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Water Quality Evaluation of the Eastern Euphrates Drainage (Iraq) Within Frame of Agricultural Sustainable Development Process.

.Prof. Dr. Abdul Zahrah A. Aljenaby
Professor
Education Faculty
Babylon University
Iraq

Mr. Zaid A. Aljenaby
Assistant Lecturer
Environment Science Faculty
Algreen Alkasim University, Iraq
aa.aljenaby@yahoo.com

K. Wo. (Drainage Water Agricultural Sustainable).

Abstract:

The Eastern Euphrates Drainage is locate in Babylon province -Iraq, and extend for more than 120km., exceeding it to Al-Qadesia prov.. It's actual average escape has been estimated in July and August as water shortage, high temperature, and Dec., at the 24th k. from its beginning at about 5m^3/s, at middle 7m^3/s, and the end 17m^3/s.. Results of water samples analysis that have been taken from, on the same months showed that they are very high salty in the first and second locations of drainage, and relatively high in the third, but it can be modification, then to be used in irrigation by mixing them with fresh water, or by using the procedure of magnetization, or both ways, in addition to farming low sensitive crops concering saltiness.

Researchers advice erecting a pivot of sustainable development agriculture lying with drainage extent consisting of two locations: the first at k. 64th include adding fresh water to Kifil creek with 2m^3/s. capacity, and magnetic water station with 3m^3/s. to farm about 20 thousand hec. .The Scound is in the k. 119th consisting of: expanding the additional channel exist near to exceed its capacity from 0.5 m^3/s. to 3m^3/s., then adding it to 12m^3/s. from drainage water to farm more than 60 thousand he. in Babylon, Qadesia, Najaf prov., combining widespread settlements in resent villages.

Introduction:

The Tigris and Euphrates rivers in Iraq and their tributaries had seen a sharp decline in there receipts from Turkey, Iran and Syria. The large quantity of storage projects and irrigation which have held in nutrition basins, results a damage to the gross acquired rights of Iraq on them, and vast agricultural lands in the plain of

Mesopotamia turned to deserts because of scarcity of irrigation water. That required rationalizing water consumption, searching for non-traditional sources, and one from this sources is water drainage. The advantage of water drainage in agriculture represents multi-target benefits: firstly reduced pressure on scarce surface water resources, and secondly, to find rational ways to get rid of unwanted water.

Research comes as an attempt to find a partial solution to the problem of shortage of irrigation water in one of the country's agricultural areas through knowing characters and the quality of drainage water, to demonstrate the potential benefit for them in making sustainable agricultural development with its extent which described as vacuum population and economic area.

The researchers supposed that there is availability to benefit from this drainage water to grow a few crops sensitive to salinity, especially in area suffer from shortage of water resources, and was characterized by low population densities, and needs to establish agricultural and industrial projects which would help to achieve sustainable agricultural development in .

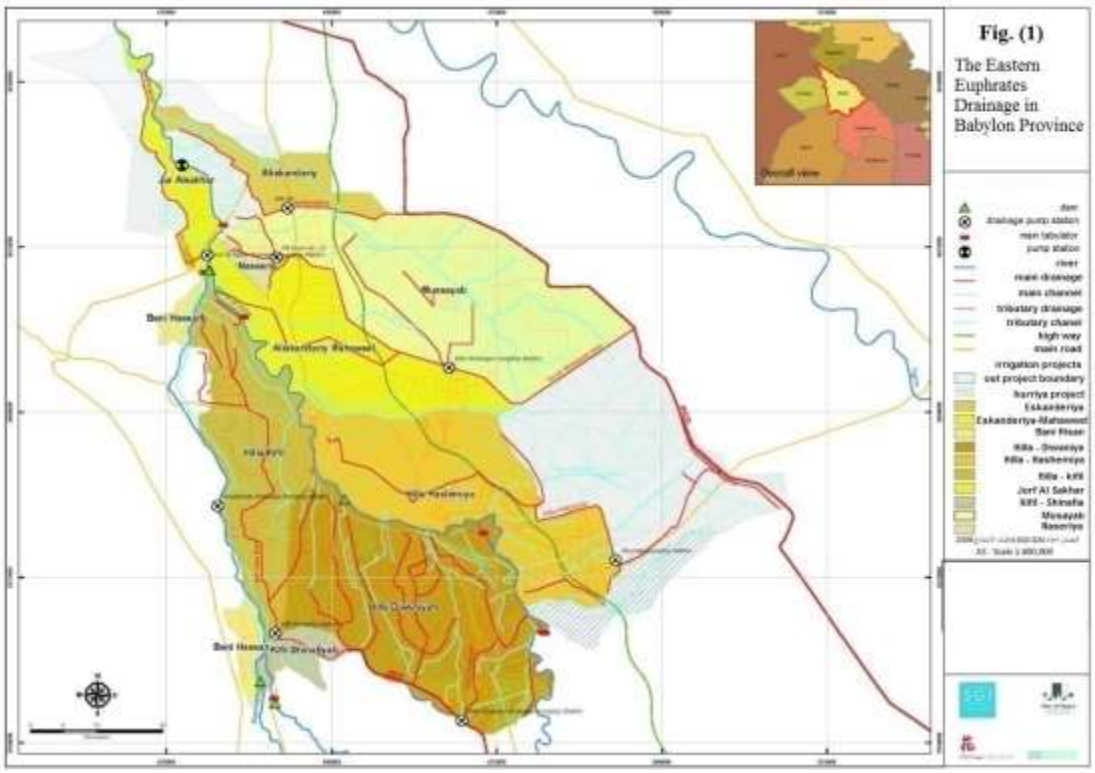
The eastern Euphrates drainage extent begins from north Babylon province (Fig. 1) between Euphrates and Hilla rivers, and agricultural lands between them get benefits from it, these lands were located within three major irrigation and drainage projects: Hilla- Kifil, Kifil- Shinafia and Hilla- Dewaniyah with extension up to 121 km. within the territory of the province, then go beyond to Qadisiyah, Muthanna , then Thiqar province, where it meets the Main Drainage. The area which served by the drainage in the province estimate about 300 thousand acres of agricultural lands.

In order to complete requirements of research three locations have been choosen along the drainage to take water samples, samples have pulled according to approved contexts consecutively on three stages in months July, August and December. The first two are the most scarcity of water, and perhaps salinity also, the other regards as one of cold winter months.

After water samples analyzing, the research discussed the results of analysis, and then concluded a set of findings and recommendations.

Fig. (1)

The Eastern Euphrates Drainage in Babylon Province



Source: Urban Planning Department in Babylon province

1. Declining water supplies in Iraq:

It was known that the earth's climate is moving towards warmth, leading to declination of condensation process, which relies on the low temperature of the air saturated with water vapor, and therefore rainfall rates were declined, especially in nutrition areas in arid and semi-arid regions. This applies to the case of Iraq, both from the point of clear decline in rainfall rates on its territory and of the feeding to the rivers Tigris and Euphrates basins and tributaries in Turkey, Iran and Syria, reflected to a sharp receipts in Iraq's water revenues, and what increased the severity of the problem that the upstream countries to establish many of the projects, control, storage and irrigation on these rivers without taking into account the actual needs of Iraq or acquired rights in its waters. On the other hand, the temperature rates rising in general region leads to raise the rate of evaporation , the long path to the Iraqi rivers in a dry environment and misuse, salinity and pollution increased in the rivers water of Iraq , this adds another face to the problem of water in Iraq.

Tigris river revenues water declined from more than 49 billion m^3 annual in last century to less than 30 billion currently, and Euphrates from 29 billion m^3 to less than 14 billion currently, whereas down to less than 7 billion some years, so scored water deficit sharply in Mesopotamia plain, vast agricultural lands turned to deserts. It is estimate that if the tone of decline continue as the same values Alrafidan will disappear in 2040.

At a time when water revenue get to Iraq were declined, the need for water is increasing by growing number of residents and their industrial, agricultural, commercial, the other service and progress of civilization in general. If the number of Iraq's population is about 4.8 million people, in the middle of the last century, it has exceeded 35 million currently, which will double the deficit in the provision of adequate water resources and threatens to difficult problems to be solute. Being of the problem impact on most of arid and semi-arid regions experiencing, including Iraq, attention has turned toward the possible scientific and practical solutions to mitigate the impact of this problem, and took the following action trends and solutions:

First: water conservation consumption, particularly in agriculture by using techniques which reduce waste, such as drip and sprinkler irrigation.

Second: establishment of dams and reservoirs on the permanent watercourses and valleys.

Third: irrigation channels lining to reduce their leaching.

Fourth: The management of available water resources with more efficiently.

Fifth: take advantage of non-traditional water resources such as sea water, groundwater, sewerage, and drainage water.

2.Theoretical framework:

2.1.The usage of drainage water in irrigation:

Many studies have been completed at the global level in the usage of saline water for irrigation, or in the reclamation of high soil salinity, including studies in United States (Boover and Reeve 1960, Doering and Reeve 1966), and similar studies in Egypt (El Gabaly study 1971), and in the Former Soviet Union (Kovda study 1973).

In Iraq ,the search has taken in this regard three pivots:

The first: proceeding laboratory studies and analyzing the quality and characteristics of drainage water to determine their suitability for use in agriculture or other uses,

from these studies (Hanna and Al-Rawi 1970, Al- Dagestani 1977, Al-Zubaidi 1978, Al-Hadithi 1997,Al-Hamdani, 2001, Al-Qaisi 2001, Omran 2010, Qahtan 2012 , Safa 2012).

The second: conducting procedure field experiments on the cultivation of certain crops and to know the extent of their response to irrigation with saline water drainage, from these: (Saadawi and Dahash 2000, Muhannad et al. 2000, Hammadi 2001, Huda 2012).

The third: attempts to gain access to means can be adopted to reduce the drainage water salinity, such as mixing it with fresh water or magnetizating it so as to be used in irrigation, from these studies (Al-Moussawi 2000, Hammadi 2001, Taj Al-Din et al. 2009, Bakhli 2013.

Various studies mentioned above and others had led to the confirmation of the possibility of using drainage water in irrigation on the whole, but for each case individually, and that success of use seem to be associated with actions to be taken some or as a whole, namely:

First: drainage water can be used alternately or mixing with fresh water.

Second: adoption of drip irrigation method to reduce accumulation of salts near the plant roots.

Third: use of salt water in the least sensitive growth stages to salinity, for example, the emerge stage regarded the most delicate for most crops, which requires using non-saline water through it.

Fourth: make washing and drainage operations of agricultural land irrigated with that water periodically for the purpose of maintaining soil from salinization and pollution.

Fifth: magnetic treatment of drainage water before use for irrigation, where the magnetic field cracking salt crystals and reducing the viscosity of the water and its surface stretching, which helps the penetration of roots in the soil and increases plant growth. Numerous laboratory tests had been confirmed the positive role of the magnetization of drainage water to increasing germination rates and its speed, and a clear improvement in leaves and root growth, increasing the winning fruiting in comparison with the non-magnetized water irrigation.

Sixth: crop cultivate witch nun sensitive or a few sensitive to salinity, such as barley, alfalfa, cotton, peas, onions, rape, cabbage, lettuce, carrots, certain varieties of wheat, yellow corn, from moderate sensitivity to salinity: sunflower, potato, tomato, split

peas, millet, calabash, peppers, beans, and from trees: palm, sidr, eucalyptus, olive, pomegranate, fig.

Seventh: establishment of desalination projects and make use of them in other fields, including human and industrial and livestock for example.

Eighth: if drainage water were few or even intermediate salinity it is possible to use it in washing saline soils.

2.2. Drainage water classification:

No drainage water quality similar to another in terms of contents of salts and minerals and other components, also identically along the watercourse, and temporally among the months per year.

Scholars , concerned and interested come in to line in this matter determine set of indicators used to evaluate water quality, namely:

First: Total Dissolved Salt: measured with ml/ Lt^{-1}, may be expressed of in Electrical Conductivity EC, measured with milmosz / cm^{-1}, or dismosz / m^{-1} at 25 ° c.. Usually drainage water divides in accordance with its content of salts to: low(> 0.250), moderate (> 0.750), high (> 2.250),and very high salinity (<2.250) (Aqidi 1990), and this had been adopted by the USA rating to the salinity of the water USRS too. The salt concentration determines whether the water quality is good or not good.

Second: the concentration of sodium Sodicity,. The rule of sodium element dominancy leads to the viscosity of the soil texture when wetting, and agglomeration when drought. The high percentage of sodium in irrigation water (more than 50%) lead to a burning of the edges of the leaves in sensitive plants.

Third: Al carbonate and bicarbonates concentration indicator in the water: where a high concentration in the water lead to precipitate calcium and magnesium.

Fourth: the presence of chlorine and sulfates: in spite of its being useful to plant, but the high concentrations of chlorine have a toxic effect on plants, especially fruit trees, which causes burning of the edges of the leaves and then becoming yellow and death.

Fifth: boron concentration ratio: which is toxic if present in high concentrations in water (more than 2 mg /L for medium sensitive plants to salinity, and more than 3 for non-sensitive).

3 . Geographical characteristics of the study area:

Babylon province which the drainage serves a large part of locate in the center of Iraq, between latitude 32° 7¯- 33° 8¯ n., and between longitudes 43° 42¯ - 45° 50¯ e.. Its total area about 5119 km^2 .

The eastern Euphrates begins from the north of the province, and extends about 123 km in districts: Saddat Al-Hindia, Abi Qaraq, Al-Hilla Center, Al-Qasim, Al-Taliaa, , and serves areas between Hilla river from east and Euphrates in the west with total area of more than 300 thousand acres in province of Babylon , that is more than 25% of the total area of the province.

Flume capacity design allows discharge of 15 m^3 / s, at the beginning of its trajectory, but it is increasing towards the south. The actual discharge varies between 6-12 m^3 at the beginning of its trajectory, but it increases with its course towards the south until reach 15-20 m3 / s, whereas actual capacity were vary between summer and winter.

The study area covered by three irrigation and drainage projects:

-Hilla- Kifil irrigation and drainage project: the project locates on the right side of Hilla river. It serves 27 minor flume drainage connect with the main drainage which extend in about 59.5 km, and most of their lands were corrigible.

- Hilla-Dewaniyah irrigation and drainage project: their lands locate on the right side of Hilla river also, starting from the previous project until the southern border of province.

-Kifil-Shinafia irrigation and drainage project: the project lands locate on the southern part of the Euphrates river basin, and on both sides of Al-Shamiya and Kufa river.

The project extend on the land of the provinces of Babylon and small parts of Najaf and Qadisiyah. The project currently lacks a regular network drainage, causing high water salinity of groundwater and soil degradation and low productivity.

4 . Laboratory analysis:

4.1. Substances and working methods:

Three locations were selected for sampling, as follows:

-Location A in Abi-Qarak mediates Hilla-Kifil irrigation project at km. 24th of the drainage.

-Location B near Kifil town at the end of Hilla- Kifil project at km. 56.

-Location C in Tliaa district at the end of Hilla- Diwaneyah project at km. 119th.

Three replicates were pulled from each location at July, August and December months 2014 as the first two months the warmest months, testify the scarcity of irrigation water , low relative humidity, high evaporation and thus reducing water drainage flowing, which means the worst characteristics of the water drainage during the year, the third month considered one of the cold winter months which are characterized with lowering temperature and increasing humidity ratios with a remarkable increase in water revenues in Iraqi rivers, as well as rainfall although it is scarce in the study area and which is not enough to rely on in agriculture but it is help for surface water irrigation.

In the laboratory analysis, which took place in the laboratories of the Department of Soil and Water Resource- Faculty of Agriculture, University of Kufa, the following elements were measured B, Cl, So4, Hco3, Co3, K, Ca, Mg, Na, SAR, TDS, PH, Ec , Hardness, Turbidity, Boron.

4.2.Results:

The results of chemical analysis, as contained in Tables 1, 2 and 3:

Table (1)

Results of eastern Euphrates water drainage analysis in July 2014

Locations	Ec ds/m	PH	TDS gm/l	Hardness	Turbidity	SAR
Lo. A	4.1	7.6	3.0	11.3	0.0	6.46
Lo. B	5.0	7.5	3.2	13.7	0.0	6.65
Lo. C	2.2	7.6	2.1	9.9	0.0	5.11

Lo.	Calcium	Mag	Potas.	Sod.	Chlori.	Sulfate	Carbo.	Bicar.	Boron
Lo.A	8.7	7.8	1.1	6.2	25.1	13.5	0.0	0.6	nil
Lo. B	11.2	8.5	1.4	7.1	31.4	14.7	0.1	1.2	nil
Lo. C	5.4	4.0	1.0	3.5	11.4	9.3	0.0	0.8	nil

Table (2)

Results of eastern Euphrates water drainage analysis in August 2014

Locations	Ec ds/m	PH	TDS gm/l	Hardness	Turbidity	SAR
Lo. A	3.5	7.6	2.8	7.5	0.0	4.79
Lo. B	4.3	7.6	2.6	9.8	0.0	5.22

Lo. C	2.1	7.7	2.1	7.0	0.0	4.07

Lo.	Calcium	Mag.	Potas.	Sod.	Chlori.	Sulfate	Carbo.	Bicar.	Boron
Lo. A	7.8	6.1	1.2	3.4	20.3	13.8	0.0	0.7	nil
Lo .B	9.1	8.3	1.3	5.8	26.5	15.6	0.1	0.8	nil
Lo. C	5.4	3.2	1.4	2.8	10.8	9.5	0.0	0.5	nil

Table (3)

Results of eastern Euphrates water drainage analysis in December 2014

Locations	Ec ds/m	PH	TDS gm/l	Hardness	Turbidity	SAR
Lo. A	2.7	7.8	1.3	4.8	0.0	1.29
Lo. B	3.2	7.8	1.3	5.3	0.0	1.41
Lo. C	2.0	7.9	0.9	4.0	0.0	1.18

Lo.	Calcium	Ma.	Potas	Sod.	Chlori	Sulfate	Carbo.	Bicar.	Boron
Lo. A	6.4	4.8	0.2	3.6	13.0	11.4	0.0	0.2	nil
Lo. B	7.7	6.0	0.2	3.2	16.8	13.5	0.0	0.2	nil
Lo. C	5.0	4.2	0.1	1.8	10.5	7.3	0.0	0.1	nil

4.3. Discussion:

From tables above and field observation the following can be concluded:

1. The drainage water salinity increases from its beginning until km. 64th (2.7-4.1 ds/m), then gradually decreases to (2.0-2.2 ds/m), because of the arrival of large amounts of drain water from rice farms in Kufa, which relatively low salinity, so improve salinity case in the drainage at edges of Babylon province .

2. The amounts of water arrived to increase until reaches more than 17 m^3 / s, which is worthy amount to be used in agricultural projects .

3. The amount of water also increasing in the drainage during winter months until some suffering appears where drainage discharged up to the maximum, which means a significant improvement in the quality of its water, and farmers often use it in the irrigation of their winter crops.

4. Salinity are declining as average from (3.7ds/m) in July to(3.3) in August, then (2.6) in September, which means a clear improvement in their proportions in winter months because of increasing the actual drainage discharge, then a better possibility to be used in irrigation at winter.

5. The salinity of drainage water according to the analysis indicated to be relatively high(2.0-2.2 ds/m), but it could be reduced with a regarded degree, by adding fresh water or magnetizing it or both methods together.

6.When treatment it as in above, there for it is possible to be successfully used in the cultivation of crops moderate or low sensitivity to salinity in summer and much better in winter.

7. The stream is extend after km. 64 up to the km. 123 in Babylon province, and then in Qadesiyah province, and with aligned to the right side by Najaf province, in a semi-vacuum population area and agricultural and economic poverty in the three provinces : Babylon, Najaf and Qadisiyah, because of the scarcity of irrigation water in winter, and the interruption in summer, in spite of the vast tracts abundance of fertile agricultural land, but it suffers neglect because it locates at the edge of these provinces, and lack in the infrastructure services such as paved roads, electricity, drinking water and education and health services, while Ibn-Rigab marsh has inundated vast tracts of them before drying..

5. Proposals:

The researchers propose erecting of establishment an agricultural development pivot rely on the principle of sustainability by getting benefit of the potential of local possibilities that are not invested, and described as semi-wasted such as soil and drainage water, extends along the drainage flume, which is actually characterized by scatter settling and very limited economic activity. The usage of available resources efficiently and sophisticated scientific methods can be the nucleus of similar attempts in other places.

They suggest the project (Fig. 2) including the following:

1. Establishment a station of withdrawal and pumping fresh water from the Euphrates river at alignment with Kifil flume near the km. 56th with capacity about $2m^3$ / s, where the adjoining flume with the river to be added to $3m^3$ / s after treatment, as in the following point to improve drainage water with expansion of Kifil flume starting from this site until km. 64.

2.Establishment of a treatment station for water drainage salt with magnetization manner to decrease the salinity at km. 64 with capacity about $3m^3$ / s, to irrigate more than 18 thousand acres in Imam Zaid area, and the drainage along.

3. Expansion of the current flume adding of fresh water (based now) near km. 119 doubling the discharge from 0.5 m^3 / s to 3 m^3 / s, and then mixing it with about 12 m3 / s of water drainage (may be a another unit of the magnetization of salty water built at the site if needed), to irrigate more than 60 thousand acres in Babylon, Qadisiyah and Najaf provinces.

4. Establishment of two residential agricultural assemblages at locations above (km. 64 and 119) to assemble the scattered settlement and to facilitate the provision of services to the population.

5.Two compilation of milk stations to be catch with and two units to be manufactured, other units probably be added for manufacturing feed for animals, poultry and fish, to integrate sustainable development between agricultural and industrial process.

6.Adoption of the few sensitive to salinity crops, such as wheat, barley, peas ,alfalfa, culture and palm trees, animal husbandry, poultry, fish and bees.

7.The official authorities in the Ministry of Agriculture should put detailed studies regarding the opinion of the local population, and introducing for establishing necessary infrastructure projects.

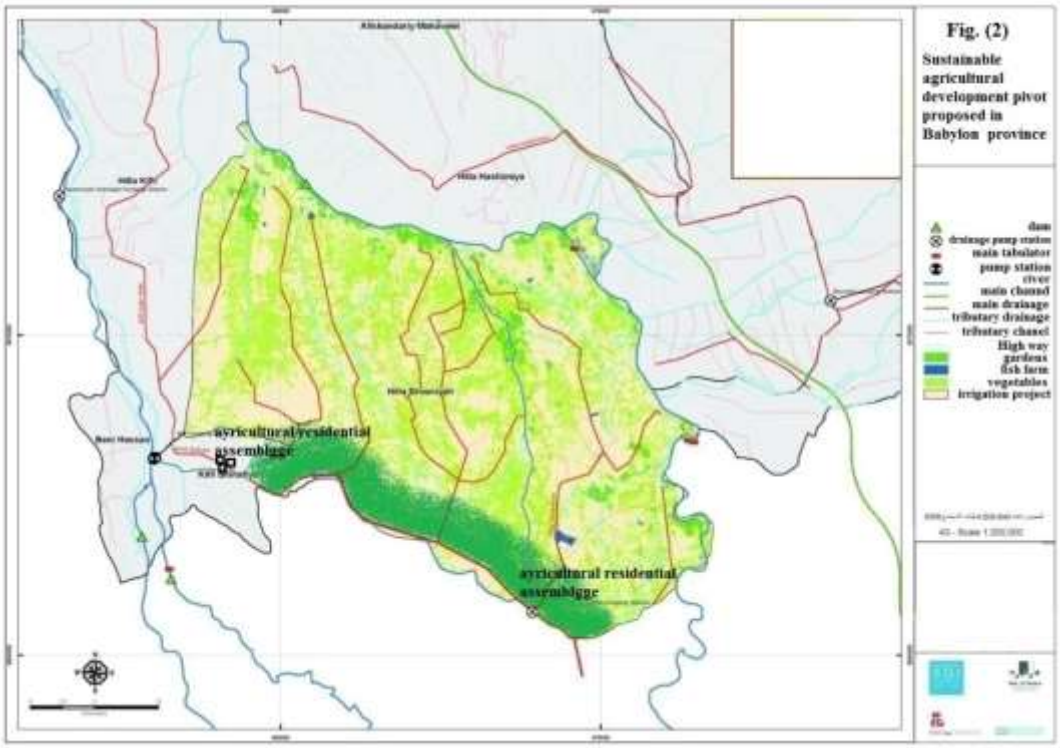
8.The actual implementation can be done by public, private or mixed investments, on the condition the local population should get an abundant share of benefits.

9.We recommend to assignment researcher to achievement academic study of Master or PhD about the subject.

10. We also recommend of an administrative and scientific coordination between the three neighboring provinces and universities concerning this project, or federal agencies to take it upon themselves.

Fig. (2)

Sustainable Agricultural Development Pivots Proposed in Babylon Province



6.Refernces:

1. Badr, Huda Hashim, Almorfomitri Analysis To Almorr Basin Valley and Evaluation of Ongoing Water Quality In It, Damascus University Journal of Science and Engineering, Volume 28, First Issue ,2012.(in Arabic)
2. Bakhli, Ahmed Baqer, The Effect of Magnetic Treatment of Water For Irrigation in Plant Growth And Yield Carrot Plant Master Thesis, Faculty of Agriculture - University of Kufa .2013.(A.)
3. Dagestani, Sami and Others, A Preliminary Study on The Possibility of Drainage Water Use in Agriculture, Bulletin 19, the Foundation of Scientific Research, The Ministry of Higher Education and Scientific Research, Baghdad ,1977.(A.)
4. Al-Zubaidi, Ahmad Haidar, Qutaiba Mohammed Hassan, Washing Some Soils Effected By Salinity in Iraq Using Drainage Water, Journal of Agricultural Science, Part I and Part II, Volume 3.1978.(A.)
5. Al-Hadithi, Essam Ahmed, Modeling of Salt Water Used in Irrigation, PhD Thesis, Irrigation and Drainage Engineering, Faculty of Engineering, Baghdad University, 1997.(A.)
6. Hammadi, Khalid Badr, Khalid Ibrahim, The Effect of Alternating or Continuous Irrigation By Saline Drainage Water in The Yield of Wheat and

The Accumulation of Salts in The Soil, Iraqi Journal of Agricultural Science, Volume 32, Issue 3,2001.(A.)

7. Al-Hamadani, Alaa Hussein, The Importance of The Pattern and The Amount of Washing Co-efficient in Salt Water Irrigation Management With saline Water And Its Impact on Soil Characteristics and Plant Yield, Master Thesis, Faculty of Agriculture, University of Baghdad ,2001.(A.)
8. Hanna, Augustine, Sadiq al-Rawi, Wash Saline And Alkaline Soils With Drainage Water, Periodic Conference of The Arab Agricultural Engineers Union, Khartoum , 1970.(A.)
9. Hassan, Qahtan Mohammed Saleh, Drainage Water Quality Evaluation At The North of Baghdad City, and Their Suitability For Irrigation Purposes, Research Accepted for Publication, Foundation of Technical Education, 2012.(A.)
10. Carball Dr. Abdul Ellah Rezouki, Dr.Ali Al Moussawi, Dr.Abdul Hassan Madfoon, The Climate Characteristics of Babylon Province, Cultural Encyclopedia of Hilla, Babil Center for Studies of Cultural And Historical, Babylon University ,2012.(A.)
11. Muhannad et al., Irrigation Maize Crop Management By Using The Manual Method And The Mixing of Fresh And Salt Water, Iraqi agriculture Magazine, Vol. 5, No. 5.2000.(A.)
12. Al Moussawi, Adnan Chabar, The Effect of Irrigation Management By Using Salt Water in The soil Characters and Maize Yield, Master Thesis- Soil Science, Faculty of Agriculture, Baghdad University,2000.(A.)
13. Al Saadawi, Ibrahim Dahash, Mohamed Ibrahim Was Astonished, in Response to Different Types of Barley to Watering With Salt Water During The Different Stages of Growth, Iraqi Journal of Agriculture, Volume 2, A Special Issue ,2000.(A.)
14. Abdul-Kadhim, Safa Mahdi, The Study of Water Quality of The Main Drainage By Using Thermodynamic Terms and Technical of Remote Sensing, Master Thesis, Faculty of Agriculture, University of Babylon, 2012.(A.)
15. Al Aqidi, Dr.Waleed Khaled, Management of Soils and Land Use, Baghdad University, Dar al-Hikma for Printing and Publishing, Mosul University, 1990.(A.)

16. Omran, Essam Issa et al., Water Quality Evaluation of The Main Drainage and Its Suitability For Irrigation Purposes, Oorruk- Iraq Magazine, Volume 3 Issue 3, 2010.(A.)
17. Al Qaisi, Shafiq Chulab, Mohammed Abood Al-Jumaili, Reduce The Impact of Salinity Irrigation Water BY using a Dual Irrigation System Proposal, The Iraqi Journal of Soil Science, Vol. 1, No. 1.2001(A.).
18. Taj al-Din, Munther Majid et al., Perform Maize When The Magnetization of Water With Sulfate And Potassium Chloride, The Iraqi Journal of Agricultural Science, Volume 40, Issue 5.2009.(A.)
19. Reeve R.C., C.A. Bower, Use of High-Salt Water as Flocculent And Source of Divalent Cat Iron for Re Acclimating Sodic Soils, USA, 1960.
20. Reeve R.C., E.J. Doering, The High-Salt Water Dilution Method for acclimating Sodic Soil, USA, 1966.
21. Kovda V., Irrigation Drainage and Salinity, An International Source Book, FAO., Pub., 1973.
22. El Gabaly, Re acclimation and Management of Salt Affected Soils, Irrigation and Drainage, FAO., 1971.