Study the physical and chemical characteristics of the soils effected by the Al-Mosab Al-Aamm river in AN-Nasiriya , south of Iraq .

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ABSTRACT :

The study involves samples of soils from nine stations divided over three regions located on different distances of 0-100m. , 100-200m. and 200-300m. respectively and at 0-20 cm. depth on the left side of the Al-Mosab Al-Aam river to study their physical and chemical characteristics, as well as, a sample of the river's water to evaluate the effect of the water upon the adjacent soils .

The physical properties of soils represented with apparent and specific density (1.08-1.24) gm/cm^3 and (2.40-2.60)gm/cm^3 respectively , and range of grain size are for the sand (20-28%) , silt (40-46%) and clay (32-34%) ,with a little percentage of organic matter ranged between (0.96 – 1.43%) .

The chemical properties of the soils are for the pH (7.9-8.3), E.C.(1220-2315mmos/cm), Total salt dissolve (TDS)(970-1618mg/l), Calcium (290-376mg/l) ,Magnesium (248-290mg/l), Sulphates (245-310mg/l), Phosphates (11.6-14.3mg/l), Nitrate (18-22mg/l), Sodium (317-460mg/l), Potassium (216-302mg/l), Alkanic (367-422mg/l),Chloride(412-458mg/l), Boron (0.34-0.84mg/l), Sodium Absorption Ratio (SAR)(1.32-8.85%), Residual Carbonate Calcium (RSC)(0.29-0.38%) .

The chemical properties of the river's water are for the pH (7.7) , E.C.(1128mmos/cm) , TDS (690mg/l) , Ca.(310mg/l) , Mg.(198mg/l) , So_4(265mg/l) , Po_4(18.2mg/l) , No_3(12.8mg/l) Na.(322mg/l) , K.(118mg/l) , HCo_3(460mg/l) , Cl.(420mg/l) .

The study has shown that , the nomenclature of investigated soils are silty loam with a little percentage of organic matter and of high salinity . Also showed the response of the electrical conductivity as well as the sodium and chloride concentrations to the repeated washing (drainage)of Al-Mosab Al-Aam project .

There are high salinity and high concentration of sodium in these regions .

INTRODUCTION :

The importance of the Al-Mosab Al-Aamm project is a matter of no controversy between authors as the key to success in the agricultural area , serving an area of six million acres and helps to open the river navigation for part of central and southern Iraq and working to improve the quality of waters of the Tigris and Euphrates rivers via reducing the concentration of salt therein .

As well as, reducing groundwater levels of agricultural land , maintaining the reclamation projects undertaken as the project contributes to the clearance of agricultural land in Iraq from the salts which are estimated at 80 million tons per year that go to the Gulf via the Shatt Al-Basrah with water drainage (1) .

The current study is conducted on the agricultural interest of the project because of it's importance to transfer the saline water from the reclamation of agricultural land in central and southern Iraq through an interconnected network of drainage

Al-Mosab Al-Aamm project is responsible to push away the salty water into the Arabian Gulf through it's southern parts.

Balancing food comes through the plant nutrients which are necessary to the absorption , leading to emerge the plant in good condition and give it a bumper crop in the end .

But an increase in the quantity of the nutrients in the soil causing damage to plant , animal and human (2) .

The plants are affected by increase the elements and salts in the irrigation water which results a higher pressure osmosis in soil solution , and making it of difficult absorption by the plants , may also have adverse impact on the plants due to the presence of some toxic effect of salt (3) .

The results of pedological studies (soil surveys) confirms that there are variation evidents in the color and the nature of the deposition of the soils with the time period , which is proved that the studied region historically has passes through multiple hydrological courses The hydrological and pedological investigations mentioned to the soils surveys during the period of 1991-1995 confirmed the presence of organic matter deposits and the incidence of pollution in soils and water in the region , which leads to a change in the physical and chemical characteristics of the soils (4) .

The study of the chemical and physical properties of the soils and the irrigation's water have a strategic economic importance for the nation as the studied region has a very shining future to give the real standard of the soils validity extent for different uses specially for farming use , as this region has been known since older agos as a farming region (5) .

Therefore , the present study aimed to give exactly and clear illustration of the physical and chemical characteristics of the soils in the studied regions .
And to evaluate the affection of the Al-Mosab Al-Aam project through statement of agricultural soils affected by the river's water within the limits of An-nasiriya city .

The Study Area :-

The Al-Mosab Al-Aamm river passes through an area of about (5615330) dunums (1) . The study area was divided into three main sub areas in the area between latitudes (32° 28" – 31° 8") north , and of the length (46° 40" – 45° 42") along the east and about (50) kilometers from the latter parts of the river even crossing the Euphrates river south of AN-Nasiriya city , as had been using G.P.S. (Global Position System) to locate the positions .
Figure (1) shows the agricultural areas from which the soil samples have been collected .

Sampling:-

Were taken two kinds of samples of agricultural soils for the three regions studied on the left side of the river :-
1- soil samples taken at a distance of (0-100m.) apart (region 1) ,
2- Soil samples taken at a distance of (100-200m.) apart (region 2) ,
3- Soil samples taken at a distance of (200-300m.) apart (region 3) .
All the samples mentioned above were taken at a depth of (0-20cm.).
4- The water sample was taken from the surface of river's water , which is contaminated by agricultural waste land at a distance of (1-2m.) from the river's edge .

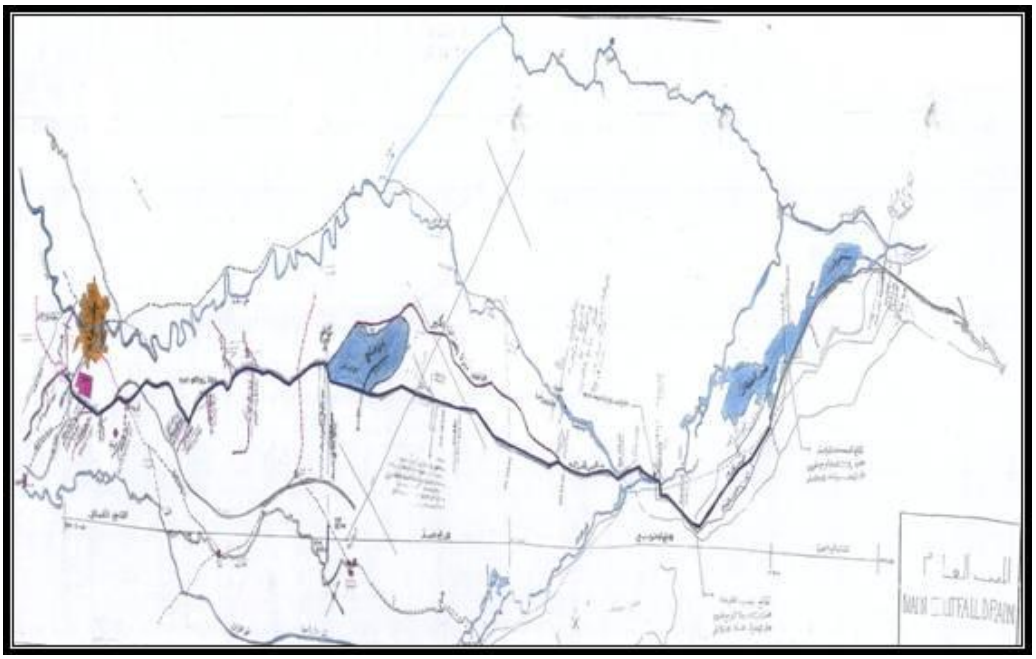

Fig. (1) map showing the locations of soil samples taken from the left side of the river

MATERIAL & METHOD :-

The samples were dried in the open air and crushed then sieved through a sieve 2mm. to determine the size of soil particles .
After making soil extract of (1 : 5) (soil : water) , the following laboratory tests have been done :-

1- Organic Matter : estimated organic matter percentage by Walkey – Black method after the oxidation by potassium chromate (6) .

2- Apparent and Specific Density : Apparent Density estimated by using the usual way , by taking known weight of the soil and putting it in a glass container of known size to extract the density from the following equation :
Apparent Density = weight (soil) / volume (soil) g/cm^3 (7) ,
Specific Density was estimated by using (Standard Volumetric Bottle) , taking known weight of the soil and place it in the bottle of known weight and fill the bottle with water , then take the difference between the two weights, the unit is g/cm^3 (7) .

3- pH : measured by pH meter (made by Hanna company) .

4- E.C. : Electrical conductivity measured through saturated paste extract , using field electric device (8) .

5- Chloride : measured by Titration method using silver nitrate (9) .

6- Calcium : the estimated calcium concentration of the sample solution after making a paste of it (1 : 5)water by Titration with EDTA-2Na solution and used Murexid dye as evidence .

7- Magnesium : the estimated values of magnesium in the solution was measured after making a paste of it by (1 : 5)water and the results expressed in units of mg/l (8) .

8- Sulfate : were measured on the filtrate soil using turbid method (9) , using spectrophotometer manufactured by P.G. company , model AS 4324 and at wavelength of 420 nanometer , the result expressed by mg/l .

9- Phosphate and Nitrate : were measured using Optical Spectrometer over a filtrate soil (9) .

10- Sodium and Potassium : were measured by the Flame Atomic Emission method (8) , using Flame Photometer manufactured by Jeonouy company , model SDE 540 .

11- The risk of Salinity , Sodium and Bicarbonates were calculated as described in FAO 2004 (10) .

12- Obtained Data was conducted to a statistical treatment according to the (SSPS) program to find rates and correlation coefficients among the studied characteristics .

Results and Discussion :-

The physical analysis of the soils described in (Table-1) showed that : the nomenclature of soils are generally silty loam and the grain size distribution of contrast limited rates , the rates are (20-28 %)sand , (40-46 %)silt and
(32-34 %)clay , the apparent and specific density ranged as (1.08-1.24 g/cm^3) and (2.40-2.60 g/cm^3) respectively , the soils of the three regions of high salinity and there are presence of organic matter of a little percentage range (0.96-1.43 %) A number of previous studies of the areas such as (Fahad—2006)(11) , (Hassan—2007)(12) and(Turkey—2008)(13)
agreed with the current study about the nature of the soils and their characteristics .
The chemical analysis of the soils described in (Table – 2) showed that : the pH values of the soils under studding and the surrounding areas more than 7 for all regions , values ranged between (7.4 – 8.3) , which had been expected because the value of the pH of the soils in Iraq would be close to 8 (14) .
Table -2 showed the value of E.C. in region-1 is (1220 microseminz/cm) , either in region-2 was (2250 microseminz/cm) and (2315microseminz/cm) in the third region , this means that the soils in these regions are of high salinity . This was confirmed by the values of total soluble solid salts which was almost doubled values of the water sample , the high values of the E.C. showed in table-2 influenced by high evaporation rates in studied regions (15) .
The results showed that the calcium ions are more than magnesium ions in all regions and that is due to the nature of the land through which the river passes , and there is an inverse correlation between them (r=-0.4)(table-3)as they are exchangeable elements in the soil (11) .
Variations in the calcium values between the under studding areas was attributed to the impact of temperature and other climatic factors such as rain fall , evaporation rates and dust storms which are the calcium compounds forming about 40% of it (16).
The source of sulfate in the soils may be because of the nature of the gypsum alluvial soils which are a direct source of sulfate dissolved in natural water (17), and this was confirmed by the direct correlation between sulfate and calcium ions in the three regions (r=0.6)(table-3). As well as due to the use of fertilizers containing sulfate especially during the growing season to increase productivity, which have varied values among the three regions while having close value to the water sample (table-2).
The value of phosphates was low in the studied regions due to the high ability of phosphorus to link with soils and not effected by repeated drainage because it have been absorbed by the components of the soil and it does not come out easily from the soils , as well as the phosphorus is characterized by a lack of soluble and movement (18) .
The results also showed high values of phosphate in the water sample compared to the soils that is due to the fact that most of the phosphorus salts are in the form of ($Po_4^{"}$ soluble) (18) .

Nitrate showed varied values among the three regions but the water sample has less concentration and this may be due to the factor of dilution.
In general , the high values of sodium in the studied regions is due to the high rates of evaporation resulting from the very high temperatures during the time of taking samples , in the meantime the sodium was the lowest in the region-1 followed by region-2 and 3 respectively this is due to the fact that the Iraqi soil salinity is usually of salt sodium chloride and this is showed by the direct correlation between sodium and chloride ions (r=0.65)(table-3) .
Potassium concentrations showed a non-distinctive distribution in the regions because it is clearly affected by the amount of evaporation and to the use of chemical fertilizers that increase the concentration of potassium ions (19) .
Potassium ion concentrations much lower than the rest of the cations and this may be due to the nature of the water of the Tigris , the mainly feeder to the Al-Mosab Al-Aam river which does not contain high concentration of this element and this may attributed to the difficulty of liberations of the element from the rocks the container (15) , and it is best proof of that has shown in the water sample which has a lower concentration .
Values of total alkaline in the studied soils are in the form of bicarbonate has a clear association with the pH value (r=0.3)(table-3) , the relationship between the hydrogen ion (H^+) which is separated from the carbonic acid and the root of the hydroxyl (H^-) resulting from the decomposition of bicarbonates have controlled the pH value (19).
The value of alkaline also associated with the values of sodium by moral proportional relationship (r=0.6)(table-3) is due to the fact that most of bicarbonate salts are salts of sodium (14) .
Noted that the high level of chloride (table-2) is due to the high rates of evaporation in this season and the flow of salts carried chloride from the agricultural land surrounding studied regions as well.
The SAR values fluctuated between (1.32) in region-1 with a low sodium risk , (6.6) in region-2 , but it was (8.85) in region-3 with a high sodium risk (20) .
The values of the remaining calcium carbonate (RSC) for all regions have been showed no risks of bicarbonates because of the high concentrations of calcium and magnesium , and to the low concentrations of carbonates and bicarbonates in it .
The values of boron were of no risks in all the regions.

CONCLUSIONS :

The investigated soils are of silty loam with a little percentage of organic matter and of high salinity, agricultural soils adjacent to the Al-Mosab Al-Aam river in Thi-Qar are of risk of salinity and sodium.
The risk of high permeability in some areas due to the high (SAR) values.
The dangerous of bicarbonate and chloride is low, and the boron of no risk.
There is response of the electrical conductivity, the sodium and chloride concentrations to the repeated washing (drainage) of Al-Mosab Al-Aam project.
There are high salinity and high concentration of sodium in these regions.

Table (1) Rates of some physical characteristics of the soil samples of the three regions

Locations	Apparent Density g / cm^3	Specific Density g / cm^3	Organic Matter %	Sand %	Silt %	Clay %	Soil nomenclature
Region – 1	1.24	2.60	1.43	24	43	33	Silty Loam
Region - 2	1.11	2.55	1.20	20	46	34	Silty Loam
Region - 3	1.08	2.40	0.96	28	40	32	Silty Loam

Table (2) Rates of some chemical characteristics of the soil samples of the three regions and a water sample of the Al-Mosab Al-Aam river in Thi-Qar

Property studied	Region -1	Region -2	Region - 3	Water sample
pH	7.9	7.9	8.3	7.7
Conductivity $Ms.cm^{-1}$	1220	2250	2315	1128
TDS mg/l	970	1420	1618	690
Ca^{++} mg/l	344	290	376	310
Mg^{++} mg/l	267	248	290	198
So_4^{--}	270	245	310	265
Po_4^{--}	12.2	14.3	11.6	18.2
No_3^- mg/l	22	36	18	12.8
Na^+ mg/l	317	388	460	322
K^+ mg/l	242	216	302	118
HCo_3^- mg/l	367	410	422	460
Cl^- mg/l	412	436	458	420
B mg/l	0.34	0.84	0.62	--
(SAR) Sodium Absorption Ratio	1.32	6.6	8.85	--
(RSC) Residual Carbonate Calcium	0.3	0.29	0.38	--

Table (3) Correlation Coefficients between the properties studied for the three regions

Coefficients Correlation	pH	E C	ALK	Ca^{+2}	Mg^{+2}	Cl^{-}	Po_4^{-3}	No_3^{-}	So_4^{--}	Na^{+}	K^{+}
pH	1	0.6	0.13	0.24	0.12	0.1	0.07	0.04	0.34	0.43	-0.2
E C		1	0.39	0.58	0.23	0.7	-0.09	-0.21	-0.21	0.26	-0.08
ALK			1	0.03	0.12	0.12	0.12	-0.08	-0.08	0.6	0.23
Ca^{+2}				1	-0.4	0.05	0.7	0.06	0.6	0.09	-0.36
Mg^{+2}					1	0.02	-0.22	0.06	-0.1	0.05	-0.21
Cl^{-}						1	0.02	0.36	0.06	0.65	0.09
Po_4^{-3}							1	0.02	0.11	0.3	0.2
No_3^{-}								1	0.02	0.39	0.26
So_4									1	0.3	0.02
Na^{+}										1	0.12
K^{+}											1

Coefficients Correlation at the borders of the confidence $p<0.05$

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دراسة الخواص الفيزيائية والكيميائية للترب التي تأثرت بنهر المصب العام في الناصرية جنوب العراق

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المستخلص :

تضمنت هذه الدراسة جمع نماذج من الترب لتسعة مواقع ضمن ثلاثة قواطع تقع على أبعاد مختلفة 0–100م ، 100–200م ، 200–300م على التوالي وعلى عمق 0–10سم من أحد جوانب نهر المصب العام لدراسة الصفات الفيزيائية والكيميائية لها ، وكذلك أخذ نموذج من مياه النهر لتقدير مدى تأثيرها على الترب المجاورة .

الصفات الفيزيائية للترب تمثلت بالكثافة الظاهرية والحقيقية وهي (1,08–1,24غم/سم^3) و (2,40–2,60غم/سم^3) على التوالي ، ونوعية الترب مزيجيه حيث كانت مديات النسب المئوية لأحجام الحبيبات (20–28%) للرمل ، (40–46%) للغرين و (32–34%) للطين مع وجود نسبة ضئيلة من المادة العضوية تتراوح بين (0,96–1,43 %) .

أظهرت نتائج التحاليل الكيميائية للترب لكل من الأس الهيدروجيني (7,7–8,3) والتوصيلية الكهربائية (1220–2315 مايكروسيمنز/سم) ومجموع الأملاح المذابة(TDS) (970–1618ملغم/لتر) ، وتراكيز كل من الأيونات التالية الكالسيوم (290–376 ملغم/لتر) ، المغنسيوم (248–290 ملغم/لتر) ، الكبريتات (245–310 ملغم/لتر) ، الفوسفات (11,6–14,3 ملغم/لتر) ، النترات (18–22 ملغم/لتر) ، الصوديوم(317–460 ملغم/لتر) ، البوتاسيوم (216–302 ملغم/لتر) ، البيكاربونات (367–422 ملغم/لتر) ، الكلوريد (412–458 ملغم/لتر) ، البورون (0,34–0,84 ملغم/لتر) ، نسبة امدصاص الصوديوم(SAR) (1,32–8,85 %) ، كاربونات الكالسيوم المتبقية(RSC) (0,29–0,38 %) .

وتقدير مدى خطورتها .

كما أظهرت نتائج التحاليل الكيميائية لنموذج ماء النهر الآتي : الأس الهيدروجيني(7,7) ، التوصيلية الكهربائية (1128 مايكروسيمنز/سم) ، مجموع الأملاح المذابة(690 ملغم/لتر) ، إما بالنسبة لتراكيز الأيونات فكانت كالآتي : للكالسيوم (310 ملغم/لتر) ، المغنسيوم (198 ملغم/لتر) ، الكبريتات (265 ملغم/لتر) ، الفوسفات(18,2 ملغم/لتر) ، النترات(12,8 ملغم/لتر) ، الصوديوم(322 ملغم/لتر) ، البوتاسيوم(118 ملغم/لتر) ، البيكاربونات(460 ملغم/لتر) ، الكلوريد(420 ملغم/لتر) .

من خلال نتائج التحاليل الفيزيائية والكيميائية لنماذج الترب من القواطع الثلاثة قيد الدراسة وكذلك نموذج ماء النهر، الدراسة بينت أن معظم منطقة الدراسة عالية الملوحة وان الصفة الغالبة لنوعية الترب هي (طينية – غرينية – مزيجيه) وهناك نسبة ضئيلة للمادة العضوية .

كما بينت النتائج استجابة كل من التوصيلية الكهربائية وتراكيز الصوديوم والكلوريد إلى عملية الغسل المتكرر (البزل) لمشروع المصب العام .

وبشكل عام أشارت النتائج على وجود ملوحة عالية وتراكيز عالية من الصوديوم في تلك القواطع قيد الدراسة .