Natural Reasons Causing Soil Salinity and its Impact of Plant Production in Ali-Algharbi District

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Abstract

Salinity is one of the major problems of Iraqi agriculture, especially in central and southern Iraq, including the study area (Ali Al-Gharbi district) in Missan province, as this problem is considered one of the problems impeding agricultural production, as most agricultural lands are subject to different degrees of salinity due to Natural and human conditions such as the prevailing climatic conditions represented by high temperatures and evaporation, the Topography and the vegetation and the salinity of irrigation water in addition to the lack of effective drainage and drainage networks and high levels of ground water and poor management of soil and water and other reasons that lead to soil salinity. The effect of soil salts on plants begins with the accumulation of a large amount of salts in the soil. Boring it becomes difficult for plants to absorb water, and these salts must be kept away from the plant roots (Rhizosphere) in the region by adding more water during the washing process, which reduces their forgetting in the soil and the soil becomes effective for agricultural production. The quality of irrigation water is also an important factor that helps to salinize the agricultural soil, as this water contains different quantities and types of salts, it is natural that part of it will be left on the agricultural land due to the continuous use of it, especially in irrigated agricultural areas and under the conditions of dry climate and semi Dry, when the amount of salts added to the soil through irrigation water exceeds the amount of salts removed by natural or artificial puncture and by crops being harvested, this leads to the accumulation of salts in the soil in the future.

Keywords: Halophytes, Soil salinity, Evaporation, Irrigation water salinity, Ground water.

العوامل المسببة لمشكلة ملوحة التربة وتأثيرها على الإنتاج النباتي في قضاء علي الغربي

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المستخلص

تعد مشكلة الملوحة من المشاكل الرئيسية في الزراعة العراقية وخاصة في وسط وجنوب العراق , ومنها منطقة الدراسة (قضاء علي الغربي) في محافظة ميسان، باعتبار إن هذه المشكلة تعتبر إحدى المشاكل المعرقلة للإنتاج الزراعي حيث إن معظم الأراضي الزراعية تخضع إلى درجات مختلفة من التملح وذلك بسبب الظروف الطبيعية والبشرية مثل الظروف المناخية السائدة المتمثلة بارتفاع درجات الحرارة والتبخر، وطوبوغرافية الارض والغطاء النباتي وملوحة مياه الري بالإضافة الى عدم وجود شبكات البزل والصرف الفعالة وارتفاع مستويات المياه الأرضية وسوء إدارة التربة والمياه وغيرها من الأسباب التي تؤدي الى ملوحة التربة، ويبدأ تأثير املاح التربة على النبات من خلال تراكم كمية كبيرة من الأملاح في التربة. مما يصبح من الصعب على النباتات امتصاص المياه، ويجب إبعاد هذه الأملاح عن جذور النباتات في المنطقة من خلال إضافة كمية أكبر من المياه خلال عملية الغسل مما يخفف نسبتها في التربة وتصبح التربة صالحة للإنتاج الزراعي ، كما تعد نوعيه مياه الري احد العوامل المهمة التي تساعد على ملوحة التربة الزراعية، اذ ان هذه المياه تحتوي على كميات ونوعيات مختلفة من الاملاح يكون من الطبيعي ان يتخلف قسما منها في الأرض الزراعية جراء الاستعمال المستمر لها وخصوصا في المناطق الزراعية الاروائية وتحت ظروف المناخ الجاف وشبة الجاف، فعندما تزيد كمية الاملاح المضافة الى التربة عبر مياه الري عن كمية الاملاح المزالة بواسطة البزل الطبيعي او الاصطناعي وبواسطة المحاصيل التي يتم حصادها ، فأن ذلك يؤدي الى تراكم الاملاح في التربة في المستقبل.

الكلمات المفتاحية: النباتات الملحية، ملوحة التربة، التبخر، ملوحة مياه الري، الماء الأرضي.

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Introduction

Missan Province suffers, like other areas within the sedimentary plain, from the problem of salinity of soil, including Ali al-Gharbi district, in which agriculture depends on irrigation agriculture, which has generated many problems, including the problem of soil fertility degradation due to salinity, waterlogging, erosion and desertification, and as a consequence it has become large areas of Agricultural land in the study area unsuitable for cultivation unless it is reclaimed.

The risk of problems affecting the soil, foremost among which is salinity at the present time, is heightened, as it coincides with the increasing population, which necessitates increasing the area of productive land or raising its productivity to provide food for this growing number of population. Agricultural from one year to another, and the decrease in agricultural areas will lead to the non-cultivation of some important crops with an economic return due to the most important problems experienced by the judiciary, as well as cultivating an area with a crop that tolerates salinity to a large extent, such as barley at the expense of other crops that bear less salinity, such as Wheat, which means that there are crops of important nutritional and economic value, the cultivated areas will be reduced, and therefore cultivation of a lower value crop than it is not encouraged to cultivate.

The research problem is represented in geographical studies by asking a set of questions that can be answered:

- Do climatic factors play a major role in the occurrence of this problem within the scope of the study area.
- Does the level of ground water and capillary properties play a role in exacerbating salinity in the soil of the district.
- Does the quality of irrigation water used in irrigation of agricultural crops affect soil salinization.
- Did the geological structure and the topography of the earth influence soil salinity altitude in the study area.

By asking questions about the research problem, we found through the research hypothesis that all the mentioned natural factors were among the reasons for the increase in salinity in the soil of Ali Gharbi district. which is represented in the Topography, Climate, soil and water resources of both types and the salinity of irrigation water from the Tigris River.

The objective of the research is to show the importance of the soil and the degree of its significant impact on agricultural production and its many problems, foremost among which is the problem of salinity and how to address this problem according to the prevailing natural conditions in the Ali al-Gharbi district.

Ali Al-Gharbi is one of the districts of the province of Missan, which includes the judiciary and the center area on the east, and an area about 3577 km ^{2} and a ratio of 22.25% of the area to maintain the (16 072) km^2.

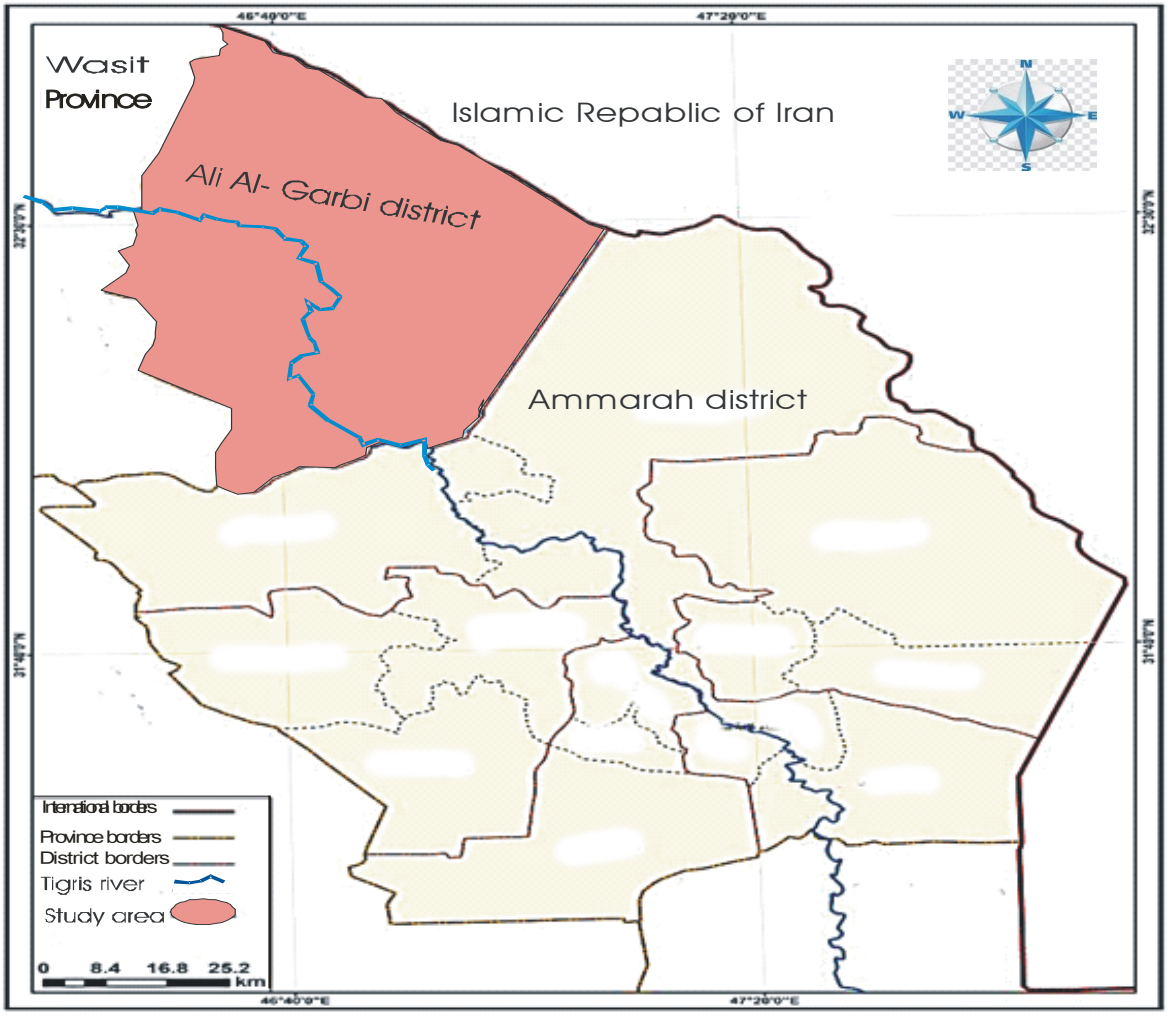
Ali al-Gharbi district is located between two latitude 31.58-32.51 degrees north, and an arc of length 46. 24 – 74.7 degrees east. As for its administrative borders, it is represented by the international borders with the Islamic Republic of Iran from the north and northeast, and Wasit province is bordered from the west and northwest. Al-Amara district is bordered from the south and southeast (Map 1).

Material and Methods:

We relay on this research to address the problem of salinity by following a descriptive approach to geographical phenomena that have an effect on increasing the salinity of the

study area, in addition to using the analytical approach to clarify the geographical phenomenon and indicate the degree of its influence on the natural elements proven in the research Ask.

To study the problem of salinity in Ali Al-Gharbi district, the term soil must be addressed in terms of definition, composition, causes and its impact on Plant production.



Map 1. The study area site for Missan province

Source: Republic of Iraq - Ministry of Water Resources - Public Survey Directorate, Missan Administrative Map, scale (1:500000), 2010.

It is the surface layer in which plants sprout their roots and absorb nutrients and water by them, it is the layer of crumbly surface and its thickness ranges from a few centimeters to several meters. If this layer disappear, it is impossible to produce human food and animal feed (Khalid, 2015). The soil is considered in terms of its impact on agricultural production as one of the elements of the natural environment second to climate in terms of the importance in influencing agriculture, especially the problems that

agricultural production suffers from, so it is known that the soils in Iraq differs in its nature and its components from the north, center and south, and this difference is in fertility And suitability for growing some agricultural crops, according to what experts say that the Iraqi soil is of the fourth degree in fertility as it is poor in organic materials, cellulose and beneficial bacteria that maintain the nitrogen component useful for the plant. The characteristics of Iraqi soil are also characterized by rapid hardening after irrigation and dehydration process, which results in the closing of pores and preventing the roots of the plant from breathing, so this needs constant flipping and leveling.

The study area, like other areas within the sedimentary plain that depend on irrigated agriculture, suffers from the problem of deteriorating fertility of its soil due to salinity, waterlogging, erosion and desertification, and as a result of which large areas of agricultural land in the study area became unfit for cultivation unless it is treated, especially the western region of the judiciary.

The agricultural areas in the district amount to about 1.438 million Acres, of which 682.2 thousand Acres are suitable for cultivation, accounting for 47.4% and the rest is neglected and uncultivated due to its low fertility, lack of rain, and the limited availability of sources of irrigation water for its distance from the course of the Tigris River.

The risk of problems affecting the soil, foremost of which is salinization, is increasing at the present time, because they coincide with the increasing population, which necessitates increasing the area of productive land or raising its productivity to provide food for this increasing number of populations. What confirms the seriousness of salinity on the agricultural situation is the continuous decrease of large areas of Agricultural lands from one year to another, and the decrease in agricultural areas will lead to the failure to grow some important crops with economic returns due to the most important problems experienced by the judiciary, as well as cultivation.

An area with a crop that tolerates salinity to a great extent, such as barley, at the expense of other crops that bear less salinity, such a Wheat. This means that there are crops with an important nutritional and economic value that will reduce the cultivated areas from them, and therefore cultivate a crop of less value than it does not encourage its cultivation. (Personal interview 2020).

Soil salinity is considered an important problem as it has an impact on agricultural production on the one hand and its impact on large areas of it, whether in Iraq or in the sedimentary plain region or in Missan Province, which occur due to the hot dry climate and the lack of exploitation of the land for a long time, in addition to the high level of water Ground. The soil is generally classified according to the degree of its salinity to several varieties as shown in Table1.

After identifying the quality of the soils in the Ali Al-Gharbi district by observing the table (1). We notice that the soils scattered in the district are a type of saline soils and poor in their organic matter, in which the salinity ratio (Ec) increases,

especially in the soils of the marshes, while it decreases in the soils of the cliffs of rivers. The reason is due to the variation in the soil tissue between placer and mixtures.

In addition, we notice the variation in the spread of these soils within the western district, as shown in map 2, through which we see that the ponds' soil takes a large area of the district's lands, and these soils are characterized as less suitable for agricultural investment compared to the soils of the rivers, where the degree of salinity in them is (1.11), the soils of the marshes with limited validity for agricultural investment are spread due to the emergence of underground water on their surface, which made them of little importance.

Table 1. soil classes in Ali Al-Gharbi district

Soil Classes	Ec (ds/m)	ph	OM
River Levees Soil	6.1	7.3	1.6
Pond Soil	11.1	7.5	1.9
Marshes Soil	25	5.5	1.4
Sand dunes	9.3	7.3	0.4
Alluvial fans Soil	11.9	6.4	2

Source: Wasit University - College of Agriculture, Laboratories of the Soil Department, 2020.

These salts affect the growth of plants and the decrease in soil productivity in several forms, including the inability of plants to absorb water and nutrients, due to the increased concentration of salts in the soil solution where salt affects through the osmotic pressure of soil water and as a result, water absorption by living seeds and roots decreases until it dies.

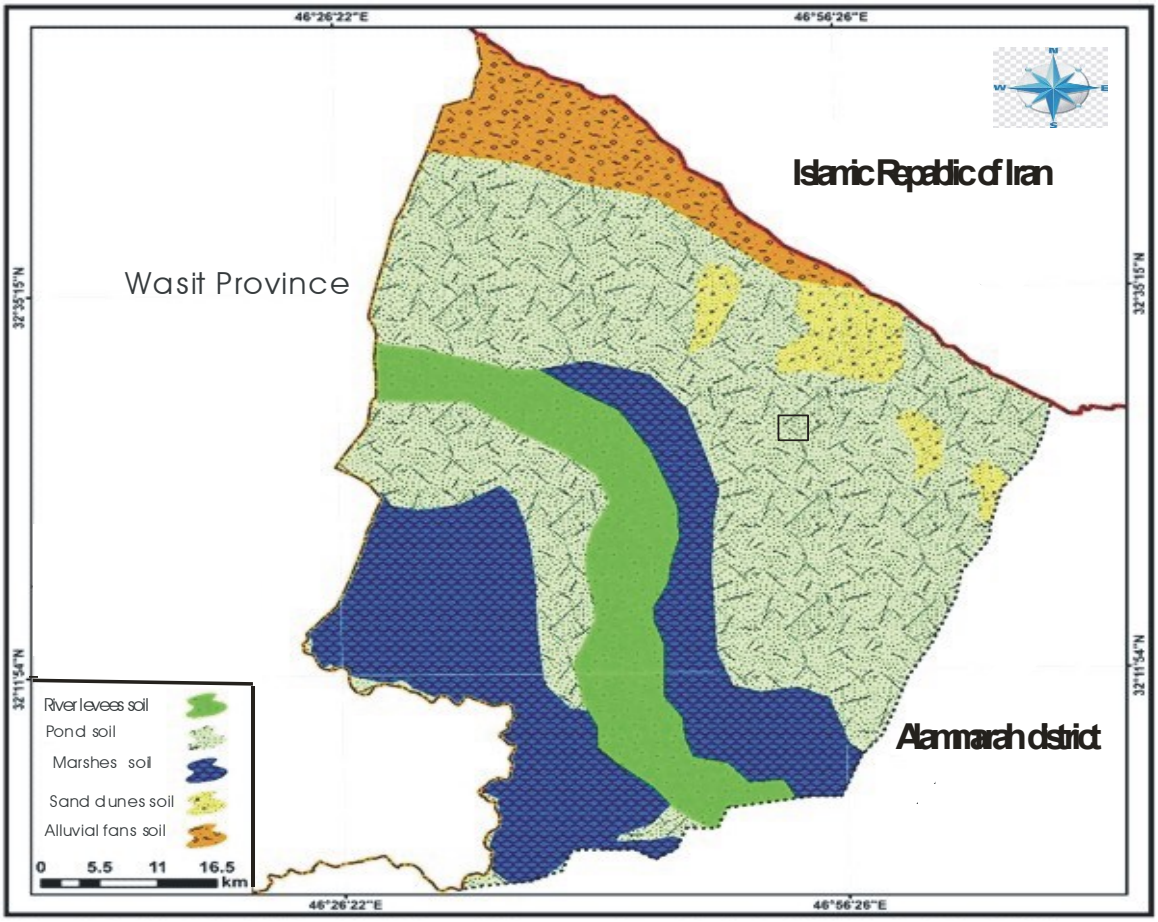
The plant, and accordingly, any increase in salinity will produce the same effect on the absorption of water from the heart of the plant. Likewise, the salts lead to a lack of nutrients in the plants, that is, the presence of one of the salts ions in the food solution or the soil solution with high concentrations leads to absorption by the plants and consequently to the low absorption for other nutrients.

As for the toxic effect on plants as a result, it is a result of the accumulation of certain elements such as sodium, chlorine and boron in the body of the plant, due to their presence in high concentrations of local media and plants differ in terms of salinity influence, (Khalid, 2015) as in Table (2).

The salinity of the soil in the study area changes due to a number of variables between the decrease and the rise in its degree according to the amount of rain, flood water, and the location of the soil and its immersion in flood water, Especially the soils of the eastern region, which are affected by flood waters coming from Iranian lands, as happened in 2018, when Iranian flood waters reached the highway that connects between Missan and Wasit province.

The overall rate of electrical conductivity reached (7 ds/m) at the end of the rainy season, and increased to (26 ds/m) At the end of the drought, this is due to the intense evaporation and the accompanying movement of salty groundwater upward by capillary action.

Map 2. Classification of soils in the Ali Al-Gharbi district



Source: Flayh, H. Altai – Soil and soil Association map of Iraq – Scale 1: 100000, Baghdad,1968.

Table 2. Classification of plants according to their resistance to salts.

Salinity – sensitive plants	Medium – resistance plants	Salinity – resistant plants
Sword, Apples. peach	Maize, Sun flower, Fig	Rice, Barley, palm trees
Orange, Almond	Sesame, Olive, pomme granate	Cotton, Spang

Source: Ahmad.H. Al-Zubaidi- Soil Salinity, (Theoretical and Applied Foundations) Baghdad, 1989 p. 195.

The salinity of the soil increases as we move from the river banks to the neighboring lowlands, due to the fact that the river banks have relatively good drainage and have a flat surface, while the low land is characterized by poor natural and industrial drainage, which contributes to raising the degree of its salinity more than the river banks (Khalid,

2015). And to study the soil salinity in the study area according to the two depths of (30-0) and (60-30) cm and for the winter and summer seasons for the year 2019 shown in Table (3), soil analysis of the electrical conductivity responsible for the soil salinity in the area showed a reason for its lack Cultivated areas and consequently the lack of agricultural (plant) production. Electrical Conductivity is defined as an increase in the concentration of dissolved salts of mutual sodium in the soil, which includes calcium, magnesium, potassium, chlorides, sulfates, and bicarbonate.

Table 3. Chemical soil characteristic in Ali-AlGharbi district of the winter and summer seasons for the year 2019.

Depth (cm)	season	OM	Ec	ph	Reciprocal Capacitance	Esp	SAR
0 - 30		9.91	7.02	7.42	17.54	9.62	9.36
31 -60	**Winter**	9.55	6.54	7.41	16.98	9.59	10.33
Average		9.73	6.78	7.42	17.25	9.61	9.85
0 - 30		9.91	7.36	7.38	16.84	10.23	9.66
31-60	**Summer**	9.55	7.22	5.58	16.38	10.29	12.51
Average		9.73	7.29	6.48	16.16	10.26	11.09

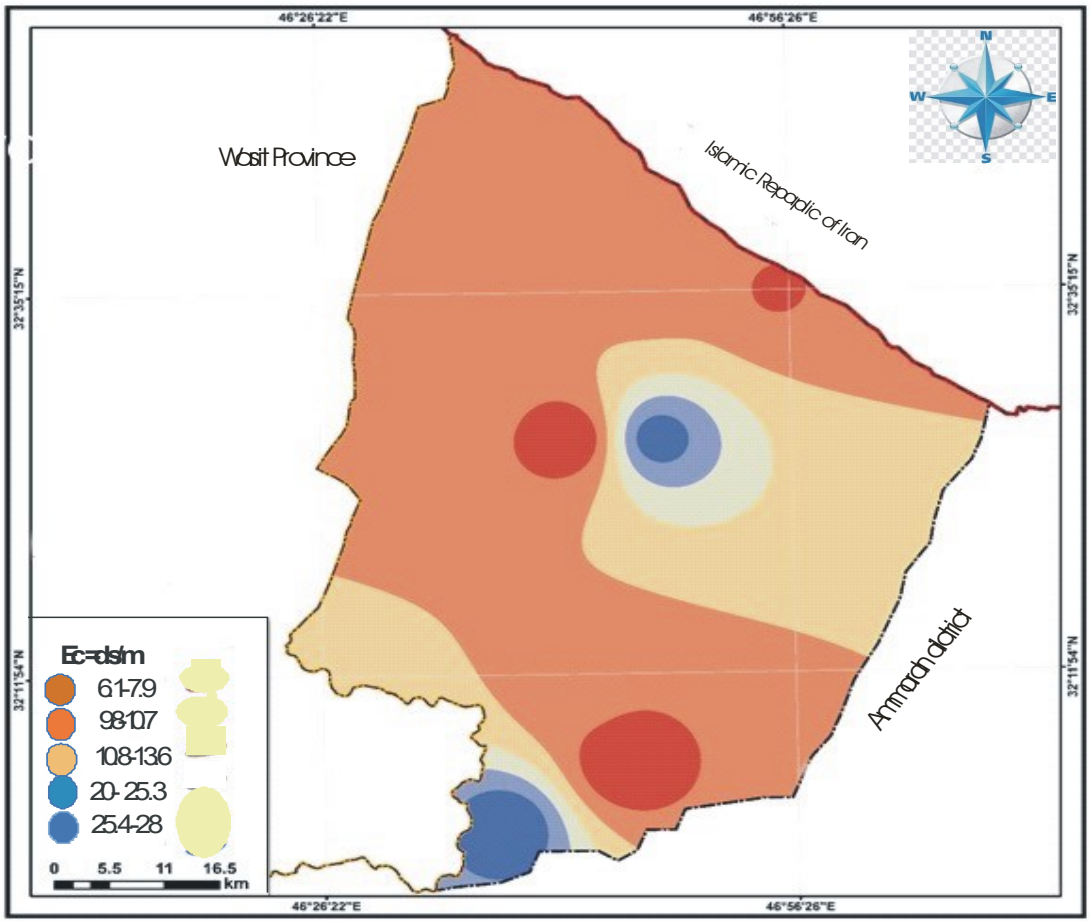
Source: Zahraa Mahdi Salih - The effect of oilfield waste on the soil properties of Wasit and Maissan provinces (study in the geography of the environment) - PhD thesis, College of Arts, University of Qadisiyah, 2019, p. 277.

The electrical conductivity is the basis for the classification of soil salinity, soils with a salinity of less than (4 ds / m) It is considered non-saline soils, while if the values of electrical conductivity have more than (15 ds / m) it is considered highly saline soils, while the degree of reaction is close to neutralization if its salinity is less than (8.5 ds / m), as shown In Table (4) cultivars of soil salinity , and for reference to Table (3), we note that the average conductivity of the winter season in the study area for the first depth (0-30) cm is about (7.02), while the summer season has reached (7.36), while the second depth of (30-60) cm for the winter season (6.54), while it reached the summer season (7.22), where these rates are classified according to the criterion of soil salinity degree, as is clear in Table (4) as medium salinity to high salinity so we note there is a spatial and seasonal variation of electrical conductivity rates and depth, where it can be observed that the rates rise In the summer season and for the first depth, the reason for this is due to the increased evaporation of water in this season as a result of high temperatures in this season, which results in an increase in the concentration of salts in the surface layer of the soil, as well as the concentration of salts in irrigation water, in addition to the role of water Ground by capillary property, as it mixes with surface water, remaining on the surface of the soil that leads to high values of electrical conductivity (EC), (Salih, 2019).

In map (3), we show that the salinity of the soil in the Ali – AlGarbi district varies in terms of location and depths, so its value has varied between (6.1 -28) ds/m and it increases as we move away from the soils of the cliffs of rivers towards the low areas (basins). The value of (EC) at the soils of rivers and sand dunes ranged between (5.8 - 9.7) ds/m, while it rose in the soils of the

flood plain, it reached between (9.8 - 13.6) ds/m, as for the soils of the marshes, it increased more than 20, especially in the western marshes, where its value reached 28 ds/m.

Map 3. Spatial variation of (EC) values in Ali Al Gharbi district



Source: Intisar Tariq Al-Sheikhly - Problems of (plant) agricultural production in Ali Al-Gharbi district - Master Thesis submitted to Missan University, College of Education, Department of Geography, 2020 – p. 163.

One of the reasons for the decrease in cultivated areas in the study area and according to the questionnaire form is the problem of salinity, where the problem percentage in the study area reached (76%) among the most important problems that the judiciary suffers from. (Field study,2020).

Soil salinity affects its natural properties. Its increase works on poor soil composition and is spaced with each other, which reduces the permeability of the soil to water. Soil salinity is a prominent feature in the soil of the study area, image (1) , it is part of the overflow of soil that indicates Historians note that the problem of salinity has existed since ancient times and has evolved with the passage of time and its causes are due to

natural factors on the one hand and climatic characteristics and the solar radiation it receives followed by high temperatures and low relative humidity, as well as an increase in the activity of north and northwest winds, on the other hand Irrigation, poor natural drainage, and the absence or neglect of industrial drainage, in addition to the salts contained in this water.

Table 4. Varieties of soil salinity depending on the Electrical conductivity ds\m of saturated soil pulp.

Soil Cultivar	**Soil salinity ds/m**
Low salinity	0 - 4
Medium salinity	5 - 6
High salinity	7-15
Very high salinity	Over 15

Source: F.A.O Unesco - Irrigation Drainage Salinity, international Source Book London, Hutchinson, Aelco, 1973 -p. 75.

Image (1) Agricultural lands that were subjected to very severe salinization in Ali Gharbi district

Source: field study, date 3/5/2020.

To study the natural causes that affect the increase in salinity in the soil of Ali Gharbi district through the following: Like all lands of the sedimentary plain, the lands of the study area suffer from salinization, which stands as an impediment to the cultivation process, due to the transformation of parts of agricultural lands into unproductive lands with poor characteristics, which are caused by natural and human factors and at the forefront of natural factors causing salinity in the study area are: And evaporation means the transformation of water from its solid or liquid state into a gaseous state, that is, to the invisible water vapor, which is an opposite process of condensation. The evaporation

process requires heat energy whose quantity is proportional to the water temperature.

The annual evaporation rate in the study area is (3566) mm, and this amount equals a very high degree of evaporation by about (21) times the amount of the amount of rain during the same year, amounting to (178.8) mm. The amount of evaporation varies from month to month and from season to season, as it reaches higher the amount of evaporation during the months of June, July and August, as the amount of evaporation for these months is about (562, 563, 541) mm, while the lowest. First: The intensity of Evaporation

evaporation quantities are during the months of January and December at a rate of (71.5-67.8) mm. There are factors that contributed to the increase in the amount of evaporation in the study area, including temperature, wind, and low relative humidity. Among the most important of these factors are as shown in Table (5).

Table (5): Monthly and yearly averages of Climate elements, Evaporation, Winds, and Relative humidity of the weather station in Ali Gharbi for the period (2000-2019).

Months	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Avrg. Or Sum
Evaporation (mm)	72	103	129	284	428	562	563	541	376	254	123	68	3502.8
Wind Speed m/s	3.6	3.8	4.3	4.5	4.4	6.1	5.8	5.1	4.3	3.5	3.3	2.8	4.3
Relative Humidity %	73.8	62.5	51.6	43	29	22	21	23	28	41	58	77	44.2

Source: General Authority for Iraqi Weather Forecast and Seismic Monitoring, Climate Department, unpublished data, 2019.

1- High evaporation rate: We note that the study area was characterized by high temperatures in the summer to a degree that leads to high evaporation from soil and water and even girls themselves, as the highest temperature rates during the summer months and for five months from May to October, as well as higher during the daytime period, exceeded It is at night, and the highest temperatures during these months are (May - June - July - August - September) respectively, 41.6, 46.5, 48, 49.2, 43.8 °C and the annual average of this temperature is 36.1°C (General Authority for Iraq, 2019).
Which led to an increase in the amount of evaporation as it reached in the study area (3566.4) mm and the highest quantity recorded during the months of June, July, August (562.3, 563.3, 541) mm respectively, while the lowest quantity was recorded during the months of December and the second whose amount is (67.8 , 71.5) Mm, respectively, Table (5), and the reason is due to the variation in temperature, as it rises during the summer months and decreases in the winter months.
2- The prevailing northwest winds are dry: It is considered one of the most dry winds in the study area, as it has reached, according to what appears in Table (5), the percentage of wind directions is about (39.3%), and this wind works to increase the intensity of evaporation in the study area that affects the growth of the plant due to the lack of water in the plant and may lead As for the death rate, the average wind speed in the study area, where the average wind speed during the mentioned period 4.3 (m / s) , and that

increasing the speed of the wind leads to an increase in the intensity of evaporation, an increase in water losses, and an increase in salts on the soil surface as a result of high water.

3- Lack of relative humidity: The average relative humidity in the study area is about (44.2%), and the highest humidity months in the month are December (76.2%), January (73.8%), and February (62.5%). The high humidity rate here is related to the increase in the amount of rainfall in the study area and the increase in the frequency of southern and southeastern winds with high humidity. As for the months of June - July - August, it is one of the least humid months of the year, where the humidity levels are about (23.3 - 21.4 - 22.2%). That increases or increases the intensity of evaporation in the study area.

Second: The quality of irrigation water

The quality of irrigation water is one of the main factors affecting agricultural production, as well as its direct impact on crop productivity, it affects the productive capacity of soils through the effect of its quality on chemical and physical soil properties, as increasing the salt concentration in it makes it an environment incompatible with the plant, that the characteristics of Irrigation water on the basis of which the quality and suitability for cultivation is improved are the total concentration of dissolved salts (the total concentration of chloride, the relative concentrations of sodium, and other positive ions, the concentrations of some special ions that are toxic to plants and humans) (Muhammad, 1989).

Also, the quality of irrigation water is one of the important factors that help to salinize the agricultural soil, as this water contains different quantities and types of salts, it is natural that part of it is left behind in the agricultural land due to the continuous use of it, especially in irrigated agricultural areas and under dry and semi-climatic conditions Dry, when the amount of salts added to the soil through irrigation water exceeds the amount of salts removed by natural or artificial puncture and by crops being harvested, this leads to the accumulation of salts in the soil, and when this situation continues for a long period of time, the concentrations of salts will increase to The extent to which the soil is not suitable for agricultural investment without reclamation first, and based on the foregoing, irrigation water can be classified according to the degree of its salinity according to the standard of the American Salinity Laboratory (1954) USDA See Table (6).

Irrigation water can also be classified in terms of its salinity and total dissolved salts in it and determining its suitability for agricultural uses as shown in Table (7).

And irrigation water can contribute to the salting process through two direct and indirect effects, namely: The first effect: it is a direct effect, through the quantities of salts transported by irrigation water, as these salts accumulate in the irrigated soil after the irrigation water evaporates. The second effect: it is an indirect effect by filtering large quantities of irrigation water through the soil towards the groundwater, causing its rise and its contribution to the salinization process, especially when there are no industrial drains (Saud, 2018).

De. Grater estimated that irrigation water in Iraq could add the equivalent of three million tons of salts annually to irrigated soils in central and southern Iraq, and that waters containing (1 g of salt per liter) transport (1 kg/m^2) From salts to irrigated areas (Muhammad, 2013).

The reality of the situation is reflected in the study area, as farmers use irrigation types of water, including the water of the Tigris River and the artesian wells water, as well as the tables in the region and according to its proximity to agricultural land, and this water contains a percentage of salts after

conducting analyzes of the region's water and in general increases The salinity level in the lowlands and in the agricultural lands whose sub-tunnels suffer from accumulation of mud deposits and water plants.

Table (6) Classification of Water by the Degree of Salinity According to the American Salinity Laboratory Standard (1954) U. S. D. A.

Water class	ds\m Salinity
Low salinity	less than 0.25
Moderately salty	0.25 - 0.75
Medium salinity	0.76 - 2.25
High salinity	2.26 - 4
Very high salinity	4.1 - 6
Overly saline	Over 6

Source: U.S Salinity laboratory Staff Diagnosis and Improvement of Saline and Alkali Soil. USDA. Agri. hand book. NO.60, Washington, gov. Printing office, 1960 – P. 71.

Table (7): Classification of irrigation water in terms of salinity, total dissolved salts and their suitability for agricultural use.

Salinity ds\m	Total dissolved salts mg/L	Irrigation water viability	Water suitability for agricultural purposes
less 0.75	0-500	Valid for all soils	beans, peas, radishes, apples and oranges
0.75-1.50	500-1000	Suitable for crops that tolerate salinity and good soil	wheat, barley, rice, corn, tomato, vegetables, olives
1.51-3.0	1000-2000	Suitable for salinity tolerant crops, provided that good soil drainage is taken care of	cotton, date palm and sugar beet
3.1-7.50	2000-5000	Valid for some crops while taking care of the soil conditions and draining them	palm, alfalfa and clover
Over 7.50	Over 5000	Not suitable for irrigation	Not suitable for crops

Source: U.S. National Technical Advisory Committee Report on water Quality Criteria Submitted to the Secretary of interior, D. C, 1968 – P. 170.

When the percentage of salinity in the soil or irrigation water is higher than the permissible level for plants, this will lead to a decrease in the production percentage in the study area, because there are crops that cannot tolerate high salinity levels or may be sensitive to the trend of high salinity in the soil or in irrigation water.

Table 8 indicates that there are degrees of tolerance for salinization of plants, whose production percentages are low if the soil salinity is higher than normal. Through Table (8), we notice the variation in the production and productivity of crops according to the degree of their tolerance to soil salinity and irrigation water. For example, we see that the

barley crop is one of the most salty-tolerant agricultural crops. 10ds/ m, the productivity will decrease to 10%, and if the salinity level rises to 13 ds/m, the productivity will decrease to brother 25%, and this decrease will reach 50% when the salinity reaches 18 ds/m.

Table 8. Degree of tolerance of some agricultural crops to salinity and the rates of low productivity when salinity increases.

The crop	Salinity Concentration ds/m	Production decrease rate %			Degree of resistance
	Less 10	10	25	50	
Wheat	6	7.4	9.5	13	Moderate resistance
barley	8	10	13	18	resistant
rice	3	3.8	5.1	7.2	Moderately sensitive
corn	1.7	2.5	3.8	5.9	Moderately sensitive
Beans	1.6	2.6	4.5	6.8	Moderate
Onions	2.5	3.3	4.4	6.3	Moderately sensitive
Lettuce	1.3	2.1	3.2	5.2	Moderate
Tomato	2.5	3.5	5	6.7	Moderate

Source: Hamid Nashat Ismail, Field Profiles on Irrigation Agriculture, Part One, Baghdad, 1991, p. 445.

Thus, we measure the degree of tolerance of agricultural crops to soil salinity, and through it we know the degree of crop resistance to soil salinity and irrigation water. By noting the data of Table (9), the average salinity of the water of the Tigris River in the study area (EC) falls within the category of high salinity during most months of the year, where we find it in December is about (2444.5) and this is a very high amount of salinity in the river water, As for the least months with regard to the electrical connection EC, they appeared in the months of (September - October) at the rate of (1780 - 1775), and this is evidence of the high salt concentrations of river water when it reached the center of the western district of Ali AlGarbi.

As for the (TDS), which is a measure of the effect of dissolved solids on the two types of water, such as minerals and negative and positive salts of organic and inorganic materials, it was recorded in the study area high levels and reached its highest rate in the month of November as it reached about (1692) which is also within the high-water category Salinity. As for the lowest rate it reached in September, it reached about (579.5). As for the degree of pH, it is slightly more than the parity ratio, which is (7.7), where the study area recorded the highest rate of the value of (ph) in the month of November, which reached about (7.45), and the reason for that is due to the increase in the concentration of salts, especially calcium salts, The water of the Tigris River is characterized by a high percentage of salts of chlorides, sodium sulfate and calcium.

As for the reason for the high saline concentrations of water in the study area, it is due to the high rates of evaporation and the decrease in the level of the river's water, thus

increasing the supply of saline groundwater for the river with salts and natural and artificial puncture of agricultural lands and other human pollutants sent towards the river, as well as the impact of falling rains and water torrents.

Table 9. The average salinity of the Tigris River during the months of the year in the Ali Al-Gharbi district.

Elements	PH	POR	NO3	Ca(mg/l)	Cu(mg/l)	Fe(mg/l)	Cl(mg/l)	TDS(mg/l)	Ec (ds/m)	Al (mg/l)	TUR
Jan.	7.2							1090.5	2181.5		30
Feb.	7.5							1161.5	2228.5		21
Mar.	7.15							1141	2284		11.5
Apr.	7.3	0.05	6.06	125	0.1415	0.0915	304	1567	2242.5	205	32.5
May	7.6	0.051	4.3215	140	0.0545	0.0925	375	1415.5	2066.5	205	26.5
Jun.	7.3	0.069	5.326	122.5	0.3245	0.074	330	1580.5	2192.5	200	31
JULY	7.3	0.2919	4.279	110	0.109	0.172	311	1213.5	2352	205	45
Aug.	7.2	0.015	5.83	105	0.2675	0.0205	330	1372	2354.5	215	30
Sep.	7.3	0.0455	4.59	91	0.977	0.022	210	579.5	1775	152.5	45.5
Oct.	7.3	0.0205	3.27	99	0.02	0.057	273.5	1003	1780	205	24.5
Nov.	7.45	0.331	4.885	127.5			365	1692	2666	200	188.5
Dec.	7.2	0.0505	5.595	137.5	450	1454.5	2444.5	1454.5	2444.5	210	531

Source: Water Resources Directorate in Missan Province, unpublished data, 2018.

The following comes from the Iranian lands and through the Shuwaigah port - Umm Al-Jari, Al-Jabab Tributary, and the Al-Shamashir outlet, which work to wash the salty soil and dump the torrential water in the Tigris River. All these matters made the water of the Tigris River salty above the natural limit.

As for the quality of the groundwater, it is light salinity (1000 - 2000) mg / liter in the hillside area and the eastern island. When the groundwater runs slowly (filtering) due to the effect of the water pressure generated by the slope, gravity, and contrast levels, it is directed towards the transitional zone between the island region and the sedimentary plain and basins.

The average value of the degree of reaction (ph) value for the water of the Tigris River has reached about (7) and this value is suitable for cultivation according to the criterion (1973) F.A.O, which determined the value of the interaction (ph) confined between (6- 8.5) most suitable for growing economic crops (Saad, 1999), And the increase in salinity at the study area is due to the lack of internal ponds in the sedimentary plain that help in the accumulation of water in it and the passage of groundwater during its transport with salty soils and formations that dissolve and increase the concentration of salts therein (Salman, 2015). The reason for this increase in the values of dissolved salts in the soil solution can be attributed to the role of crop composition, as vegetable cultivation prevails in the study area, which is one of the crops with high water needs, which increases the process of accumulating salts in the soil surface due to irrigation in large quantities and constantly.

Also, one of the reasons for the accumulation of salts in the soil is the lack of falling rain and high temperatures that increase the intensity of evaporation from the soil surface, which in turn leads to the movement of slow groundwater from inside the soil that increases the speed of its evaporation, and thus the accumulation of a layer of salts on the surface when Sometimes water reaches the surface of the soil through the capillary characteristic.

Third - Topography

The sedimentary plain area in the study area is characterized by diastole, like the rest of the plain, as well as the presence of some depressions as a result of the river sedimentation process that affected the formation of this plain, in addition to the presence of some depressions that represent the course of the old Tigris River represented in the central and southern parts of the study area, as a result of the gathering The water in these areas leads to waterlogging in it and in the vicinity of it, as well as the leveling of the surface that helped the soil to retain water, thus increasing the problem of salinity (Muhammad, 2013).

The prevalence of soils affected by salinity in some areas may be caused by the presence of a large depression surrounded by a series of heights, where this depression is a center for the gathering of salts transported by surface and ground water that work to saline these soils in this depression. The flow of water currents towards the depression transports not only the materials Dissolved salts but also transport suspended matter, and the transport of dissolved materials continues to lower locations and then exposed to evaporation leaving large quantities of salts, that all these conditions lead to salinization of lands and the formation of salty soils (Saud, 2018), And that the nature of the surface of the region led to poor natural drainage of the basin areas and then to the salinization of agricultural lands as a result of the water remaining without being discharged and evaporating, leaving the salts behind on the surface, which led to an increase in the level of the groundwater whenever we progressed to the southern regions of the study area, to increase this work Capillary characteristic or accumulation of salts above the soil surface level under conditions of high temperatures and the resulting evaporation ratios, as the geographical nature of the lands in the study area is characterized by a slope of the ground level so that the water collects, leaving behind a salt layer after evaporation.

As a result of these characteristics, the high level of the ground water, its proximity to the surface or sometimes above it, has resulted in the difficulty of draining water in excess of the plant's need, therefore it remains in the soil or above its surface, and under conditions of severe evaporation the salts accumulate above the surface of the soil, and at depths Varying from it, and despite the general flatness of the surface, the lands adjacent to the Tigris River are more elevated than those away from it, and the lowest levels of which are in the marshes and marshes regions, so the first area became better drainage and less salinity not only because it is high but also because the texture of its soil is lighter than that Which are found in depressions (Muhammad, 1989).

The degree of surface slope affects the formation and development of the soil or

climatic variables and the movement of water on the surface of the soil and its interior, and the sedimentary plain is characterized by its flat surface, so that it is almost devoid of the variation of the surface forms of the earth except from some forms resulting from the work of rivers and humans, i.e. resulting from the formation and not the composition This diastole is due to the nature of the geological structure of the area consisting of flood deposits, while the stretches of river beds are observed in the form of a strip of elevated lands above the level of the sedimentary plain on both sides of the Tigris River due to the irregularity of the sedimentation process during formation. As for the study area, it is noticed that the opposite height of the river's shoulder varies due to the variation of the sedimentation process on both sides of the river during formation, as well as the course change across its historical phases (Salman, 2015).

Fourth: The geological formation of the study area

The formations are represented by the deposits of the Pleistocene era, as large quantities of sediments were deposited by the processes of erosion, transport, and sedimentation. Also, the formations of this era included all the collected rocks that were deposited with layers of limestone, clay, and sandy rocks, so the ancient river terraces that existed in the northern sections of the study area were formed. The formations of this time are represented by sediments of the Holocene era (modern), which are river deposits consisting of sand, silt and clay, and they are called sediments of the flood plain that resulted from river floods. The thickness of these formations is about (62) m in the southern part of the region and about (32) m in its section The northern, which also includes the swamp sediments that consist of sandy clay. The sediments of this era also resulted in modern river terraces, in addition to sediments transported by wind.

In summary from the above, the parent material for the soils of the banks and basins of the Tigris River in the sedimentary plain region consists of sediments transported by the Tigris River and its tributaries during the ages of the fourth time, causing the difference of river sedimentation between the areas near the river courses and areas far from it during the flood seasons. Soil tissue texture has varied in it Soil with moderate alluvial mixture texture prevailed in areas of river banks, while soil with alluvial clay mixture prevailed in the basin areas. For water and air, as most of its pores are large and effective type of pores, this was a reason for the quality of their drainage, as it is characterized by its low susceptibility to water retention, while the river basin soil has low permeability of water and air and its pores are small and ineffective type, so the soil became poorly spent, but it has a high-water retention capability, which is reflected in its moisture content.

The parent material of the soil affected some of its chemical properties, so the salinity of the soil in the Tigris River basins is more than the salinity of the banks of the soil, due to the nature of the soil texture of the basins that depend on the mother material for the soil, where the capillary property is activated as one of the factors of soil salinity in the soil with the softest texture, while Its

activity in soils with more rough texture decreases, as is the case with the banks of the Tigris River.

The parent material transported to the soil of the banks and basins of the Tigris River was a reason for its high content of Calcium Carbonate ($CaCo_3$), which it moved from the northern and northeastern highlands adjacent to the sedimentary plain region, and it was also a cause of its content of Calcium Sulfate (Gypsum) ($CaSo_4$) that It also moved from the feeding areas of the northern and northeastern Tigris River basins, and became part of the formations of these soils due to the frequent flooding of the river and the use of its water for irrigation purposes from thousands of years to the present time, despite the low content of the soil of the study area of calcium sulfate, but it was of great importance In reclaiming saline soils in the region (Saad , 1999).

Fifth: the poetic characteristic

Soil consists of a body composed of rocky crumbs interspersed with voids of different sizes that are filled with water and air, and the pore proportions and sizes vary according to the size of the granules and the extent of their homogeneity, the smaller the grains, the lower the porosity and vice versa, as the height of the water in the capillary property is directly proportional to the decreasing pore diameter, It is higher in clay and soft alluvial soils than sandy soils, as the ability of capillary gravity to withdraw water to the soil surface ranges from (60) cm below the surface of sandy soil to (150 cm) below the surface of clay soil, and whenever the groundwater moves away from the surface, rates of withdrawal begin The water is upward and its evaporation is decreasing until the average depth of groundwater reaches (92) cm in mixed tissues, where that effect stops.

Capillary water is distinguished by that it can be cut off from the surface of the groundwater in the event of a rapid descent to it, and it can also reach the surface of the earth where it is subjected to evaporation and soil enrichment with harmful salts. This characteristic is mainly due to the relationship that governs the boundaries between the two states, solid state, liquid state and liquid state with a gaseous state where a tensile force arises between the pore walls and the opposite pressure force of the water and the formation of uneven surfaces on the surface of the pores or at the point of separation of the porous water from the groundwater (Salman, 2015).

High temperatures with low relative humidity heat the soil and then move the water vapor pressure in the soil within the pores of the connected soil from the high pressure areas to the areas with low pressure, there is pressure for water vapor at the surface of the earth and another pressure for water vapor in the depths of the soil, and accordingly The amount of pressure of water vapor at the surface and throughout the heat season is little due to the high temperatures and the interruption of rain, while the amount in the lower layer of the soil is high, so the water in the soil goes from the bottom up to the capillary characteristic, and leads to the loss of its moisture and leaving the salts on the surface the soil (Shanshul, 2013).

Sixth: Lack of vegetation

The vegetation has a great effect in reducing the evaporation process, by raising the air humidity by the transpiration process, as well as protecting the soil from direct exposure to solar radiation and activating the aforementioned process, and that the quality and density of the vegetation are very effective in reducing the wind speed and its effect in stimulating the evaporation and transpiration process Through its displacement of the air layer over the soil loaded with moisture, and since the quality and density of the vegetation is a result of the prevailing climatic conditions in its areas of growth, especially humidity, and due to drought conditions and the lack of rain on the study area and its seasonality, the vegetation in the region has become poor in its quality and density As there are no natural pastures, as well as lands that are left unsuitable for cultivation, as the vegetation that have been mentioned previously grow in them, so the soil has become exposed to the action of different climate elements, especially solar radiation and high temperature, which increases the process of evaporation leaving The salts on the soil that hinder agricultural activity, and affect it, and yields that reduce agricultural production.

As for the study area, the vegetation is low and this is due to the lack of a suitable environment for its growth, due to the high summer temperatures to a high degree that is almost compared to the temperatures in Basra Province in terms of severity, but there are areas that enjoy a moderate climate in the study area, as it is The situation in the island region where the vegetation is characterized by abundance, especially oases and forests where vegetation are available, and there is an interest from the municipality department in cultivating some plants whose purpose is to grow them.

Mitigating the atmosphere, such as cultivating some male palm seedlings that may not succeed in the study area due to the high temperatures in the summer that lead to the death of these plants, and there are many types of them that have been mentioned previously.

The importance of vegetation stems from the important effects it leaves on soil properties. The difference in its quantity and quality results in a difference in the proportions of the organic materials of the soil, and given the poverty of the area in the vegetation, the content of its soil from the organic materials is higher compared to the soil of the river basins, and the vegetation has an important effect in the aggregation of grains. Soil, linking it with each other, and forming soil clusters through what the roots do when they die by pressing the soil grains so they come close to each other and facilitate their bonding process. The organic materials resulting from the decomposition of herbs may be responsible for giving the soil construction. The vegetation cover has an effect in reducing the thermal range of the soil, as a thermal difference was found between the soils covered with plants and the bare soils may reach (10°C) and this would affect the oxidation process of the organic materials (Saad, 1999).

The effect of soil salinity on agricultural production in Ali Al Gharbi district

After examining the impact of salinity on agricultural production in general, we note by observing the data of Table (10) that salinity has had a significant role in reducing the cultivated areas in the study area for the period between 2000 and 2019 and for the summer and winter agricultural seasons and its effect was clear in irrigation of agricultural crops Summer, especially those that depend on irrigation from the Tigris River and its branches and streams in the judiciary compared to the ruminant crops.

Table 10. Area and production of agricultural crops for the summer season in Ali Gharbi district for the period 2000-2019

Crop	Space and pr	2000		2005		2010		2015		2019	
Paddy	Region	Ali Al-Gharbi	Ali Al Sharqi	Ali Al-Gharbi	Ali Al Sharqi	Ali Al-Gharbi	Ali Al Sharqi	Ali Al-Gharbi	Ali Al Sharqi	Ali Al-Gharbi	Ali Al Sharqi
Rice	space			490	810					3720	3222
	Produce			378	662					3162000	2738700
Corn	space			4600	2800	4975	4000	6702	8808	8270	12000
	Produce			2990	2100	181250	1035	3361600	1223600	3330600	2853450
Sorghum	space			260		507					
	Produce			78							
Sesame	space			300		110	100		40	90	15
	Produce			45		16500	15		6	13500	2250
Mung bean	space			200		15	50	15	30	100	30
	Produce			250		3750	12500			20000	6000
Millet	space				200	10	50	3750	7500		50
	Produce				30	1500	7500	205	35		10000
Sunflower	space	175									
	Produce	43									
Vegetables	space	6197	4513	20555	12351	6405	7240	1724	286	23519	4318
Total	Total product	6372	4513	26145	16421	12022	11440	8646	9199	35699	19635

Source: Missan province Agricultural Directorate - Department of Lands Planning and Follow-up Unpublished data – 2000-2019

Agricultural production and cultivated areas have varied. The cultivated areas of sesame crop decreased from 300 Acres in 2000 to 90 Acres in 2019, a decrease of 70%. The other decreased from 200 Acres to 100 Acres for the same years, with a decrease of 50%, in addition to that, the lack of agricultural areas for many crops, or farmers retreated from their cultivation, such as sunflower, millet and sorghum, and exceeded the case to the rice (paddy) crop except for the last agricultural season (2018- 2019).

As for the winter crops, some of which depend on rain, the other varied their cultivated areas in the study area, as shown in Table (11). The salinity effect was on crops irrigated with the water of the Tigris River and its streams that reach the agricultural lands, especially the crops of vegetables and barley that complete the irrigation process with water The Tigris River When the amount of rain decreases or does not exist in some years, the cultivated areas of the barley transformer in the Ali Western Judicial Center decreased for the period 2000-2019 from 20,000 Acres in 2000 to 13082.

Table 11. Area and production of agricultural crops for the winter season in Ali Gharbi district for the period 2000-2019

Season	Region	wheat		barley		Vegetables	Total production
		space	Produce	space	Produce	space	Produce
2000-2001	Ali Al-Gharbi	12000	2940	20000	4580	5502	37502
	Ali Al Sharqi	14500	4553	21000	5859	1761	37261
2004-2005	Ali Al-Gharbi	14500	3423	42000	11556	6640	63140
	Ali Al Sharqi	13000	3297	31870	9189	3510	48380
2009-2010	Ali Al-Gharbi	12500	5,312,500	34350	10,957,650	3511	50961
	Ali Al Sharqi	14360	5049	25240	6,944,350	3252	42852
2014-2015	Ali Al-Gharbi	41000	18,162,900	19950	5,985,000	846	61796
	Ali Al Sharqi	46270	18,400,000	13500	4,030,000	1045	60815
2018-2019	Ali Al-Gharbi	73304	56,197,000	13082	5,471,400	383	86769
	Ali Al Sharqi	76832	63,169,000	10949	4,887,000	143	87924

Source: Missan province Agricultural Directorate - Department of Lands, Planning and Follow-up - Unpublished data – 2000-2019.

Acres in 2019, a decrease of 43%. In the eastern region, the areas decreased Cultivated from 21,000 Acres to 10949 Acres for the same agricultural seasons, with a decrease of about 48%. As for the crops of vegetables, they are the other, their agricultural areas decreased due to the salinity of the soil and the water of the Tigris River used in irrigation operations. The agricultural seasons mentioned in the Judicial Center decreased from 5502 Acres in 2000 to 383 Acres, i.e., a decrease of 93%, and in the eastern region it decreased from 1761 Acres To 143 Acres for the same agricultural seasons, with a decrease of about 92%.

Conclusion

After looking at the most important reasons that led to the problem of salinity in Ali Al-Gharbi district, we can summarize the most important natural causes that led to the exacerbation of this problem, the most important of which are:

1- The effect of salinity on the production of agricultural land varies, so the relationship is inverse between them, and the higher the degree of salinity concentration in the soil, it will lead to a decrease in the quantity of production, and this varies from soil to another according to the nature of its texture as well as the type of crop grown in it, for example the productivity of the cultivated

land reaches In the barley crop to its maximum when its salinity is (8ds / m), as it is one of the crops that tolerates very high soil salinity, thus the production quantity decreases by 10% when the level of salinity rises 10 ds / m and thus applies to the rest of the crops according to their sensitivity to soil salinity.

2- The climate factor has a continuous effect on the increase and accumulation of salts on the soil surface in the Ali al-Gharbi district, as the district received large amounts of solar radiation, whose annual average reaches 9.5 hours, which increases in some months to 14 hours / day, which made the degrees of higher levels The temperature, which sometimes reaches 46 degrees Celsius, which led to a high rate of evaporation of water from the surface of the soil, whose rates in July reach more than 560 millimeters. All these things made the soil covered with a layer of salt affecting its lack of agricultural production.

3- Irrigation water from the Tigris River contributed to the high level of salinity in the soil of the district, especially in areas far from the riverbed (basins soil). Which made this case in increasing the quantities of salts in these soils and with the help of high temperatures and evaporation from the soil surface in the lack of suitability for agricultural production due to salinization.

4- The variation of different soil textures in district soils contributed to the increase of salinity in the surface of its soil through its capillary property, which helps the rise of groundwater to its surface, which also varies from one soil to another, and which this property increases in clay soils that have the ability to absorb Underground water is from a depth of up to 60 cm. The characteristic increases in sandy soils that have the ability to absorb from a depth of up to 150 cm.

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