

# LETTER OF ACCEPTANCE

**Journal of Global Ethics**

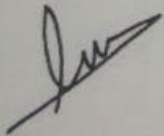
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We are pleased to inform you that your paper titled “**Spatial analysis of geo-terrestrial factors (soil and surface) and their impact on the cultivation of barley crop in the province of Babylon**” has been accepted for publication in the Journal of International Ethics and will appear in Volume 19, Issue No. 2, 2023 I take this opportunity to thank you for your interest in the GGE Center, and I wish you all the best in your future endeavors.

**Managing Editor**

Sirkku Hellsten



**Date Issued**

*May23, 2023*

# **Spatial analysis of geo-geographical factors (soil and surface) and their impact on the cultivation of barley in Babylon Governorate <sup>(\*)</sup>**

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## **Abstract :-**

The research showed that the geo-geographic factors (soil and surface) in Babil Governorate have a close relationship with the cultivation of the barley crop, and the study area has soil and surface potential suitable for the growth and cultivation of the barley crop. It became clear that the cultivation of the barley crop is widespread in all administrative units in the study area, but the widest spread of its cultivation It appears in the southern and southeastern parts of it. The average productivity of the barley crop in the governorate reached (457) kg/dunum for the year 2021, and the Al-Qasim district center ranked first with a productivity of (504) kg/dunum, while the Nile district came in last with a productivity of (410) kg/dunum, while the The rest of the administrative units are in between.

## **the introduction :-**

Fodder crops, including barley, play an important role in the development of livestock. The study area is among the important Iraqi governorates in the cultivation and production of fodder crops of various types. Fodder crops are used to feed animals in different ways. Either the animal feeds on them directly by grazing in cultivated fields. With green fodder, or fodder is given to the animal after drying it and is known as (hay) <sup>(\*\*)</sup> or in the form of (silage) <sup>(\*\*\*)</sup>, as wealth depends.

Animals are fed on concentrated fodder, the most important sources of which are barley grains, and the hay produced from crop stubs and the cuttings of these stubs after harvest are also used for grazing animals.

The problem of the study is represented by asking about the relationship of geo-geographical factors (soil and surface) and their impact on the cultivation of barley in the governorate? The

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**\*. Research extracted from a master's thesis titled (Geographic analysis of fodder crop production in Babylon Governorate and its development potential)**

**\*\* Hay:** It is a green fodder crop that is cut and dried so that it can be preserved for a long period during which it remains suitable for feeding animals. The farmer resorts to making hay when the production of his green fodder crop exceeds the needs of his livestock during the growing season. For more information, see: Ali Ali Al-Khashin and Mahmoud Muhammad Habib, Rules of Crop Cultivation, 6th edition, Dar Al-Maaref, Cairo 1977, p. 359.

**\*\*\* Silage:** The silage process is based on mowing and cutting the green fodder at an appropriate growth stage, then storing it directly in a sealed pit for the purpose of creating a place isolated from the air. This leads to anaerobic fermentation of the sugars and carbohydrates present in the green fodder and the production of acids such as butyric, lactic, and acetic. It helps provide a suitable environment for preserving green fodder for a long time. The silage making process aims to obtain a material that retains a high nutritional value that is close to its value in the initial state of the crop before it is silted.

For more: Hussein Saleh, Faisal Al-Baraka, and Ahmed Khreisat, Silage manufacturing and its use in feeding ruminants, National Center for Agricultural Research and Extension, The Hashemite Kingdom of Jordan, 2008, p. 5.

hypothesis of the study is that the geographical factors (soil and surface) in Babil Governorate have a close relationship with the cultivation of the barley crop, and that the study area has potential soil and surface suitable for the growth and cultivation of the barley crop? This study aims to analyze the effect of geo-geographical factors (soil and surface) on barley productivity in Babil Governorate and to determine the suitability of the available land resources in the study area with its barley requirements.

The study area is determined by the administrative borders of Babylon Governorate. Babylon Governorate is located astronomically between latitudes (-32.7) north and (-33.8) north and between longitudes (-43.42) east and (-45.50) east, and geographically it is located to the north of them. Baghdad Governorate, and to the south, Al-Qadisiyah Governorate and Najaf Governorate. To the east, it is bordered by Wasit Governorate, and to the west by Anbar Governorate and Karbala Governorate, Map (1). The area of the governorate is (5,308,542) km<sup>2</sup>, constituting a percentage of up to (1.2%) of the area of Iraq, which amounts to (435,052) km<sup>2</sup> (\*), and it is divided administratively into (7) Districts, Table (1).

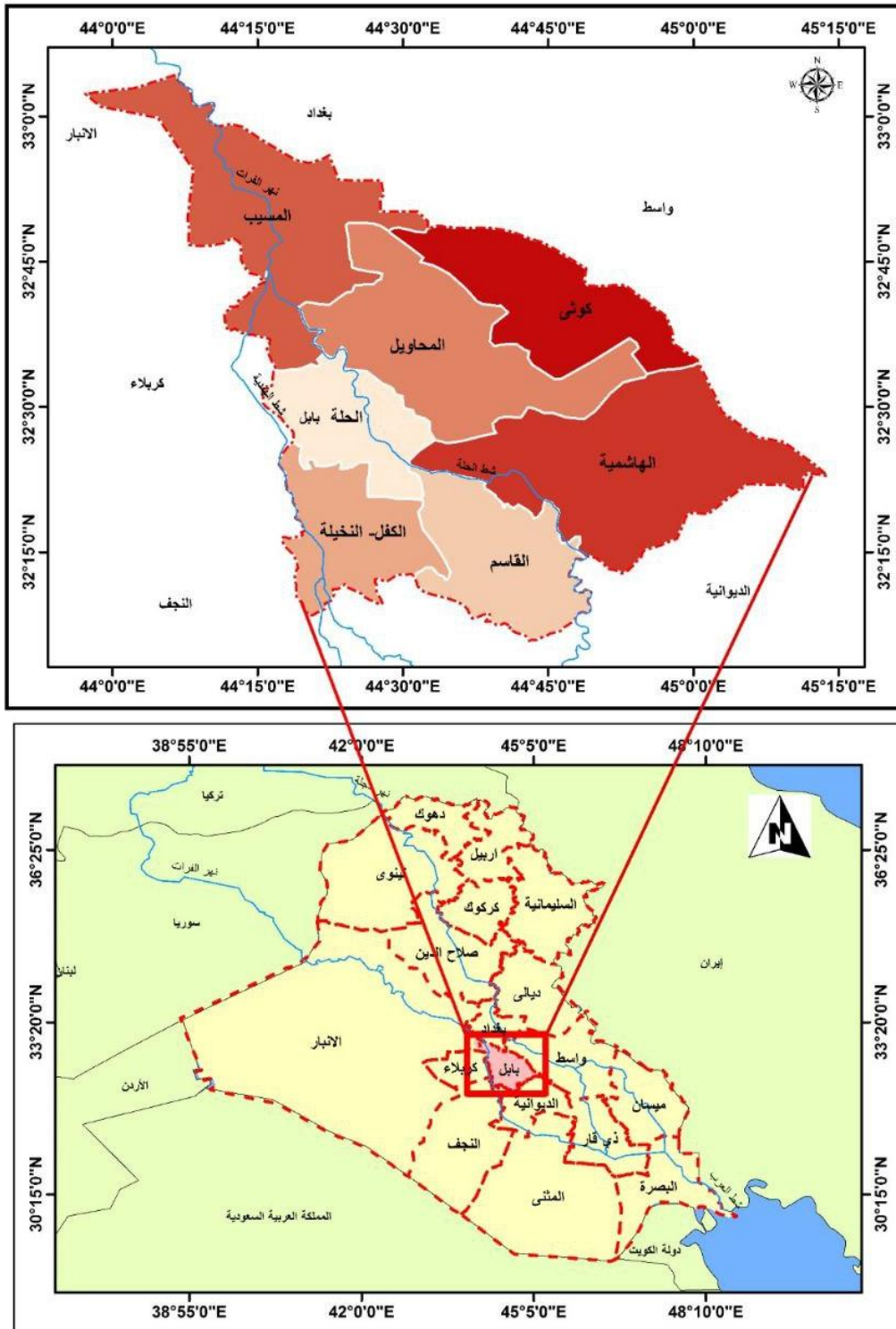
**Table (1): Administrative units and their area (km<sup>2</sup>) in Babil Governorate**

the governorate (%)	area km <sup>2</sup>	relative to	District
4.8	256.83	Hilla District Center	Hilla district
3.4	182.144	My father's side drowned	
5.4	223.494	Mahaweel District Center	Mahaweel District
4.2	223.494	AL-Imam city	
8.6	456.236	AL-Nile city	
1	54.808	Al-Hashimiya District Center	Hashimiya District
10.9	576.952	Al-Madhatiya district	
10.6	563.233	Al-Shumali district	
0.2	10.934	Musayyib District Center	Al-Musayyab district
4.9	260.764	Hindi dam	
6.6	350.789	Victory cliff	
7.1	377.497	Alexandria	
4.6	244.787	Kothi District Center	Kuthi district
7.6	403.871	Al-Baqir	
3.5	185.071	Al-Qasim District Center	Al-Qasim district
5.5	293.125	Al-talieat	
1.9	99.475	Al- Ibrahimiyah	
9.1	482.359	Al-Nakhila District Center	Al-Nakhila District
100	5308.542	Total	

Source: Babylon Planning Directorate 2022, unpublished data

\* Republic of Iraq, Ministry of Planning, Central Bureau of Statistics, Annual Statistical Collection for the year 2019, Natural Conditions, p. 3.

Map (1) Location of Babil Governorate in Iraq and its administrative units



Source: Researcher relying on :-

1. The Republic of Iraq, the Ministry of Water Resources, the General Directorate of Survey, the Maps Production Department, the administrative map of Iraq, a scale (300000000: 1). 2019
2. The Republic of Iraq, the Ministry of Water Resources, the General Directorate of Survey, the Maps Production Department, the administrative map of Babil Governorate, scale (500,000: 1). 2019

As for the study methodology, the study of geographical research relied on the principle of description and analysis mainly because it is the most important basics of geographical research, and the research was relied on on the descriptive analytical approach with the use of the statistical quantitative method according to the requirements of the study.

### **The first topic**

#### **Earth geographical factors (soil and surface) in Babylon Governorate**

Agricultural production depends on the natural factors in a great degree, especially the nature of the surface and the type of soil are all facts that are important in agricultural production. This topic deals with the geographical factors that affect the cultivation of barley crops in Babil Governorate, and will be clarified as follows:

##### **First: the surface:**

The surface is one of the natural factors affecting the uses of the agricultural region, as agricultural processes are determined in light of the external form of the terrestrial terrain, and therefore the first stage facing the agricultural product is to find the appropriate surface that is consistent with the nature of agricultural production, whether it is linked to the nature of the crop Or in the nature of the processes that the crop needs <sup>(\*)</sup>

Babil Governorate is part of the sedimentary plain in Iraq, which is of flat lands that slowly descend to the southeast, as the equal height line (44) m above sea level passes in its northern sections and the height line (20) m in its southern sections, map (2), The degree of the general decline of the surface of the region does not exceed (1/0.00011) meters from the northwest to the southeast, and the surface of the region comes from the northwestern sides towards the eastern and southeastern sides, and its effects have been reflected on the tables and irrigation channels, and this land is an easy to help agriculture and bring the population to prepare Great leveling the surface helps to preserve the soil that is characterized by its quality and fertility, as well as it helps to extend the various transportation methods.

This general leveling does not mean that there are no local terrain in separate areas of the governorate, especially in the hills located to the north of the city of Hilla with (5 km) and to the southwest of it by (15 km) in which the main hill is about 17 m from the surface level The neighboring lands <sup>(†)</sup> As for the roof sections in Babylon Governorate, they can be mentioned as follows (3):-

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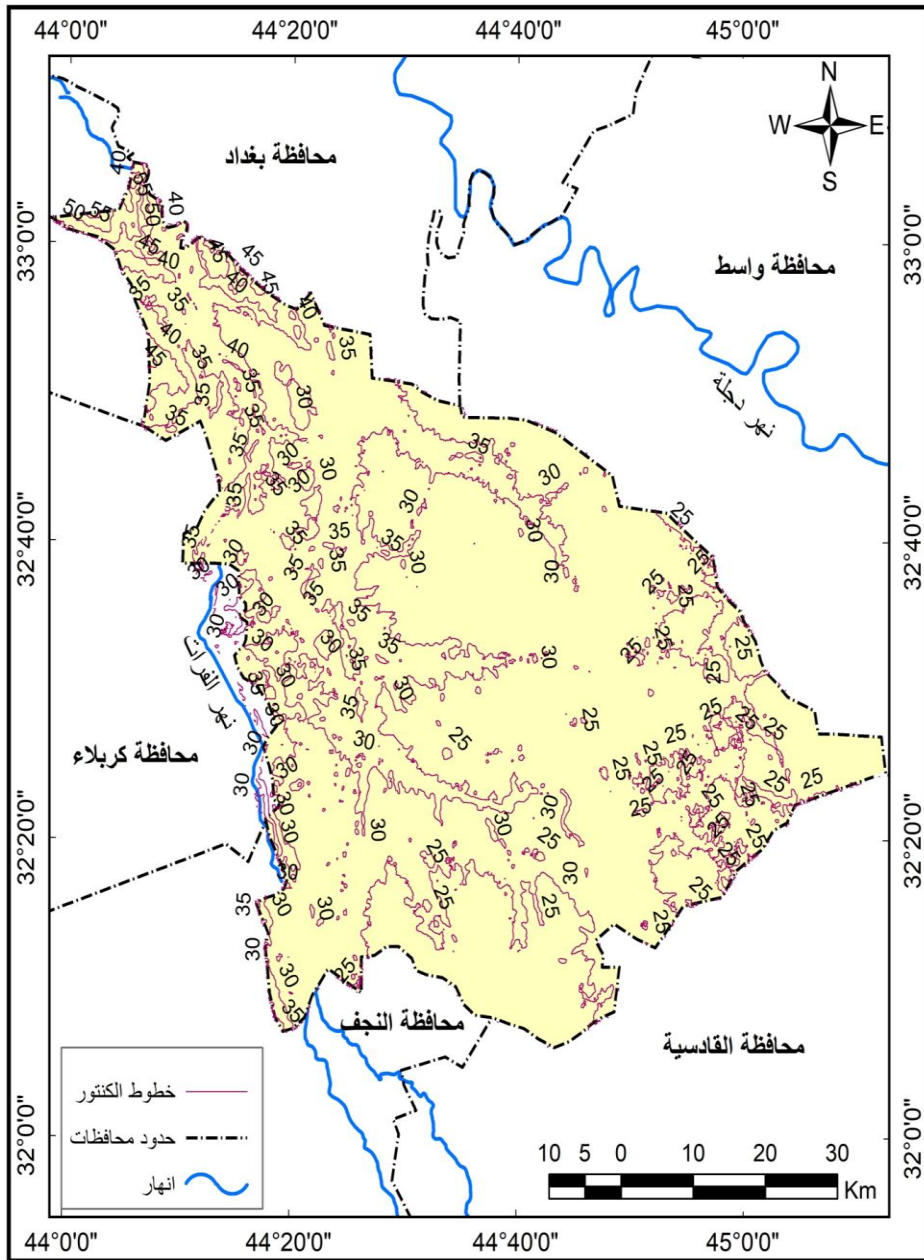
\* Nuri Khalil Al -Barazi and Ibrahim Abdul -Jabbar Al -Mashhadani, Agricultural Geography, 2nd edition, Dar Al -Kutub for Printing and Publishing, Mosul, 2000, p. 45.

† Abdel -Ilah Razouki Karbal, Agriculture of Vegetables and its Future in the Hala Brigade, Master Thesis (Unpublished), College of Arts, University of Baghdad, 1967, p. 24.

### 1- River's shoulders:-

It is one of the most important departments of the roof in the study area from the agricultural point of view, due to its height and the low level of internal water in it, as well as the quality of its soil, appears in the form of a long range from the far northwest of the study area to the south on both sides of the Euphrates River and its Sen (Shat Al -Hilla and Shatt al -Hindi).

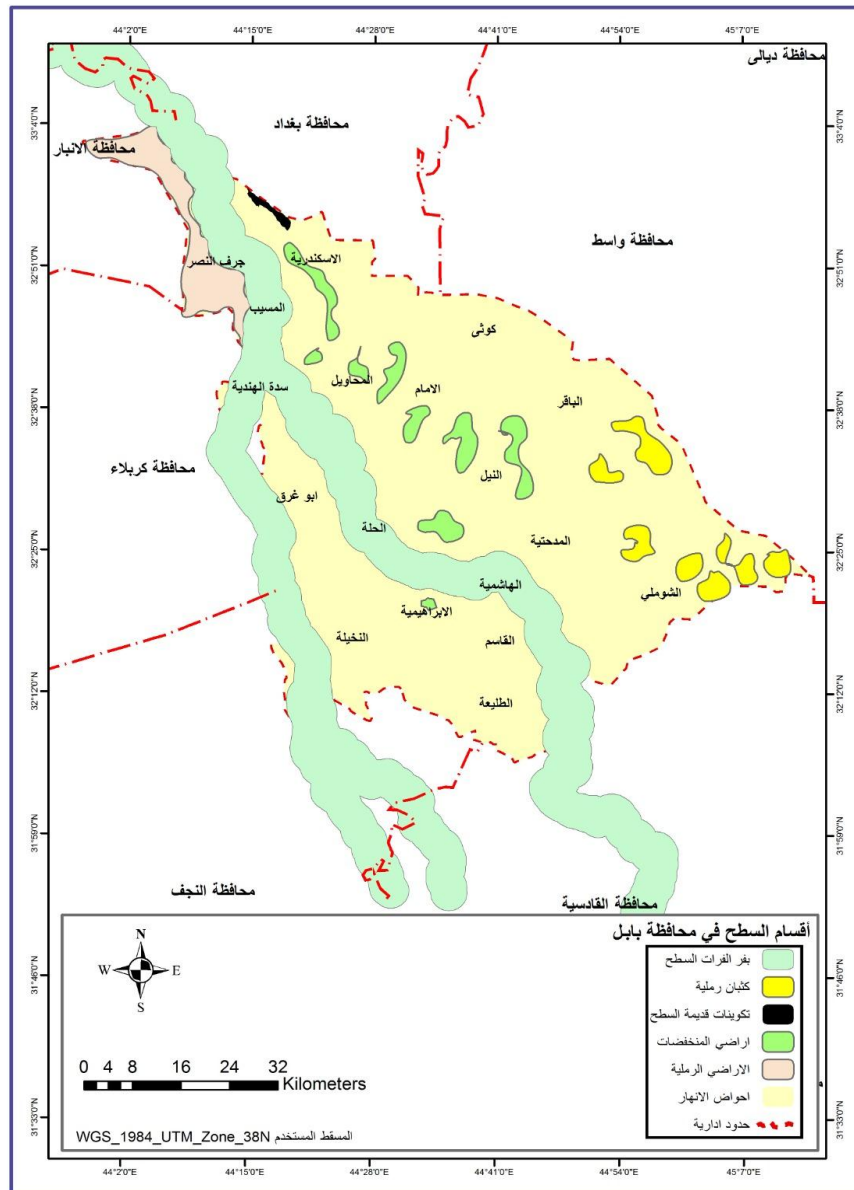
Map (2) Equal Rights Lines for Babylon Governorate



Source: Satellite visualization of the DEM type (Digital Molding Model) for the year 2015, processed using Arc Map 10.5 program.

It is higher in the northern parts than it is in the southern parts, and its height in the northern parts reaches (8) meters above the surface level of low-lying lands far from the river, while the height in The southern parts are about (only two metres )<sup>(\*)</sup> which explains the good drainage in the northern section, in addition to the fact that its soil has a rough texture and high porosity. Therefore, it has become an area of great importance in agricultural activity, especially the cultivation of barley.

Map (3) of the surface sections in Babil Governorate



Source: Abdul-Ilah Razouki Karbal, Vegetable Cultivation and its Future in the Hilla District, Master's Thesis (unpublished), College of Arts, University of Baghdad, 1967, p. 24

\* Israa Hussein Obaid Ali, Regional Geography of Babylon Governorate, Master's Thesis, College of Education, University of Babylon, 2015, p. 35

## 2- River basins

It occupies most of the area of the governorate, as it is geographically distributed on both sides of the Shatt al-Hilla and its branches in the study area, map (3). This area was formed from sediments brought by river water, especially in the flood season, and it is composed of sandy clay deposits with good permeability compared to areas far from the rivers. The areas of river basins far from the river shoulder area are lower (2-3 meters) than the areas close to them, and their soil is fine-grained and clayey, with poor permeability and drainage, and excess water drains into it during floods <sup>(\*)</sup>. Due to its large area, this region has become suitable for growing some fodder crops, especially barley.

## 3- Lowlands:-

The depressions are spread in various areas of the governorate within the river basins area, but they differ from them in that they are lower and filled with water throughout the year. It appears that most of these depressions have more water in winter and less in summer, and that the source of this water is underground water (seepage), in addition to rainwater that collects and descends to it from neighboring lands<sup>(†)</sup>. In general, this section is not relied upon for agricultural production except for the cultivation of fodder crops, especially Barley crop.

## 4- Sandy lands:

This region was formed as a result of many factors, perhaps the most prominent of which is the role of winds and air precipitation, which prevail in the governorate to the west of the Euphrates River in the north of the governorate. These dunes take their typical crescent shape and move generally from the northwest to the southeast due to the prevailing winds in the region, which have the same direction. The range of movement of these dunes is between (30-40) meters annually<sup>(‡)</sup> and the height of the dune reaches (3) -6) metres. It is considered an extension of the western plateau in Iraq and begins to decline towards the east in line with the general slope of this plateau. Its surface is covered with sand with fine and medium grains deposited on layers of lime. Due to the nature of its composition, it is not very reliable in agricultural production, as it is often Production is limited to growing barley<sup>(§)</sup>.

## 5- Old formations:-

This small area is a group of hills that are similar to a plateau, which is located north of the study area. It is known as a plateau or hillock (Dhahr Al-Majasa), and it is one of the barren hills known in the alluvial plain. This hill is considered a continuation of the hillock that extends from Fallujah to the Euphrates River and then begins from

The directly opposite side of the river ends in Alexandria, extending from Fallujah to Alexandria, and is cut in half by the Euphrates River. This area is approximately 6-9 m above the level of its neighboring lands and is located to the north of the Alexandria Stream. It is made up

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\*. Nada Mohsen Amin Al-Khafaji, Geographical analysis of the poultry region of Babylon Governorate for the period (1999-2009), a study in the geography of agriculture, Master's thesis, College of Education for Human Sciences, University of Babylon, 2011, p. 18

†. Abdul-Ilah Zarrouqi Karbal, Source of Saq, p. 21.

‡. Same source, p. 23.

§. Ali Abdul Amir Al-Abadi, Agricultural Patterns in Babylon Governorate, Master's Thesis (unpublished), College of Arts, University of Baghdad, 1981, p. 14.



of ferrous gypsum sand rocks dating back to the Miocene era. Due to its height, it has become difficult to deliver irrigation water to it, in addition to its soil being unsuitable for agricultural production. Therefore, it appears barren in the middle of the alluvial plain. There are some weeds and thistles that grow on subterranean moisture <sup>(\*)</sup> and are suitable for growing barley, which tolerates drought and salinity.

## **Second : Soil**

Soil is known as the fragile, crumbled layer that covers the surface of the Earth at a height ranging from a few centimeters to several metres. Soil varies from one region to another according to the factors that led to its formation. The most important of these factors are the original rocks, vegetation, climate, living organisms, and time. In addition to humans <sup>(†)</sup>. The soil requirements of fodder crops vary depending on the type of crop. Barley, despite its resistance to salinity compared to other crops, can grow in soils with a salinity of 16 mm/cm, and fodder crops achieve significant growth in soils whose degree of interaction is close to neutral <sup>(‡)</sup>. The soil in the study area is of the type of transported sedimentary soil. Because the governorate is located within the alluvial plain of Iraq, its soil is classified as a riverine soil. Such soils are formed as a result of the accumulation of various materials carried by rivers, whether they are dissolved salts or crumbled rocky materials that have been added to those. River and water sediments are sediments brought by the wind from areas located outside the alluvial plain or from other sedimentary areas that formed air sediments. Accordingly, the soil in the governorate is considered a type of transported soil. It consists of layers that differ in texture and mineral composition within the soil section, in addition to being generally flat topographically, and characterized by depth and continuous renewal through its coverage with light layers of soil transported by river water and river streams <sup>(§)</sup>. Map (4) shows us the types of soil as follows :-

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\* . P.Buringh. soil and soil Condition in Iraq , 1960, Baghdad, p.

† . Alan Strahler, Arthur Strahler , Introducing Physical Geography, Second Edition, New York, 1999, p . 239.

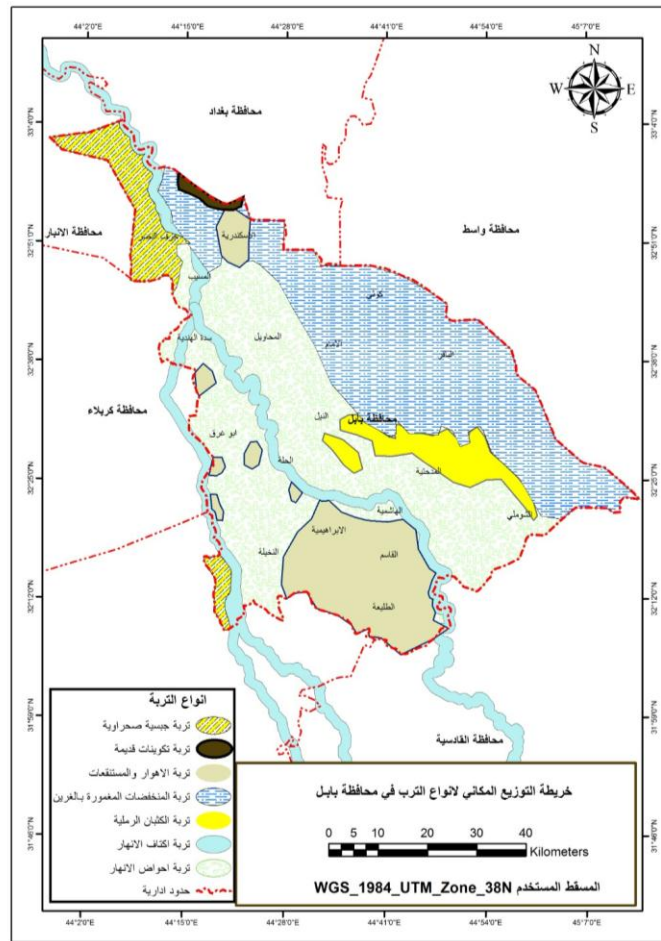
‡ . Samar Muhammad Ghayyad, Obstacles to the agricultural development of fodder crops in Dhi Qar Governorate, Master's thesis, College of Arts, Dhi Qar University, 2022, p. 44.

§ . Abdul Ilah Razouki Karbal, Ali Sahib Al-Moussawi, Abdul Hassan Madfoun, Natural Geography of Babylon Governorate, Hilla Cultural Encyclopedia, Babylon Center for Cultural and Historical Studies, University of Babylon, 2012, p. 35.

## 1- Soil of river shoulders.

This area of soil appears along with the geographical extension of the Euphrates River and the Shatt al-Hilla, and in the form of a strip of the network of rivers and irrigation streams, starting from the northwestern part of the governorate until it reaches the city of Al-Hashimiya, as well as up to the city of Al-Kifl on the branches of the second Euphrates, Shatt Al-Hindiyya<sup>(\*)</sup> and since it is located above the Ektaf area. Natural rivers have the characteristic of being high compared to the rest of the areas of the floodplain, and a low level of groundwater at a depth ranging between (2, 3)<sup>(†)</sup> m. The soil of the river shoulders is characterized as having a medium texture, with the percentage of clay separations ranging between (40 - 44.8%)., silt (32 - 43.7%) and sand (14 - 28%), and thus it is a mixture of alluvial and clayey soil, Table (1).

Map (4) soil types in Babil Governorate.



Source : Burring.p. soil and soils condition Iraq .1960

\* - Abd al-Ilah Razouki Karbal, Soil Characteristics and Geographical Distribution in Babil Governorate, Journal of the College of Arts, Fifth Year, Issue 6, 1972 AD, p. 124

† . Ibrahim Sharif, Ali Hussein Al-Shalash, Soil Geography, Baghdad University Press, 1985 AD, p. 215 .

It is also neutral soil, as the soil reaction rate (ph) <sup>(\*)</sup> reached (7.5%), and it is low in salinity, as its percentage reached (5.0) mm/cm <sup>(\*\*)</sup> . It also contains (2.5%) of lime and (0.4%). Gypsum, and the percentage of organic matter in this soil increases, reaching (3.1) Table (2).

Table (1) Some physical properties of the soil in some locations in Babil Governorate to a depth of (30 cm)

Soil type / texture	clay %	Alluvial %	the sand%	Soil classification	Sample location (county name and number)	Administrative units
Mixed / sandy coarse	14.3	15.h	70	Gypsum stone	Muwailiha / 35/1	Alexandria district
Alluvial mixture i/medium	40	32	28	Collapsed shoulders	alkhawas 99/11	abi gharaq district
Alluvial clay/medium mix	44.8	40.a	15	Collapsed shoulders	Al-Muradiya / 20/15	Al-Nakhila District Center
Alluvial clay/medium mix	42.3	43.h	14	Collapsed shoulders	Mansouriya/6/5	Musayyib District Center
Medium/medium silty clay mixture	41.9	43.1	15	Collapsed shoulders	South Al Saddah / 13/1	Al-Saddah district
Clay/soft	49.4	30.kh	20.1	Depressions	Al-Wa'aa / 12/1	Al-Qasim district
Clay/soft	50.2	30.z	19	Depressions	Albu Hamid 1/2	altaliea district
Sandy/rough	7.6	22.4	70	Sand dunes	Mashimish/4/1	Al-Madhatiya district
Sandy/rough	6.7	Put	75	Sand dunes	Mashimish/4/1	Nile district
Mixed sandy/coarse	9	11	80	Desert gypsum	North Al Jurf /33/1	Jurf Al-Nasr district
Mixed silty/soft clay	40.3	40.a	19.5	River basins	Lamloum/12/1	Kuthi District
Mixed silty/soft clay	41.5	40.kh	18	Buried	aleibarat /19	Alamam District
Mixed silty/soft clay	45.3	40.h	14	River basins	Al Jazeera /14/1	Al-Shumali district
Mixed silty/soft clay	40.4	45.i	14	Buried	Al-Awara /9/2	Mahaweel District Center
Mixed silty/soft clay	44.2	40.kh	15.3	River basins	Amadiya/6/10	Al-Hashimiya District Center
Mixed silty/soft clay	40.4	44	15.6	Buried	dawrat wahminiatur/17/2	Hilla District Center

Source : Zainab Abbas Musa Al-Sarhan, Spatial Analysis of Agricultural Development Potential (Plant Production) in Babil Governorate, PhD thesis, College of Education for Girls - University of Kufa, 202, p. 68

Table (2) Some chemical characteristics of the soil in some locations in Babil Governorate to a depth of (30 cm)

\* It is a measure that expresses the degree of acidity or alkalinity of the soil. The pH ranges between (1-14) with an average rate of (7), which indicates neutrality. Based on the average limit, it is possible to know whether the soil is acidic or alkaline as follows: 1- Acidity (1) , 2, 3, 4, 5, 6) 2- Basra (8, 9, 10, 11, 12, 13, 14): Ali Hussein Al-Shalash, Soil Geography, 2nd edition, Basra University Press, College of Arts, University of Basra, 1985 , p. 52.

\*\* It is a unit of soil salinity measurement and is divided into (4) sections:

1- Less than (4) mm/cm for non-saline soil

2- From (4-8) mm/cm in low-salinity soil

3- From (8-16) mm/cm in medium salinity soil

4- More than 16 mm/cm high salinity: Ahmed Haider Al-Zubaidi, Soil salinity, theoretical and applied foundations, House of Wisdom, Baghdad, University of Baghdad, 1989, p. 161.

Gypsum %	Lime %	EC mm/cm	PH%	Organic matter	Soil classification	Administrative units	T
25.5	10.6	1.3	7.9	0.1	Gypsum stone	Alexandria district	1
0.4	25.0	3.7	7.5	3.1	Collapsed shoulders	abi gharaq district	2
0.5	25.1	5.2	7.8	3.0	Collapsed shoulders	Al-Nakhila District	3
0.3	20.8	4.9	7.5	3.2	Collapsed shoulders	Musayyib District Center	4
0.4	25.1	6.4	7.6	3.1	Collapsed shoulders	Al-Saddah district	5
25.0	20.1	2.6	7.8	0.1	Depressions	Al-Qasim district	6
23.8	19.6	15.2	8.2	0.3	Depressions	altaliea district	7
1.3	18.0	4.2	6.8	0.2	Desert gypsum	Jurf Al-Nasr district	8
1.2	23.3	6.0	6.8	0.3	Sand dunes	Al-Madhatiya district	9
1.5	18	4.8	6.7	0.1	Sand dunes	Nile District	10
4.0	25.5	7.3	7.3	1.0	Buried river basins	Al-Shumali district	11
3.5	23.4	7.5	7.5	1.7	Buried river basins	alamam District	12
3.7	22.0	7.1	7.8	1.5	Buried river basins	Kuthi District	13
1.2	21.20	10.2	7.7	2.0	Poor river basins	Mahaweel District Center	14
1.0	20.0	8.2	7.1	1.9	Poor river basins	Hilla District Center	15
1.2	33.4	9.8	8.9	1.4	Poor river basins	Al-Hashimiya District Center	16

Source : Zainab Abbas Musa Al-Sarhan, Spatial Analysis of Agricultural Development Potential (Plant Production) in Babil Governorate, PhD thesis, College of Education for Girls - University of Kufa, 202, p. 69

According to these characteristics, this soil is considered one of the most suitable types of soil for agricultural work in the study area compared to other types of soil, and it has very good productivity. As a result of its height, the slope of its surface, the fertility of its soil, and the high percentage of organic matter due to the density of plant cover, it has therefore become the best agricultural areas, which encourages agriculture. Fodder crops, especially those that need low-salt, well-drained and aerated soil, such as millet and yellow corn, and the use of modern techniques in their cultivation.

## 2- Soil of river basins.

It occupies a large area of land in the governorate, and is distributed in the parts confined between the Al-Musayyab project in the north and the Babylon and Nile creeks in the south, as well as the parts located between Shatt Al-Hilla and Shatt Al-Hindiya. It is characterized by a lower level between (2-3) m below the level of the soil of the shoulders of the rivers<sup>(\*)</sup>. This soil was composed of River sediments transported by rivers and irrigation streams, and as a result of the differential sedimentation process of rivers coming from the north of the study area, so their particles in the north of the study area are larger in size than they are in the south, as it is natural that the large particles of sediment are deposited before the small particles, and the soil of the basins is characterized by Bad rivers have a smooth texture, with varying levels of clay separation

\*. Ali Abdul Amir Aboud Al-Abadi, previous source, pp. 35-36.

Between (40.4 - 2.44%), silt (40.5 - 45.6%) and sand (14 - 15.6%), and thus it is a clay-silty mixture soil (Table (1). It is also neutral soil as the soil reaction rate reached pH (7.9%). It is a medium-salinity soil, as its percentage reached (9.4) mM/cm, and the percentage of lime is (21.5%) and gypsum (1.1%), and the percentage of organic matter in this soil is (1.7%), Table (2). This soil is considered one of the most suitable types of soil for growing barley.

### 3- Soils of depressions flooded with silt:

This type of soil appears in the southernmost part of the study area, in the lands located between the two shores (Al-Hilla and Al-Hindiya), and in small scattered areas in the center and north of the study area, map (4). This soil is represented in the relatively low parts of the river basin area, and the soil of the lowlands is characterized as clayey soil with a fine texture, with the percentage of clay separations ranging from (49.4 - 50.2%), silt (30.5 - 30.8%), and sand (19 - 20.1%). Table (1) It also contains a high percentage of lime, amounting to (19.8%), while the percentage of gypsum reached (24.4%). It is characterized by its poor drainage, in addition to the depth of its underground water, which ranges between (1.5 - 2.5) m, but the salts are concentrated in it to a percentage Medium to high during periods of permanent irrigation, as its salinity reached (2.6-15.2) mM/cm, while its pH rate reached about (7.8%), and thus it is a saline or highly basic soil, and the percentage of organic matter in it reached (0.1-0.3%) (Table (2).

### 4- The soil of marshes and swamps.

This soil is located in the southern part of Babil Governorate, between the edges of Shatt al-Hilla to the east and Shatt Hindiyah to the west, around the northern edges of the former Ibn Najm marsh. In the winter, while in the summer it drops to about two meters above the surface of the earth <sup>(\*)</sup>, and therefore it was and is still used as areas for draining flood waters, except for its northern sections, and it was covered by the waters of the Ibn Najm Marsh, but the operations of constructing ditches and canals led to its drying up in 1995 AD <sup>(†)</sup>, The soil of the bottoms of river basins buried in silt is characterized by its poor drainage as it has a soft texture, with the percentage of clay separations ranging from (40.3 - 45.3%) and silt (40.2 - 40.7%) and sand (14-19.5%), and thus it is a silty-silty mixture soil (Table 1), and the ground water level in it rises, especially in the lower parts of the river basin, despite the depth of the underground water, which ranges between (5.1 - 5.2), and it reaches The percentage of organic matter in this soil is (1.0-1.5%), and the percentage of lime is (23.6%) and gypsum (3.7%). It is also low in salinity, reaching (7.3%) mM/cm, while the pH rate is about (7.5%). Table (2). Therefore, they are neutral soils and less suitable for agricultural investment than the river shoulders area. The agricultural potential of these areas is weak as a result of the severe decline of their surface below sea level, the high level of groundwater, and the increased concentration of salts in them. Although large areas of them are affected by salinity, It is used to grow fodder crops due to its suitability to these conditions.

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\* . Dia Bahij Raouf Al-Quraishi, Manifestations of Harsh Weather in Babylon Governorate and Their Environmental Impacts, College of Education for Human Sciences, University of Babylon, 2013, pp. 78.

† . Ali Karim Muhammad Ibrahim, Maps of the Environmental Potential for Cereal Crops Production in Babil Governorate Using Geographic Information Systems (GIS), Master's Thesis, College of Arts, University of Baghdad, 2007, p. 112.

## 5- Sand dune soil.

It appears in a small area in the middle of the southeastern part of the study area on map (4). It was formed from aeolian deposits, as the wind transported its components from neighboring areas devoid of plants, such as: desert areas and floodplains of rivers, as the size of the materials carried by the wind ranges from small sand particles to fine silt and clay particles. There is also another source for the formation of this soil, which is represented by materials transported from The bottoms of ancient rivers that were filled with dissolved sediments <sup>(\*)</sup>, and the soil of sand dunes is characterized as a sandy soil with a coarse texture, with the percentage of separated sand (70-75%), clay (6.7-7.6%), and silt (18.3-22.4%), Table (1) The pH rate reached about (6.7%), and thus it is acidic soil. Its salinity is low, reaching (4.8) mM/cm. It contains a high percentage of lime, amounting to (19.7), while the percentage of gypsum is no more than (0.1-0.3%) Table (2). The investment of this soil depends on the processes of stabilizing and leveling the sand dunes and delivering water to them, especially since it needs large quantities of water due to its high permeability and the addition of natural fertilizers, especially organic ones, which leads to an increase in its ability to retain water and thus it is a soil suitable for agriculture. In general, sandy soil is warmer and suitable. To produce some agricultural yields, especially legume and root crops and fodder crops <sup>(†)</sup>.

## 6- Mixed desert gypsum soil.

This soil occupies a small area in the study area in its far northwest, in intermittent forms. It is a light layer that reaches only a few centimetres. It contains few organic materials because its plant and animal cover is poor. Its source is the desert in Anbar Governorate due to the dominance of northwestern winds over the region. The soil is characterized by Mixed gypsum desert is a mixed sandy soil with a coarse texture, consisting of (80%) sand, (11%) silt, and (9%) clay, Table (1). The wind and water moved the atoms to their current locations. In general, the surface of this soil is devoid of natural vegetation due to its light soil with high porosity and the low ground water level in it, which makes it very poor in organic matter <sup>(‡)</sup>, as the rate of organic organic matter in it is (0.2). It is a neutral soil, as its pH rate is about (6.8%), and its salinity is low, amounting to (4.2) mM/cm, and the percentage of lime is (21.5%) and gypsum (1.1%) (Table (2), and as a result of these characteristics It is an agriculturally unexploited soil, but it can be exploited by growing fodder crops, especially those that tolerate salinity and the lack of organic matter in the soil.

## 7- Soil of ancient formations.

This soil appears in a small area north of the study area (northeast of Alexandria district), and it consists of fragments of gypsum sand rocks dating back to the components of the Miocene era (). The gypsum gravel soil is characterized as a mixed sandy soil with a coarse texture, as the percentage of sand separations reached (70 %), clay (14.3%) and silt (15.7%). It also contains a high percentage of gypsum, amounting to (25.5%), while the percentage of lime reached (10.6%) (Table (1). It is also a neutral soil, as its pH averaged about ( 7.9%), and non-saline as its salinity rate reached (1.3%) mM/cm, and it is a very poor soil in organic matter, its percentage reached

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\* . Saif Zahir Jabr Al-Shammari, A Digital Geographic Atlas of Economic Activities in Babylon Governorate, Master's Thesis, College of Education, University of Babylon, 2018, p. 34.

† . Ali Karim Muhammad Ibrahim, previous source, p. 111

‡ . Samah Ibrahim Shamkhi Hamid Al-Halawi, previous source, p. 27.

(0.1%) (Table (2)). The reason for this is that its surface is devoid of natural vegetation and is therefore unsuitable soil. For agriculture.

### **The second topic : The reality of barley cultivation in Babil Governorate**

The scientific name for barley is (Barley), and it is a winter crop that belongs to the Grass family (Gramineae) and the genus (Herdeum), as barley is one of the oldest crops that humans domesticated and cultivated before Christ. Some scientific references state that the original homeland for growing barley is the continent of Asia, especially Iraq <sup>(\*)</sup>, as Its grains are used in making bread after grinding and mixing them with yellow corn flour in poor regions of the world <sup>(†)</sup>. It is considered one of the best fodder crops used in feeding animals ( concentrated feed ), especially for sheep. It has good nutritional value as it contains an amount of protein substances ( 12.9%), carbohydrates (72.4%), fibers (7.1%), fats (3.6%), and minerals (4.0%) <sup>(‡)</sup>. The amount of dry matter consumed by a head of sheep is estimated between (2.2-4.1%) and (2.0-2.7%) in beef cattle (calves) and vary according to the age of the animal <sup>(§)</sup>, in addition to the importance of harvest residues (butts and hay), as barley hay is better than straw. Wheat, because it is softer and more palatable to all animals raised in the governorate, especially sheep, goats, and camels, is served crushed and mixed with bran in certain proportions to feed cows and buffaloes. Therefore, it is used as green fodder by the animals, or it is harvested and presented to them as concentrated fodder (grains) or as fodder mixtures, provided that it does not More than (50%) in the components of the feed <sup>(\*\*)</sup>.

Among the barley varieties grown in Iraq is the Marriott variety, which is more resistant to salinity and drought. The Baladi variety (265) and Montcolm and Arifat are among the most common varieties. However, the cultivation of these varieties has begun to decline, especially in the study area, where new types of barley crop have been hybridized that are more productive and resistant to the conditions. Different environmental types, including: Samir, Mahli and Abad <sup>(††)</sup>.

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\* . Kamel Saeed Jawad and Sayed Irfan Rashid, *Field Crops Production in Iraq*, Al-Rassam Offset Press, Baghdad, 1981, p. 145.

† . Waiting for Ibrahim Hussein Al-Musawi, *Spatial Analysis of Agricultural Land Use in Al-Qadisiyah Governorate*, PhD thesis, College of Arts, Al-Qadisiyah University, 2007, p. 160

‡ . Faryal Farouk Hussein Al-Dahi, *The effect of breed and source of vegetable protein on the production and composition of cow's milk*, Master's thesis, College of Agriculture, Tikrit University, 2002, p. 13.

§ . Muhammad Fouad Al-Rabbat, Abdullah Abu Zakhm, *Basics and Methods of Pasture Maintenance*, Damascus University Press, Damascus, Dr. T, p. 213.

\*\* . Abdul Hamid Ahmed Younis, *Barley Cultivation*, Ministry of Agriculture, General Authority for Agricultural Guidance and Cooperation, Guidance Bulletin No. 10, 1997.

†† . Babil Governorate Agriculture Directorate, Plant Production Division, unpublished data, 2022.

Natural factors for its production are available in the study area. Barley is grown in the governorate from mid-October to mid-November to obtain the maximum production and quality of grains. It is harvested in early April. Early planting time leads to damage to pollen grains during the flowering phase as a result of the low temperature at the time. Flowering: Late planting leads to incomplete grain formation and maturity due to the high temperature during the ripening period. Studies have shown that delaying the planting date for a month beyond the appropriate date leads to the production of thin, incompletely formed grains and causes a decrease in yield by (25%). Planting In the study area, barley generally matures earlier than wheat on average (10-14 days), matures earlier than wheat and is harvested about two weeks earlier (\*) .

By observing Table (3), it is clear that the cultivation of barley is widespread in all administrative units in the study area. However, the widest spread of its cultivation appears in the southern and southeastern part of the study area. The areas cultivated with barley vary among the administrative units in the study area. Al-Shumali district topped the list. The rest of the administrative units in the area cultivated with the crop amount to (5000) dunums and constitute (20%) of the total area cultivated with barley in the governorate. The Nile District came in second place with an area of (3027) dunums and a percentage of (12.1%), followed by Al-Madhatiya District in third place with an area of (2750). dunums, representing (11%) of the total area cultivated with barley in the study area, and the smallest area amounted to (350) dunums in the Imam district, which constitutes (1.4%) of the total area cultivated with this crop.

In terms of the distribution of barley production according to administrative units in Babil Governorate for the year 2021, the administrative units in the study area can be divided into four levels, which are classified on the basis of the standard grade (\*) and agency technology, map (5):

- 1- The first level: The standard score ranges between (0.50 + and more), as the standard score for barley production during this level did not reach any significant percentage in the administrative units.
- 2- The second level: The standard score ranges between (0.00 - 0.49+) and includes the Al-Shumali district in the Al-Hashimiya District with a standard score of (0.49), and the reason for this is due to the increase in barley production, which is estimated at (2250) tons.
- 3- The third level: The standard score ranges between (0.01 - - 0.49 -) and includes both the Medhatiya subdistrict in the Hashimiya district with a standard score of (0.27) and the Nile subdistrict in the Mahawil district with a standard score of (0.36), and the reason for this is due to An increase in barley production, estimated at (1348) tons and (1241) tons, respectively.

\* . Abdul Hamid Ahmed Al-Younis and Wafqi Shaker Al-Shamaa, Grain and Legume Crops - Theoretical - Practical, Dar Al-Kutub for Printing and Publishing, Baghdad, without a year, p. 56.

\* . The standard score is a statistical technique used to determine the number of standard deviations by which individual values in a distribution differ from the

arithmetic mean using the following equation :- 
$$\frac{(س-م)}{ع} = د$$
 Where: D = standard score / S = any of the values / S = arithmetic mean / Z = standard deviation

We extract the standard deviation from the following equation: 
$$\frac{\sqrt{\frac{\sum(س-م)^2}{ن}}}{ع} = د$$
 So: p = standard deviation / x = any value of the observations / x = arithmetic mean / n = number of values.

See 1- Muhammad Alaa al-Din Yunus, Nour al-Din Hassan Farhat, Principles of the Statistical Method, Baghdad University Press, Baghdad, 1987, pp. 72-73.

2 - Abd al-Razzaq Muhammad al-Butaihi, The Optimal Use of Quantitative Classification Techniques in Geographic Studies, Ministry of Higher Education and Scientific Research, Dar al-Hekma for Printing and Publishing, University of Baghdad, 1989, p. 16.



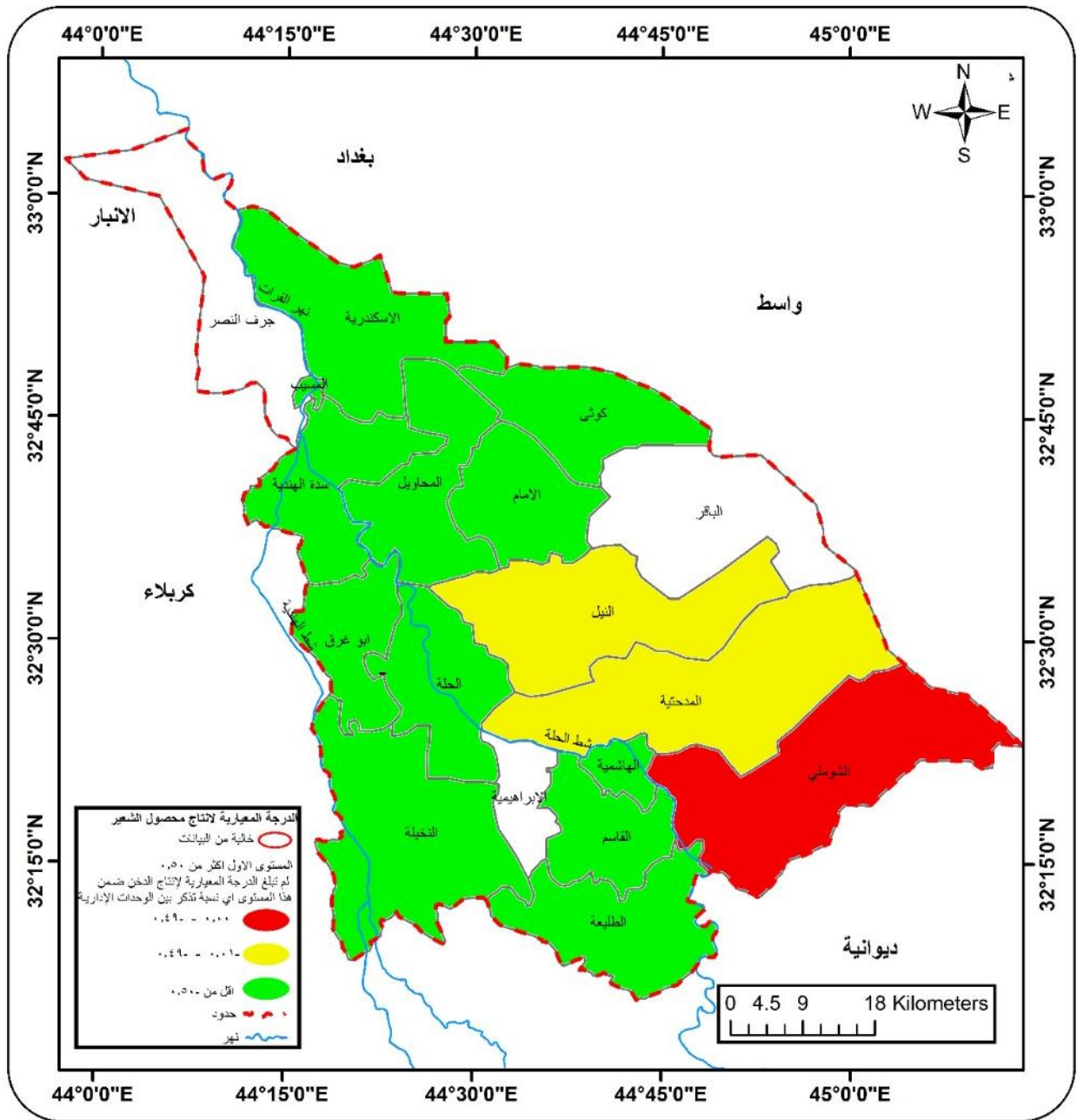
- 4- The fourth level: The standard score ranges between (0.50 - and less), and includes each of the districts (the center of Al-Qasim District, Al-Tali'ah District, the Center of Al-Hilla District, the Center of Al-Musayyab District, the Alexandria District, the Center of Al-Hashimiyeh District, the Abu Gharq District, the Center of Al-Nakhila District, and the District Al-Hindiyya Dam, Kuthi District Center, Al-Mahawil District Center, and Al-Imam District), with a standard score of (0.56 - - 1.27 -), and the reason for this is due to the lack of barley production in these administrative units.

As for productivity, the average productivity of the barley crop in the study area for the year 2021 reached (457) kg/dunum, and it varied between administrative units, as the Al-Qasim District Center ranked first with a barley crop productivity of (504) kg/dunum, followed by the Al-Hashimiya District Center in second place. With a productivity of (500) kg/dunum, while the Nile region came in last place with a productivity of (410) kg/dunum, while the rest of the administrative units came in between.

**Table (3) Geographical distribution of barley production in Babil Governorate for the year 2021**

Standard score	Productivity (kg/acre)	Production / ton	%	Area / acre	Name of the agricultural division	
-0.65	450	900	8.0	2000	Hilla District Center	Hilla district
-1.02	460	460	4.0	1000	abi gharq District	
-1.26	450	180	1.6	400	Mahaweel District Center	Mahaweel District
-1.27	471	165	1.4	350	alamam District	
-0.36	410	1241	12.1	3027	Nile District	
-0.99	500	500	4.0	1000	Al-Hashimiya District Center	Hashimiya District
-0.27	490	1348	11.0	2750	Al-Madhatiya district	
0.49	450	2250	20.0	5000	Al-Shumali district	
-0.81	470	705	6.0	1500	Musayyib District Center	Al-Musayyab district
-1.05	430	430	4.0	1000	Sadda Al-Hindiyya district	
-0.87	424	636	6.0	1500	Alexandria district	Kuthi District
-1.22	450	225	2.0	500	Kuthi district center	
-0.56	504	1008	8.0	2000	Al-Qasim District Center	Al-Qasim district
-0.63	460	920	8.0	2000	Altaliea District	
-1.04	440	440	4.0	1000	Al-Nakhila District Center	Al-Nakhila District
	457	11408	100	25027	The Total	

Source : From the work of the researcher, relying on the Babil Governorate Agriculture Directorate , Agricultural Statistics Division, unpublished data, 2022.



Source: From the researcher's work based on Table (3)

## **Conclusions and suggestions**

### **First: conclusions**

1. The surface of the governorate is characterized by almost complete flatness and low slope, which is very suitable for carrying out the various stages of the agricultural process and the possibility of horizontal expansion. However, this almost complete slope is a major reason for the spread of the salinity problem due to poor natural drainage.
2. It became clear that soil has a major role in the spatial variation in the cultivation of barley in the study area due to the variation in its properties from one place to another.
3. It is clear from the study that the cultivation of barley is widespread in all administrative units in the governorate, but the widest spread of its cultivation appears in the southern and southeastern part of the study area.
4. The average productivity of the barley crop in the study area for the year 2021 was (457) kg/dunum, and the Al-Qasim district center ranked first with a productivity of barley crop amounting to (504) kg/dunum, while the Nile district came in last place with a productivity of (410) kg/dunum. dunums, while the rest of the administrative units came in between.

### **Second : Proposals**

- 1- Establishing a specialized department in the administrative units linked to the Directorate of Agriculture of Babylon Governorate, concerned with analyzing the soil on a regular basis to monitor the change in elements, humidity, and amount of salinity and its impact on production and productivity, and reconsidering the distribution of agricultural crops in a way that suits the nature of the soil in the study area, as well as finding ways to To bring it back to life.
- 2- Establishing an integrated drainage network, especially field and subsidiary sewers in all provinces of the region, and working to purify existing ones on an ongoing basis to alleviate the severity of the salinity problem.
- 3- Work to complete projects to reclaim agricultural lands located outside the boundaries of irrigation in the study area, on which work has stopped since 1990, as the reclamation process was limited to the areas located within the boundaries of irrigation.
- 4- Establishing and updating a database of accurate statistical information and information in each agricultural division, provided that it is linked to the Directorate of Agriculture and the Directorate of Statistics in the governorate.

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