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Effect Of Water Salinity In The Increasing Of Desertification Indicators And Degradation Palm Groves Phoenix Dactylifera L. South Of Basra

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Abstract.

The study was conducted in an area located in the south-east of Basra province within the judiciary of Abu Al-Khasib and Fao during the 2018 season,To study the impact of irrigation salt on the degradation of palm groves and the increase in desertification in the region. Six palm groves were selected randomly distributed in six different locations and located within the study area,Four trees of date palms were selected in each study site to have a total number of trees of 24 trees .The trees were the same in size, age, length and nature of growth as much as possible.Pollination of palm On 27 March 2018, the number of Date palm Bunch was reduced to 4 palm trees, and the irrigation method used for irrigation was the traditional irrigation method prevailing in the region (tides).Soil samples were taken at a depth of 0-30 cm from the sites studied with three replicate for the purpose of conducting field measurements and various laboratory analyses.Models of irrigation and ground water for the same sites were also taken for analysis and simultaneously with the taking of soil samples.At the end of the season, fruit samples were collected at the rate of 15 fruits per palm randomly and with four repeaters to measure some physical and chemical qualities, including the proportion of dry matter, the weight of the meat layer, the length of the fruit and the rate of palm production.

The results of the study showed that the salinity of water used for irrigation ranged from medium to very salty (4.80 to 22.14 dS m^{-1}) and ranged from ground water 9.22 to 54.17 dS m^{-1}.The results also showed that high salinity caused problems and increased manifestations of desertification, the most prominent of which was the high soil salinity values in the study area between (19.13 and 122) dS m^{-1}.The deterioration of palm groves and the low rate of plant density in them to an average of 7 palm dunums^{-1} , The rate of production qualities has been reduced, including the length of the fruit, the weight of the meat layer, the forgetfulness of dry matter and the production rate of the palm. The deterioration has increased from the north of the site to the south.

Keywords: physical and chemical characteristics, production qualities, plant density, irrigation water, ground water, drought coefficient.

Introduction

Desertification is defined as decreasing the production capacity of soil as a result of human misuse, through which there is a continuous deterioration in agricultural land through the decline of water resources, plants and wildlife due to climatic changes and human activities, and therefore it is the transformation of a relatively dry area to barren land (Al-Obaidy, 2013) . Phillips (1993) showed that there is desertification caused by permanent or emergency drought and subsequent environmental changes, while there is desertification caused by human malinvestment of natural environment resources, which leads to the disruption of the state of natural ecological balance, and there is desertification caused by the interaction of both natural and human factors. This applies to the phenomenon of desertification in Basra province**.**A number of indicators and indicators have been used to monitor and track desertification situations in various places, including soil indicators, their misuse and deterioration in their various characteristics (physical, chemical and biological), and there are hydrological indicators that give an assessment of the quantity and quality of water. And their different negative effects, in addition to biological indicators and their implications for the variation in plant density and cultivated areas in different regions, in addition to climatic indicators that address the impact of different climatic factors in the transformation of agricultural land into land desert or barren (Sultan et al. , 2015) .Lal (2001) noted that dry lands are constantly increasing, which in turn leads to processes that can cause salt,soil degradation and reduced fertility and crop productivity.Salting is an important and key factor in the occurrence of desertification in dry and semi-arid areas , due to a number of geomorphic, hydrological, climatic and soil and water properties, in addition to the human factor of not following modern scientific methods andthe absence of modern irrigation technologies in Agriculture (Arab Organization for Agricultural Development, 2010).The salinity problem is caused by many factors, some related to the natural environment and the other to human work.These factors interfere with the degree to which they affect the prevalence of salinity, the levels of which vary from place to place. Natural factors have a prominent role, with the climate at the forefront, where increased solar radiation, high temperature, low clouds, relative humidity and the supremacy of north and north-west winds lead to increased evaporation rates,hence the increase of salts collected at the surface layer of soil, and coincides with the over-irrigation process, especially if the water used for irrigation contains salts, and the nature of the soil has a clear effect on the emergence of the problem and its exacerbation with the accompanying follow-up of the wrong agricultural systems (Al-Fadhli and Mousavi ,2007).

Palm cultivation areas south of Basra province are areas adjacent to the Shatt Al-Arab and are influenced by daily tidal events.This soil is irrigated and naturally removed twice a day through channels spread on both sides of the Shatt Al-Arab, and these soils are often soft, low permeability and little movement of water and air,and with a high level of ground water, and because of some of these characteristics, the poetic property is active in it leading to increased salinity of the soil, especially at the surface layer of it (Al-Hamad, 2010) . Al-Fayyad (2012) stated that the lowest salinity rates in the ground water of these areas were at the sites adjacent to the Shatt al-Arab and then increased significantly by moving away from it,this has had a negative impact on the quantity and quality of production of date palms.the UNDP report of the United Nations in the Arab Republic of Egypt (2006) indicated that date palms were heavily tolerated for irrigation water salinity,However, he cautioned that the high concentration of salts reduces the rate of vegetative growth and affects the quantity and quality of the total outcome,the report showed that production is reduced by 50% if the salt concentration reaches 8,000 ppm.FAO (2006) stated that date palm needs an acceptable quality of water for the purpose of high growth and productivity.To reach that goal, the electrical conduction of the soil salinity should be in the range of 4 dS m^{-1} and the irrigation water at 2.7 dS m^{-1}.Based on the above, one of the main problems of the deterioration of palm cultivation in the region is the problem of salinity, which is one of the important indicators for monitoring and tracking the state of desertification,for this reason, the research aims to study the impact of salinity as an important indicator in increasing the severity of desertification in addition to other indicators and their role in the deterioration of palm groves in southern Basra province and ways to reduce them.

Materials and Method

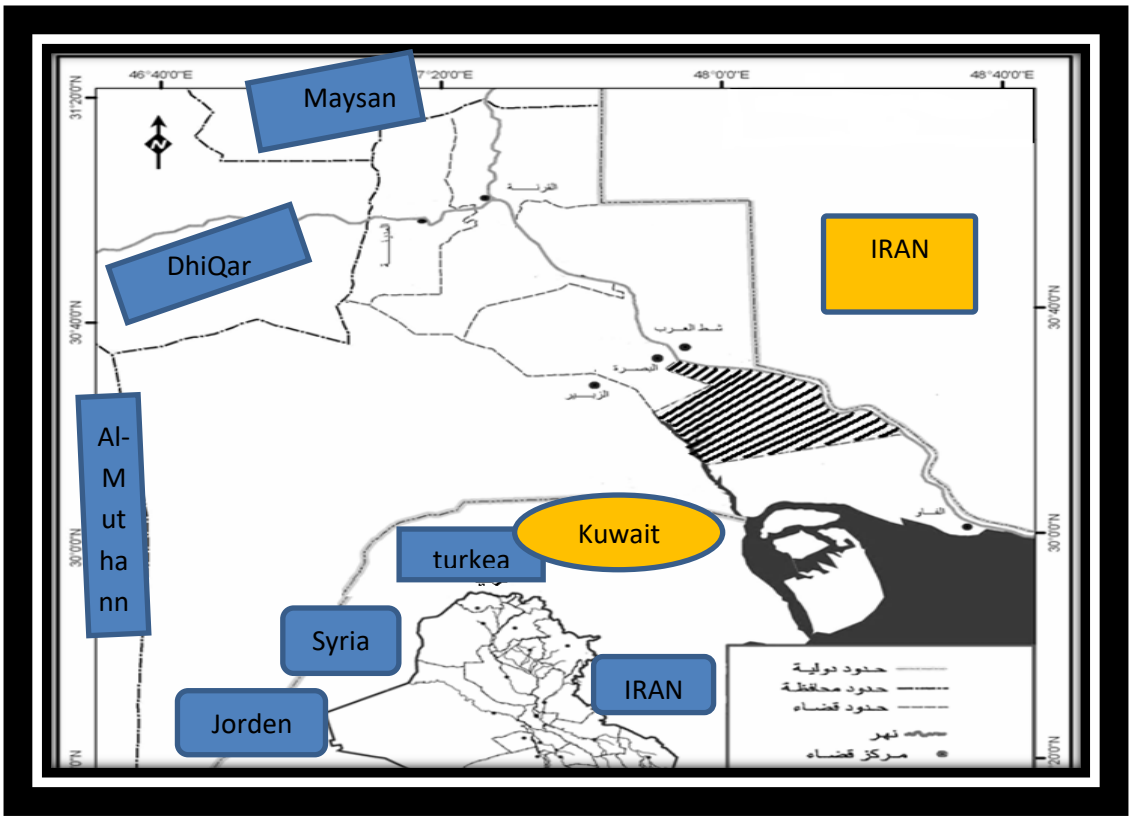
The study area is located in the south-east of Basra governorate within the districts of Abu Al-Khasab and Fao (within a width circle 15-30 and a length arch -25 48), which is part of the sedimentary plain ,the earth's surface is characterized by slow slope, ranging from 2 meters above sea level (north of Abu Al-Khasab district) to less than 0.5 meters (south of Fao district).Its territory is also characterized by a gradual decline from east to west at the behest of rivers, after which the moorlands, which occupy the western territories, appear. The area is mainly famous for its palm cultivation, which is spread on both sides of the Shatt al-Arab, and its irrigation method is natural (tides) which occur twice a day. Figure 1 shows a map of the study site from Basra province.

The study was conducted during the 2018 planting season, and six palm groves were selected randomly distributed in six different locations and as described in Table 1

Four date palm trees were selected for the halawi category at each study site to have a total number of trees of 24 trees, and the trees were the same in terms of size, age, length and nature of growth as much as possible. On 27 March 2018, the number of Date palm Bunch was reduced to 4 per palm, and the irrigation method used for irrigation was the traditional irrigation method prevailing in the region (tides).

Table 1: Study Sites

Location	**The government's work on the development**
Abu AL-Khaseeb **N 30.43 E 47.95** **FAO** **N 29.98 E48.45**	HamdanBab SuleimanSaraji FuddadiAl-MeamerSouthern FAO



Figer 1: map showing the study site from Basra governorate Soil and water sampling

Soil samples were taken at the beginning of the experiment (second month 2018) at a depth of 5-30 cm from the sites studied by four repeaters. The soil dried pneumatically after removing impurities and gravel and then grinded and sifted through a sieve diameter of

2mm holes and kept in plastic bags and recorded on it location and date for the purpose of conducting various analyses. samples of irrigation and ground water (at a depth of 2 meters) were also taken for the same purposes for analysis and simultaneously with the taking of soil samples.

Physical and chemical analyses of the soil

The distribution of soil size volumes was estimated in a pipette analysis and virtual density by a known disk (Core Sampler) as mentioned in Black et al.,(1965) . The degree of soil reaction pH for soil was estimated at 1:1 byPage et al. (1982) and the calculation of the electrical conduction of saturated soil paste extract by Richards,(1954). The organic matter in the soil was estimated in the Walkley-Black method described in Page et al. (1982) ,total carbons in the soil were estimated using the reverse acid excision method with sodium hydroxide using the Phenolphthalein guide, according to Jackson (1958).The monitoring wells (bezometers) have been established and the search sites are pvc tubes with diameters of 10.16 cm (4 inch) ,Perforated with diameters of 0.3 cm, buried to a depth of 2 meters with a metal buckle positioned at the bottom .Filters were placed around the tube to facilitate the flow of water towards the tube and prevent clogged holes ,the top of the tube is covered with a cloth that allows air to pass through to ensure that pressure does not increase during the ascent stages of ground water .The depth of the ground water was measured periodically using the measurement bar method and took the value rate for each site and did not notice a significant difference between the values of the single site as it is between the six different locations.

Preparing plant samples and measuring some qualities for fruits

Samples were collected at the end of the growing season. I took fruits at the rate of 15 fruits per palm randomly and with four replicate , measured some physical and chemical qualities , the dry material ratio of the fruit is estimated to weigh 10gm of the soft weight of the fruits at the date stage and then dried using the oven at 70º C and for 72 hours. The length of the fruit was measured using vernier caliper, weigh the meat layer after removing the kernel from the whole fruit,estimated the production rate of one palm at the end of the season after the process of harvesting fruits, as it was weighed by a field balance for each palm and then extracted a rate of three repeaters for each site.

$$\text{Percentage of dry matter } \% = \frac{\text{Dry fruit weight}}{\text{----------}} \times 100$$

Soft weight of fruit

Measuring some indicators of desertification

one indicators were used to monitor the state of desertification in the study area, such as climate indicators, soil indicators, biological indicators and agricultural production, and some data and statistics for previous years issued by the Iraqi Ministries of Planning and Agriculture were used .

Climate indicators

The study area is characterized by a lack of rain with a significant increase in temperatures and increased evaporation rates, and it was noted that these climatic elements play a big role in affecting some soil and water characteristics in the study sites through increased salting processes, especially during dry periods in the summer months.

Table 2 :Monthly and annual rates of brightness and temperature hours and monthly and annual total of rain and evaporation for the study area

Evaporation (mm)	Rain (mm)	Average temperatures (ºC)	Sunshine hours (hour/day)	months
January	6.80	13.80	42.40	76.30
February	8.30	14.70	23.50	105.40
March	8.20	19.10	17.10	210.90
April	8.80	26.50	13.90	286.70
May	10.20	33.40	2.00	359.40
June	11.50	37.20	-	467.10
July	11.70	38.10	-	517.70
August	11.70	37.40	-	475.60
September	10.50	34.60	-	430.70
October	8.60	29.50	4.10	256.90
November	7.60	20.70	13.00	146.00
December	6.00	14.30	36.80	71.10
Annual rat	9.20	26.80	12.73	283.65

Iraqi Agricultural Meteorological Network

Drought coefficient calculation

The drought coefficient rate for the last two years was calculated for the purpose of knowing the type of climate prevailing and the type of plant life prevailing in the region using the equation (Emberger,1999) and its formula as follows**:**

$$Q = \frac{2000 \times P}{M^2 + m^2} - - - 1$$

Where- :

Q= Drought Coefficient (actual fall value)

P= general average of rainfall (using the Iraqi Agricultural Meteorological Network)

M2= average great temperature for warmest month of the year

m2 = average minimum temperature for coldest month of the year

The number 2000 is fixed for correction.

An absolute 273.2 degrees is added to the maximum and small temperatures to avoid negative numbers.

The type of prevailing climate and plant life in each region was determined by the classification (Emberger,1955) shown in the following table 3

Table 3: Classification (Emberger 1955) climate

Plant life type	**Type of climate prevailing**	**Actual value of precipitation Emberger**
Deserts	Less than 20Very dry	
Plateaus and Plains	dry30-20	
Pastures	Semi-dry50-30	
Groves	Semi-wet90-50	
Forest	More than 90Wet	

Table 3 according to (Iraqi Ministry of Planning data for 2018).

Biological indicators

There has been a significant deterioration in palm cultivation until 2018, whether due to the prevailing conditions in the region such as soil and water conditions and climatic conditions or due to human intervention and the destruction of the environment intentionally or unintentionally such as wars, neglect, dredging, overgrazing, etc.

Table 4: Farmer's number and the area of orchards occupied by palm trees

Location	Orchards area / Acres	Number of farmers	the year
Abu AL-Khaseeb	17443	11770	2012
	11494	2564	2013
	9086	2566	2014
FAO	1017	317	2012
	1017	316	2013
	911	222	2014

Design and statistical analysis

This experiment was carried out in a working-based method using factorial experiment conducted in Randomized Completely Block Design (R.C.B.D) and four replicate .

Results and discussion

The results in table 5 showed some of the chemical and physical properties of soil studied and are one of the soil indicators for monitoring the state of desertification, as the results showed that the prevailing soil texture of these sites is the heavy texture (Silty clay and clay) and has a bulk density is about1.35 Mg m^{-3}in Hamdan and 1.49 Mg m^{-3}in the AL-fdagia with high level of ground water In it, about 0.89 m in the south ofFao and 1.58 m in the Al-Sarraji, . the results in the table showed that the percentage of organic matter of the soils was low about with 0.67 – 5.34 gm kg^{-1} in the Southern Fao and Al-Sarraji. With regard percentage of calcium carbonate about 376.76 gm kg^{-1} in AL-fdagia. the results showed that the salinity of the soil for the study sites about 19.13 dS m^{-1} in Al-Sarraji and 122.11dS m^{-1} in the Southern Fao,. The presence of heavy soil (Silty clay and clay) and the high level and salinity of ground water under hot climate conditions and high evaporation rates, this increased the activity of the water capillary and the rise of salts ground water, which increased the rates

of salinity to soil these areas, especially at the surface layer of them .This is consistent with Al-Hamd(2015) that the decrease in

Table 5: Some chemical and physical properties of site deposit

Study areas	Soil properties									
	OM g kg^{-1}	Depth grand water (m)	Total Carbonateg kg^{-1}	pH	Electrical ConductivityECe ds m^{-1}	bulk density Mg m^{-3}	texture			
							Texture g kg^{-1}	Salt	Clay	Sand
Al-Sarraji	5.34	1.58	368.33	7.18	19.13	1.41	Clay	344.30	612.55	43.15
Hamdan	4.34	1.45	356.67	7.87	28.98	1.35	Clay	322.35	641.20	36.45
Bab Suleiman	4.19	1.32	278.45	8.15	49.11	1.47	Clay	326.20	622.61	51.19
AL-fdagia	2.98	1.05	376076	8.78	95.45	1.49	Silty clay	450.01	445.40	104.59
Al-Meamer	2.24	0.95	298.54	8.12	98.48	1.45	Clay	229.26	659.30	111.44
Southern Fao	0.67	0.89	327.86	7.86	122.11	1.48	Clay	335.29	566.20	98.21

moisture content at the surface of the clay soil due to high temperature and evaporation rates has increased the rates of water rise in the capillary properties and salts and has led to increased salt aggregation in different soil layers.

The results in figure 2 showed salinity rates for irrigation water and ground water for study sites, the salt of water irrigation is between 9.22 dS m^{-1} in Al-Sarraji and 54.17 dS m^{-1} in Southern Faowith average 30.56 dS m^{-1} with significant differences. the values varied of ground water about 11.35 – 58.19 dS m^{-1} inAl-SarrajiandSouthern Fao . The resultsshowed the salinity of water irrigation and ground water are very high and increasedouble the southern FAO area, south until they reached more than double the southern FAO area, and this increase may be due to the proximity of the southern areas of the waters of the Arabian Gulf . average salinity values for irrigation and ground water study sites and what confirms the effect of increasing salinity of irrigation water and ground water on the height of soil salinity and that there is a positive correlation relationship with a high correlation value (0.98 or 0.97) , respectively , between each of the irrigation water salinity and the salinity of the ground water on one side and the salinity of the soil on the other side Fig 3 , 4 .These results are consistent with Al-Hamd (2010) that increasing the salinity of irrigation water for palm grove areas located far fromthe Shatt Al-Arab or so-called ear buds can cause soil

salinity through two impacts, direct impact by transferring large amounts of salt salutations to those orchards and influencing .Fayyad (2012) noted that the main reason for the increase in salinity values for irrigation water and ground water for the Shatt Al-Arab basin areas in the last two decades is due to the lack of rain and the decrease in water imports to theShatt Al-Arab riversfrom the Tigris, Euphrates and Karon rivers in addition toprogress

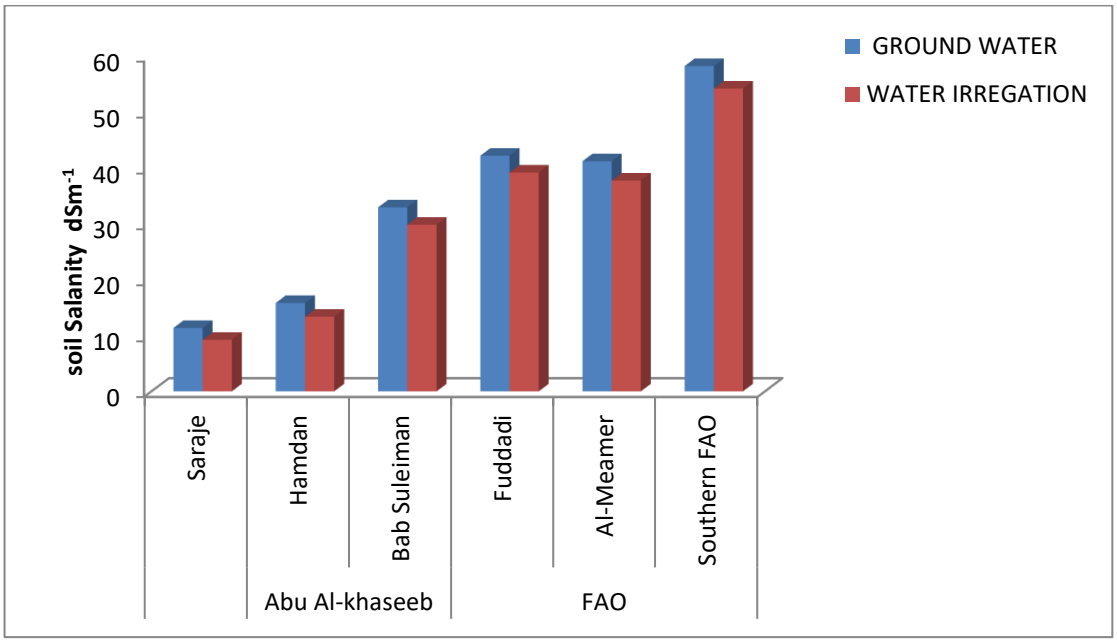


Fig 2: average salinity values for irrigation water and ground water for study sites

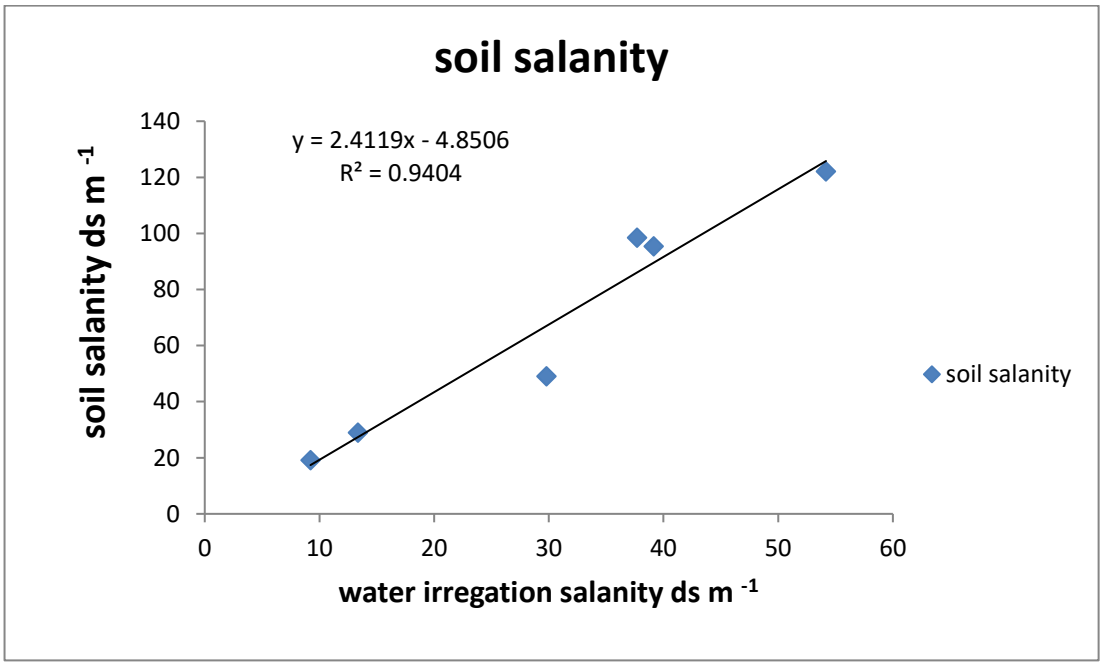


Fig. 3: The relationship between irrigation water salinity and soil salinity

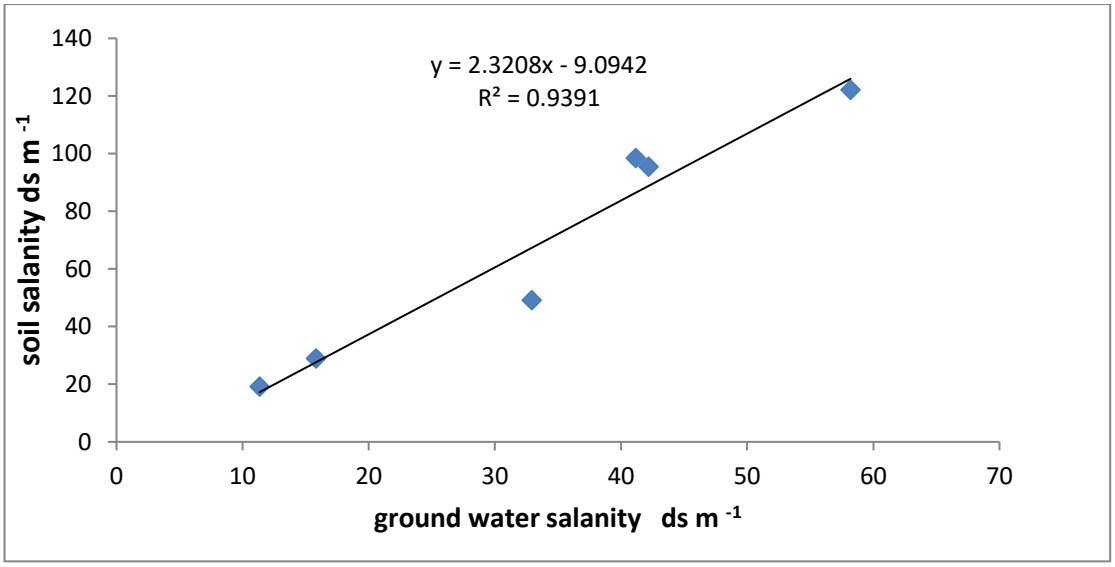


Fig. 4: The relationship between ground water salinity and soil salinity

The salt tongue of the Arabian Gulf towards the Shatt Al-Arab.Water with very high salinity, unsuitable for irrigation uses, and causes major soil and plant problems, according to the classification of the Saline Laboratory in the United States of America (Hand book No 60,1954).

The results in table 6 showed that the average annual rainfall for the last two years was within the range of 75.13-49.2 mm,the actual value of precipitation (drought coefficient) ranged from 13.6 to 24.7, indicating that the region's climate is located within a very dry and dry climate and that plant life is of a nature (deserts, plateaus and plains) as classified byEmberger (1955).

Table 6: Actual value of drought factors, type of climate and plant life for study areas by classification (Emberger.1955)

Location	Plant Life	Type of climate prevailing	Actual value of drought factores	Average minimum temperature for the coldest month of the year ºc	Average maximum temperature for the warmest month of the year ºc	Average annual rainfall (mm)	Year
Abu AL-Khaseeb	Deserts	Very dry	20	17	49.2	56.2	2313.6
		Very dry	20	18	61.4	50.0	17.5

FAO	Plateaus and Plains	dry201773.245.956.6121.4 dry201875.1346.387.8424.7

Accordingly, the area of decertified areas is affected by drought conditions and suffers from the movement of expansion from time to time.This result coincided with Faraj and Taghred (2017) that the desert climate in Iraq prevails in Basra province of the sedimentary plain and the western plateau, where annual rainfall ranges from 200 to 50 mm.High temperatures, increased evaporation rates and low rainfall Table 2have also contributed to higher soil salinity values and increased degradation in the study areas.(With irrigation water and salt ground water)the result is reflected in the deterioration of palm groves, their low area and the small number of farmers there (Table 4).

The results in table 7 showed that the number of palms varied by location and that the highest plant density occurred at the northern sites,If it was 29, 27 and 18 Palm Dunum^{-1} for the sites of Saraji, Hamdan and Bab Suleiman, respectively,As it decreased south Fao . It was 7.9.12 for the sites of the AL-fdagia, Al-Meamer and Southern Fao, respectively.The plant density of the study area is very low compared to its density in the neighboring countries of Iraq, which have a value of more than 75 palm dunum^{-1} (Barbandi, 2000).

Table 7: Plant density rate for sites studied (Palm Dunum^{-1})

Location	Dependent areas
Abu AL-Khaseeb FAO	Bab SuleimanHamdanAl-Sarraji 292718 Al-Meamer AL-fdagiSouthern FAO 1297

RLSD(0.05) = 8.27

The results in table 8 showed the rate of some of the productive qualities of date palms, the halawi category of the sites studied.The dry matter ranged from 82.35 in the southern Fao region to 86.42 in Hamdan, with a significant difference.The values of the meat layer ranged from 4.35 g at the southern Fao area to 4.56 g at Bab Suleiman,the fruit lengths ranged from 3.18 cm in the southern Fao region to 3.76 cm in the Al-Sarraji region,as for the average productivity of a palm tree, the values ranged from 12.45 kg palm^{-1} at the southern Fao area to 39.47 kg Palm^{-1} at theAL-Sarraji In the district of Abu Al-Khasab.This decrease in the values

of productive qualities is increasing from the north to the south of the site ,this is due to the high salinity of the soil in these locations due to the progress of the saline tongue in them , the decline in Shatt al-Arab water imports has increased the salinity and deterioration of irrigation water , this has been reflected in the deterioration and decrease in the number, intensity and productivity of palm trees, and all of this is an important indicator in monitoring the state of desertification in the region.

Table (8) The rate of productive qualities of date palms, halawi class for study sites

Adjectives	Location						R.L.S.D.$_{0.05}$
	Southern FAO	Al-Meamer	AL-fdagia	Bab Suleiman	Hamdan	Al-Sarraji	
% Percentage of dry matter	82.35	83.85	85.15	84.25	86.42	86.14	1.12
eight of meatlayer (g)	4.35	4.45	4.51	4.56	4.49	4.54	0.35
Length of fruit (cm)	3.18	3.31	3 .26	3.67	3.64	3.76	0.64 12.45
Palm Production Rate kg Palm^{-1}	17.83		29.42	31.54	39.45	39.47	11.25

Conclusions And Recommendations

It can be concluded from this study that the salinity of irrigation water and ground water led to an increase in the deterioration of the physical and chemical properties of soil ingesting the region and contributed to the increase of indicators of desertification in it and led to the deterioration of the cultivation of date palms , therefore I recommend that the right scientific methods should be followed in agriculture, the addition of soil enhancers and the use of modern technologies in irrigation as a drip irrigation method to counter this serious deterioration **.**

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