved iron, ready-made iron, total iron, iron in rice soil.
Research extracted from the doctoral thesis of the first researcher

-1Introduction

The soil contains the element iron, which is the fourth in terms of its prevalence in the Earth's crust, and its concentration in the soil ranges from 0.2 - 55%, and it is one of the basic microelements that support plant growth and is found in the form of oxides, hydroxides and phosphates and in the structural composition of primary minerals and secondary clay minerals, and iron oxides affect the physicochemical qualities of soils, because they have a high surface area and have the ability to adsorb ions and interact with carbonates and retain phosphates and affect the physical qualities (1.(

He pointed out (2) that the dissolved and ready-made iron in the soil solution is relatively little compared to the total iron, and the reason for this decrease is that most of the predominant iron is trapped in the minerals of the parent material, which is the first source of iron in the soil, and enters into the chemical composition in the secondary minerals of iron, especially in neutral and alkaline lands. In a study conducted by (3)that the total iron content is influenced by the type of rocks and primary minerals, weathering, climatic and environmental factors among (4(

The percentage of total iron associated with carbonate minerals, which depends on the amount of iron associated and the percentage

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of active or effective carbonates, and the formulas of carbonate minerals in calcareous soils are in the form of fine dispersed grains that are difficult to distinguish with the naked eye from soil grains, or they may be in the form of threads that fill the gaps caused by the decay of roots as a white mass mixed with red and black colors and may be in the form of hard knots difficult to disintegrate.(5) pointed out that the bulk of iron is found in the crystal plates of various minerals, and the most important primary minerals containing iron, such as oxides, sulfides, carbonates, sulfates and silicates.

In light of this, the study aimed to: study the formulas of iron in surface soil samples of unexploited soils and others exploited by rice cultivation in Diwaniyah governorate.

-2Materials and methods of work

-2.1study sites

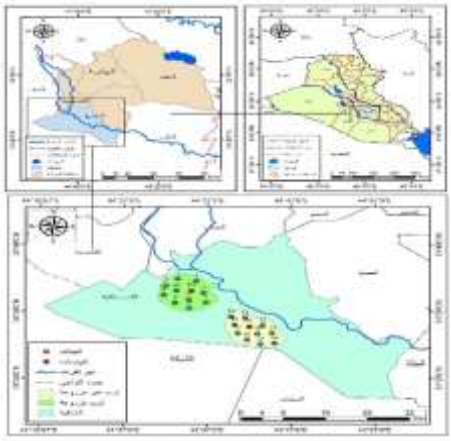

Figure 1 map of the study area locations in Diwaniyah governorate

-2.3different iron formulas

-2.3.1molten iron

Dissolved iron was extracted in a suspension of 1:1 water soil according to the method given in (9) and then estimated using the Perkin Elmer 1100b Cautionhot atomic absorption Spectrophotometer.

Figure 1 represents the map of the study area in Diwaniyah governorate, which is located within the dry and semi-dry areas characterized by high temperatures and low vegetation density, and it is of sedimentary soils characterized by the sediments of the Euphrates River, as a stream from the Euphrates river passes near the cultivated area .

-2.2Physical and chemical properties of the soil

Estimate the volumetric distribution of soil arthropods by international pipette as described in(6). The electrical conductivity and soil reaction pH of the extract were measured (1: 1) according to the method described by(7). Cations and anions were estimated, organic matter was estimated by the method of wet digestion and the exchange capacity of positive ions according to the method described in ICARDA (8.(

-2.3.2 prefabricated iron

After extraction, the ready-made iron by chelating material dtba according to (10) was estimated by means of the Perkin Elmer 1100b type Cautionhot atomic absorption Spectrophotometer.

-2.3.3mutual iron (Exchangeable (

Mutual iron was extracted by the method mentioned by (11(

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Mutual iron = ready-made iron-melted iron.

-2.3.4non-mutual iron

Non-exchange iron was extracted by the method mentioned by (11(

Non-mutual Residual = total iron - (dissolved iron+ mutual iron.(

-2.3.5Total iron

Total iron was extracted from the soil using anhydrous sodium carbonate with (10) milliliters of hydrochloric acid (HCl) at a concentration of (5M) and (60%) of hydrochloric acid according to the method given in (12.(

-3 Results and discussion

-3.1Volumetric distribution of surface soil separators

Table 1 shows the volumetric distribution of soil separations of the study samples, to a depth of 0-30 cm and the type of tissue for Diwaniyah governorate, as the results showed the predominance of silt separations, and comes with several alternations in the amount of sand and clay separations, and this variation may reflect the proximity and distance from the sources of river sedimentation that would carry the minutes according to their granular size and the speed of water flow (13; 14.(

-3.2Chemical properties of the studied soil

Table 2 shows that the values of electrical conductivity in the study soil of Diwaniyah governorate ranged between 120.44-3.90 dSm-1, with the lowest value at the sample Sf110 and the highest value at the sample S08 .The soil reactivity values range from 7.15 - 7.62, the lowest soil reactivity value is in S010 and the highest soil reactivity value is in Sf17 . As for the calcium concentration, it ranged from 192.83-5.83 mmol.l-1, the lowest concentration at the sf110 sample and the highest concentration at the S08 sample, and the magnesium concentration was 226.97-6.54 mmol.l-1,, the lowest concentration at the sf110 sample and the highest concentration at the S08 sample. And for sodium and potassium they ranged from 476.64-12.84, 0.77-0.36 respectively. The negative ions ranged from14.11-3.34 ،965.11-14.41 ،113.45-9.41 for bicarbonate, chloride and sulfate in succession.The values of the exchange capacity of positive ions ranged from 19.86-12.77 cmol.kg-1 charge, although the lowest value at the Sf110 sample and the highest value at the S010 sample.

The values of organic matter in the soil samples of the study range from 16.62-10.22 g kg-1, the lowest value at sample S010 and the highest value at sample S01.The results of the study indicated that there is a wide variation in the values of the chemical properties of the soil under study, and this variation is due to the impact of the rise of ground water in unexploited soils, as the process of agricultural exploitation led to an increase or decrease in the values of rice crop soils, and the length of the.

Table 1 volumetric distribution of surface sample soil separators in Al-shanafiya area

Conservatism	Location	Simple code	Soil separators g kg^{-1}			Textuer
			Sand	Loam	Clay	
Diwaniyah Al-shanafiyya	Untapped	S01	262.3	464.1	273.6	Si L
		S02	195.4	452.2	352.4	L C Si
		S03	271.7	460.4	267.9	Si L
		S04	283.5	531	185.5	Si L
		S05	154.8	694.8	150.4	Si L

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		S06	202.9	494.4	302.7	L C Si
		S07	325.1	557.7	117.2	Si L
		S08	577.1	332.7	90.2	S L
		S09	554	354	92	S L
		S010	250.22	413.6	336.18	C L
	Exploited	Sf11	298.7	530.3	171	Si L
		Sf12	125.4	589.4	285.2	L
		Sf13	304.2	474.4	221.4	Si L
		Sf14	302.6	452.4	245	Si L
		Sf15	279.9	339.4	380.7	C L
		Sf16	196.16	452.42	351.42	L C Si
		Sf17	156.84	427.02	416.14	Si C
		Sf18	188.04	440.92	371.04	L C Si
		Sf19	371.25	359.07	269.68	L
		Sf110	190.7	441	368.3	L C Si

Table 2 chemical properties of surface samples in Diwaniya governorates, exploited and Unexploited

Diwaniyah (Shanafiyah)	Sample code	EC dS m^{1-}	pH	Positive and negative ions mmol L^{-1}								CEC Cmol kg^{-1}	S.O.M gm Kg^{1-}	Lime gm kg^{1-}	Active lime Gm kg^{1-}	Gypsum gm kg^{1-}
				Ca^{2+}	Mg^{2+}	Na^{1+}	K^{1+}	CO_3^{2-}	HCO_3^{1-}	Cl^{1-}	SO_4^{2-}					
Unused soil	S01	22.7	7.21	32.05	29.37	97.6	0.71	NIL	7.43	159.82	27.91	16.734	16.62	380.12	155.62	4.35
	S02	9.88	7.42	11.36	9.99	53.31	0.36	NIL	4.23	69.61	11.67	16.24	14.414	318.24	142.84	4.72
	S03	16.88	7.35	24.2	29.04	56.84	0.7	NIL	6.21	118.68	20.5	14.22	16.63	357.15	152.61	5.84
	S04	12.08	7.32	17.59	14.89	51.95	0.59	NIL	7.93	87.06	11.9	13.84	12.84	411.22	165.54	6.64
	S05	32.4	7.27	36.39	58.03	125.46	0.55	NIL	11.88	256.92	24.9	13.41	16.68	384.32	158.16	3.98
	S06	96.6	7.35	163.03	184.57	239.91	0.64	NIL	14.11	773.81	80.73	18.85	14.26	402.26	162.86	4.82
	S07	114.2	7.21	182.69	215.88	308.79	0.64	NIL	7.15	927.76	93.73	15.24	11.16	332.12	146.32	5.27
	S08	120.44	7.28	192.83	226.97	327.27	0.65	NIL	4.16	965.11	107.09	19.62	12.52	342.26	150.14	4.6
	S09	112.8	7.16	117.95	191.87	476.64	0.74	NIL	5.63	877.12	112.7	18.46	15.27	431.18	156.82	6.26
	S010	102.16	7.15	176.14	189.66	257.2	0.59	NIL	9.65	767.4	113.45	19.86	10.22	426.42	168.2	7.12
exploited soil	Sf11	19.9	7.2	19.9	25.91	101.82	0.65	NIL	5.91	140.67	24.51	15.14	14.22	423.84	177.46	3.25
	Sf12	21.04	7.22	26.12	29.77	92.13	0.77	NIL	12.37	104.22	44.97	18.46	12.82	354.15	168.23	2.84
	Sf13	18.71	7.24	17.85	37.98	69.64	0.48	NIL	5.96	130.94	23.52	16.9	14.62	419.25	184.82	3.61
	Sf14	13.3	7.21	20.8	16.48	54.32	0.6	NIL	7.26	90.46	16.46	15.35	13.25	441.28	185.64	2.55
	Sf15	14.17	7.26	16.26	21.84	60.98	0.65	NIL	7.06	102.78	14.75	14.7	12.85	407.16	181.44	2.68
	Sf16	9.77	7.21	9.61	20.53	34.08	0.74	NIL	6.3	63.66	13.03	14.44	12.06	323.28	173.82	2.18
	Sf17	5.64	7.62	8.34	7	23.84	0.48	NIL	3.61	25.6	13.03	17.65	11.57	354.2	168.35	3.54
	Sf18	4.52	7.32	6.4	7.79	15.15	0.41	NIL	3.34	21.76	9.59	15.58	14.24	424.42	182.66	2.82
	Sf19	6.93	7.38	11.64	8.98	25.5	0.68	NIL	5.92	31.81	15.13	15.69	10.3	420.18	185.22	4.08
	Sf110	3.9	7.26	5.83	6.54	12.84	0.36	NIL	5.14	14.41	9.41	12.77	13.06	386.16	178.42	3.28

.3.4.1Formulas of iron in soil samples of Diwaniyah governorate that are not exploited

-4Formulas of iron in the study soil

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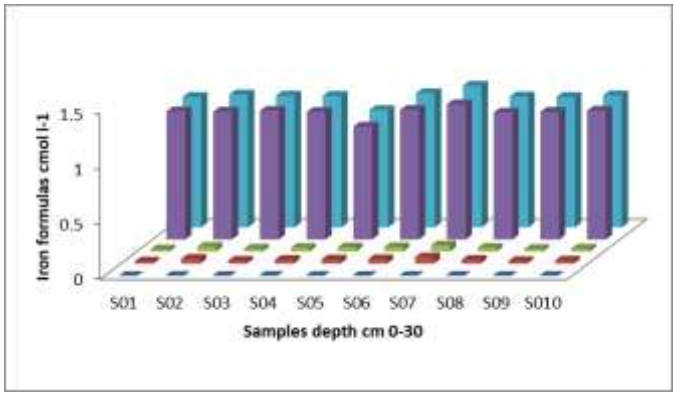
Table 3 shows the formulas of iron in the soil samples of the Diwaniyah governorate that are not exploited, as the values of dissolved iron ranged between 0.00-0.001 Cmol l-1. The values of ready-made iron ranged from 0.021-0.058 cmol kg - 1 and the lowest value in the sample S01 and the highest value in the sample S07. The mutual iron values ranged from 0.021-0.057 cmol kg-1, the lowest value in the S01 sample and the highest value in the S07 sample. As for the values of non - reciprocal iron, they were between 1.024-1.226 cmol kg-1, the lowest value of non-reciprocal iron in the sample S05 and the highest value in the sample S07. The results of the table also showed that the total iron values ranged from 1.064 - 1.284 cmol kg-1 and the lowest value of total iron in the sample S05 and the highest value in the sample S07. Figure 2 shows Iron formulas in unexploited soils at a depth of 0-30 cm diatom

Table 3 formulas of iron in the soil samples of Diwaniyah governorate

Study area	Soil samples (Comparison)	Iron formulas				
		Melted cmol kg^{-1}	ready cmol kg^{-1}	Exchangeable cmol kg^{-1}	Non-reciprocal cmol kg^{-1}	Total cmol kg^{-1}
Diwaniyah Untapped	S01	0.000	0.021	0.021	1.161	1.182
	S02	0.001	0.046	0.045	1.158	1.204
	S03	0.000	0.028	0.028	1.166	1.194
	S04	0.001	0.036	0.035	1.156	1.192
	S05	0.001	0.04	0.039	1.024	1.064
	S06	0.001	0.042	0.041	1.174	1.216
	S07	0.001	0.058	0.057	1.226	1.284
	S08	0.001	0.036	0.035	1.15	1.186
	S09	0.000	0.025	0.025	1.157	1.182
	S010	0.001	0.029	0.028	1.167	1.196



Formula_2 formulas of iron in undeveloped Terp diurnal samples

.-3.4.2Formulas of iron in soil samples of the exploited Diwaniyah governorate

Table 4 shows the formulas of iron in the soil at the three stages of growth at the beginning of the season, mid-season and after the end of the agricultural season of the rice crop, where

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the dissolved iron record for the three stages ranges from 0.00-0.001 Cmoll-1. While the ready - made iron content increased by increasing the growth stages between 0.059-0.112, 0.069-0.125 and 0.104-0.136 Cmol kg-1 for the three stages in succession, as the lowest value of ready-made iron in the SF19 sample at the beginning of the season and the highest value in the ST11 sample at the end of the agricultural season, Figure 3 shows the formula of ready-made iron and the value of the correlation coefficient R2=0.979 samples for the three stages. When following the results of the table, it was found that the mutual iron values range from 0.058 - 0.111, 0.068 - 0.124 and 0.103 - 0.135 Cmol kg-1 in the sequence of the three stages, since the lowest value of mutual iron in the sample Sf19 at the beginning of the season and the highest value in the sample St11 at the end of the agricultural season. As for the values of non-reciprocal iron ranges between 1.222-1.565, 1.278 - 1.471 and 1.281-1.483 C mol kg - 1 for the three stages in succession, since the lowest value of non - reciprocal iron in the SF19 sample at the beginning of the season and the highest value in the st18 sample at the end of the agricultural season, the total iron values were between 1.281 - 1.644, 1.386-1.596 and 1.385-1.612 cmol kg-1 for each of the three stages in succession, as the lowest value of total iron in the SF19 sample at the beginning of the season and the highest value in the st18 sample at the end of the agricultural season, Figure 4 shows the formula of total iron and the value of the correlation coefficient R2=0.992 in the soil samples of Diwaniyah governorate exploited for ten samples for the three stages. These results indicate that at the beginning of the season, the role of water in the degradation and decomposition of iron compounds, as well as the role of the biological factor and crop growth, while the effectiveness and activity of these environmental conditions and factors increased by increasing the time of growth stages.

-4Conclusions

The results of the study showed that the mutual and total iron formulas increase in cultivated soils and during the stages of plant growth when compared with unexploited soils, and it was noted that the values are higher in surface unexploited soils compared to exploited soils.

-5Recommendations

The current study recommends expanding the study of mineral transformations occurring in rice soils using an electron scanning microscope, and to find out the effect of images of oxides in the readiness of iron and microelements in the soils of the study area because of their importance in the aspect of plant nutrition.

Table 4 formulas of iron in the soil samples of Diwaniyah governorate used for rice cultivation

Iron formulas Cmol kg^{-1}	Samples of Shanfiya soil used for rice crops - Diwaniyah Governorate									
	The beginning of the agricultural season (first phase)									
Sample code	Sf11	Sf12	Sf13	Sf14	Sf15	Sf16	Sf17	Sf18	Sf19	Sf110
Molten iron	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Ready iron	0.112	0.087	0.081	0.065	0.067	0.09	0.084	0.079	0.059	0.066
Exchangeable iron	0.111	0.086	0.081	0.065	0.066	0.089	0.083	0.078	0.058	0.065
Insoluble iron	1.361	1.239	1.303	1.263	1.265	1.324	1.378	1.565	1.222	1.32
Total iron	1.473	1.326	1.384	1.328	1.332	1.414	1.462	1.644	1.281	1.386
Iron formulas	Mid-season (second phase)									

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Cmol kg-1	Ss11	Ss12	Ss13	Ss14	Ss15	Ss16	Ss17	Ss18	Ss19	Ss110
Molten iron	0.02	0.001	0.001	0.001	0.002	0.002	0.001	0.002	0.002	0.001
Ready iron	0.121	0.099	0.086	0.069	0.101	0.125	0.082	0.117	0.116	0.079
Exchangeable iron	0.119	0.099	0.085	0.068	0.1	0.124	0.082	0.116	0.115	0.078
Insoluble iron	1.405	1.295	1.496	1.317	1.294	1.471	1.382	1.304	1.278	1.323
Total iron	1.526	1.394	1.582	1.386	1.395	1.596	1.464	1.421	1.394	1.402
Iron formulas Cmol kg-1	End of the agricultural season (third phase)									
	St11	St12	St13	St14	St15	St16	St17	St18	St19	St110
Molten iron	0.002	0.002	0.003	0.002	0.003	0.002	0.002	0.003	0.002	0.02
Ready iron	0.136	0.119	0.122	0.119	0.126	0.11	0.106	0.129	0.104	0.116
Exchangeable iron	0.135	0.117	0.121	0.118	0.125	0.109	0.105	0.128	0.103	0.115
Insoluble iron	1.462	1.287	1.36	1.412	1.482	1.301	1.298	1.483	1.281	1.412
Total iron	1.598	1.406	1.482	1.531	1.608	1.411	1.404	1.612	1.385	1.528

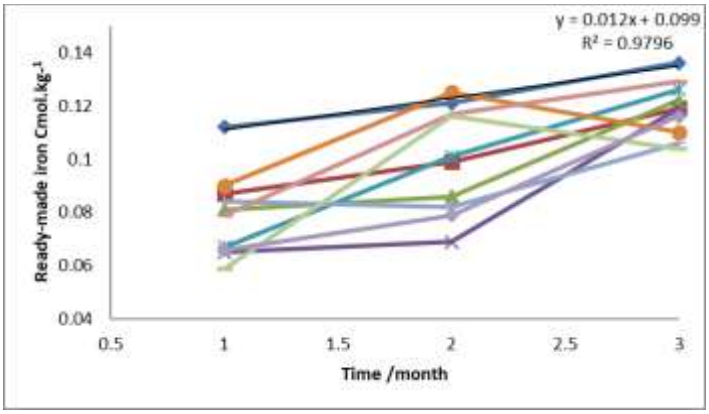

Figure 3 formulas of the content of ready-made iron in soil samples used for the three stages in Diwaniyah governorate

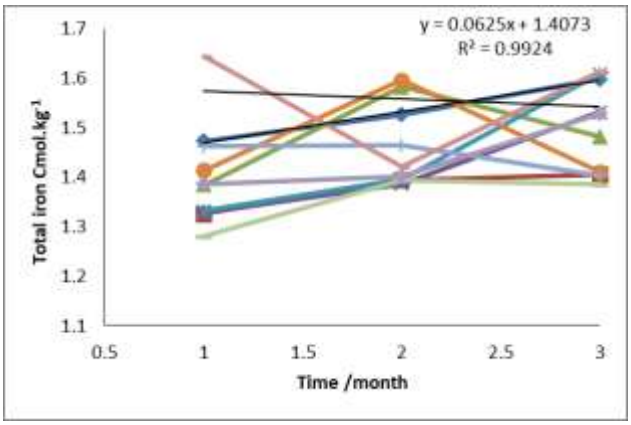

Figure 4 formulas for the total iron content in soil samples used for the three stages in Diwaniyah governora

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