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The effect of climate on the cultivation of cereal crops (rice, wheat, barley) in Shamiya district

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Abstract:

Shamiya district, is considered one of the agricultural -governorate , including Al Qadisiyah-Al governorates, due to its natural components and a favorable climate that contributes to the production of various agricultural crops, including grain crops (rice, wheat, barley), which are one of the main and production of these food crops with direct dependence for population consumption. The cultivation crops were affected by the prevailing climatic characteristics in the study area, so our study came to Knowing .grain crops cultivation and production of show the impact of climate characteristics on the the climatic conditions available in the region and their compatibility with the climatic requirements of To expand its cultivation and increase the quantity and quality of its production. As well as grain crops knowing revealing the reality of its geographical distribution and the reasons for its spatial variance and the extent of the correlation and impact of climatic characteristics on this distribution and variance, which leads planners and decision makers to prepare development plans and appropriate and necessary programs for the advancement, development and advancement of the agricultural reality in the future .

The study aims to clarify the effect of climate elements on the production and productivity of grain crops (rice, wheat, barley), by comparing the climatic requirements of crops with the characteristics of the climate of the study area during the growing season by using a number of techniques and statistical determine the type of methods such as linear regression, correlation and interpretation coefficient to The relationship and the degree of its strength to come up with the appropriate calendar for the influence of climate elements on the production of agricultural crops .

Introduction :

Agriculture in the study area is the main economic activity because it includes large agricultural areas that produce various agricultural crops, including grain crops (rice, The quality of grain crops and . (wheat, barley so agricultural ,the quantity of their production activity is one of the most dependent and affected activities by climate conditions, as the success of cultivating any grain crop depends on the nature of the climatic characteristics prevailing in that region, in addition to other natural factors that participate in determining . the level of annual productivity of grain crops

The production of grain crops is of great economic importance, and this importance is represented in being strategic crops that constitute the main source of food for the population, in addition to their ability to adapt to many and different environments, in addition to the fact that they are characterized by the small size of their grain and low moisture content, which helps in easy transportation and period of time. Also, some of these storage for a crops, such as barley, are used as animal feed in the form of grains or green fodder materials. Agricultural activity is a basis for development in most countries of the world. It is known that the agricultural sector plays a strategic, economic and political role in the development processes of all countries, regardless of whether the economic and political systems prevailing in them are developed or not. Therefore, the study the of the impact of climatic characteristics on production of grain crops is important in knowing the available development potentials according to which it is possible to plan to increase the production of grain crops and in a way that reflects a quantitative and qualitative development in agricultural production, especially that the study area enjoys the

presence of a number of elements of agriculture such as fertile soil and abundant water Which helps to establish an agricultural activity in it and a large production of grain crops, especially since Karbala governorate has natural, human and economic potentials and resources that help in achieving multiple development projects that reflect positively on the reality of agricultural activity .

Theoretical Framework

Study problem :

1. characteristics affect the Do climatic variation in the cultivation and production of cereal crops ?

2. Which climatic factors are more influential?

3. What is the impact of climatic factors on the variation in crop production?

This problem included a number of secondary problems, as follows :

1. What are the climatic characteristics affecting the variation in the cultivation and production of cereal crops in the study area ?

2. Are there climatic conditions suitable cultivation and production of grain crops for the in the study area ?

3. Is it possible to expand the production of grain crops according to the prevailing ?climatic characteristics in the study area

Research Hypotheses

1. Climatic elements affect the cultivation of cereal crops directly and indirectly .
2. Climatic elements vary in their impact on crop production and productivity.
3. Climate contributes to fluctuation in production during the school years **.**

Purpose of the study :

1. Shows the suitability of climatic for the cultivation of grain crops elements .
2. Detection of the most influential climatic elements .
3. Work to encourage the growth and expansion of cereal crops .

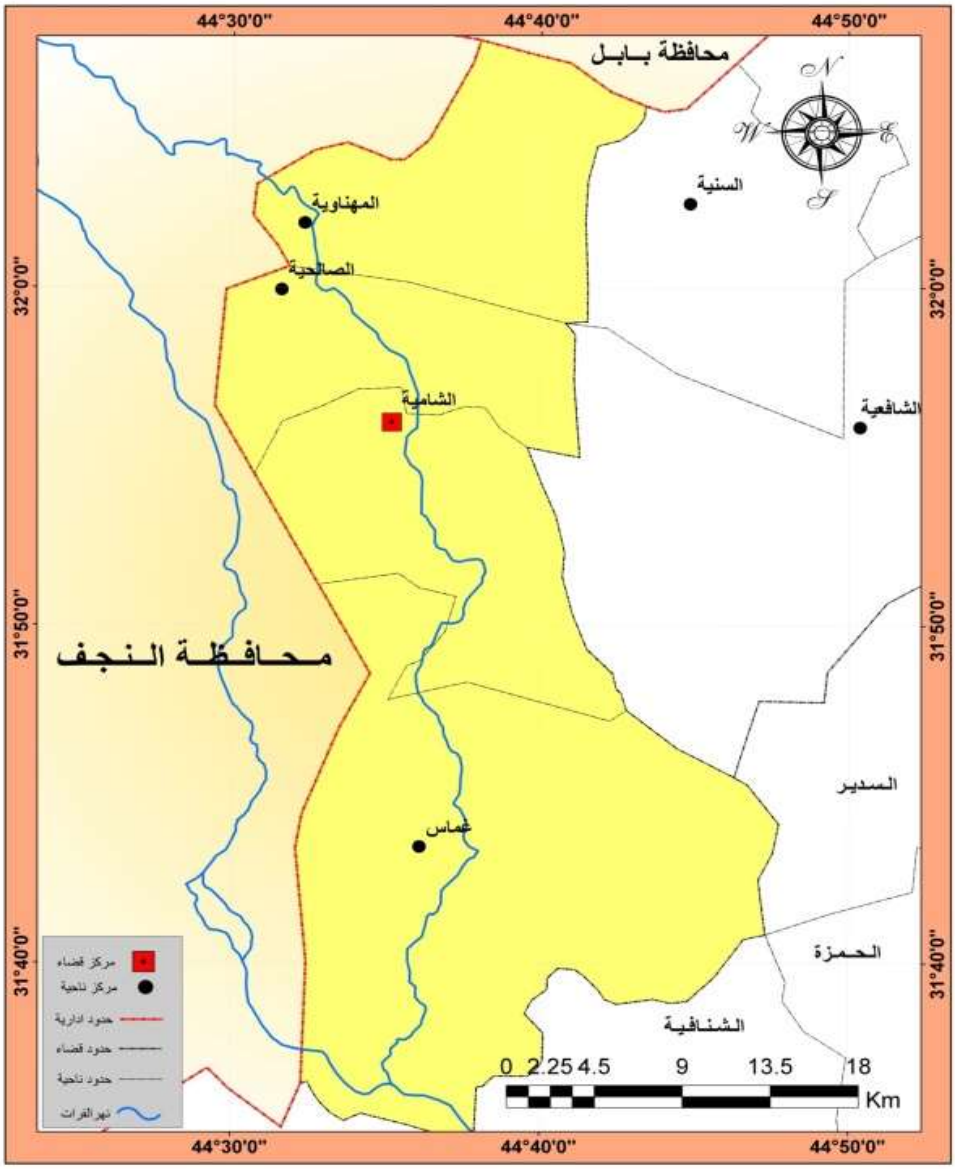
StudyLimits :

The limits of the study on agricultural crops are Shamiya district, which is part-represented in Al which is located , Qadisiyah governorate-of Al Qadisiyah-in the northwestern part of Al Sudair, either to the south , -governorate . As (1) on map ,Shanafiya district-bordered by Al

The area of the district is (903 km2), at a rate of s area of (8153), and 'of the governorate (%11) the arable area is (260,294) dunams, at a rate of of the arable area in the governorate (%14) four amounting to (1878943) dunams and it has the , administrative units As shown in the map And district-district center and Ghammas sub the hand of professionalism and the hand of validity. Ghamas district topped the first in and arable area (% 47.84) terms of total area followed by the district center with a ,(%56) -and arable (17%), while Al (% 19.93) total area) Mihnawiya district came third with a total area and a percentage of (15%) of the ,(% .(18.82 arable area, and the last area of validity with an and suitable for cultivation ,(% 13.39) area of .(1) as in Table ,(%12)

) The time limits of the cultivated crops were . . (2018-2000

Map (1) of the administrative borders of the Levant District



Source: Republic of Iraq, General Authority for Survey, Levant District map, on a scale.

Table (1) the total area and arable area in the study area

Ratio %	**/ Cultivable area acres**	**The ratio**	**Area km2**	**Administrative unit**
17	43000	% 19.93	180	Levantine
56	145949	% 47.84	432	spread
15	40000	% 18.82	170	career
12	31345	% 13.39	121	validity
%100	260294	%100	903	M

Ministry of Planning, -Republic of Iraq :Source Department of Regional Development, Department of Local Planning, Diwaniyah Planning Division, Development Plan for Qadisiyah Governorate 2020, p. 23

the climatic characteristics of -The first axis the study area

Climate is an important component of the natural environment ; Because of its effect on the plant with all its elements and phenomena, on the quality and it is the main influence . production of grain crops (rice, wheat, barley) [1]

1 - Solar radiation

It is the rays that travel in outer space and the atmosphere in all directions The speed of light (km/s), and it is responsible for all 298,000 climatic phenomena and a major source of temperature, through the intensity and quantity depends on the angle of of solar radiation that incidence of solar rays and the duration that it and solar rays hours of brightness , [2] takes theoretical) ** As it varies between -(actual summer and winter, as well as because it is affected by various factors, including clouds and the rise of dust and dirt.

shows that the angle of incidence (2) Table of solar radiation begins with an increase in the direction of the hot season, reaching the highest value of radiation in the months of (June and each, respectively. Then (80.38-July) by (82.38 it begins to decline in the cold season to reach -the lowest value in the months (January 1 for each of them, (37.38-January 2) by (35.38 respectively, as in Figure (1) , and the number of theoretical and actual brightness hours increases towards the hot season until it reaches the highest value of brightness Theoretical in 14-July) at a rate of (14.2-the months (June hours) for each of them, respectively, and the for each of them, (11.5-4-actual (11.4 and the , (2) respectively, as shown in Figure hours of theoretical and actual brightness begin to decrease in the cold season until reaching the January -lowest theoretical brightness (Canon 1 hours) for each, respectively , 10.3-by (10.4 (2 each, hours) for 6.2-and actual brightness (6.2 respectively, As in Figure (2), the days are short in winter and longer in summer in the study area The area has a long day .

The angle of incidence of solar (2) Table radiation and hours of theoretical and actual for the Diwaniyah station-brightness of Al (2018 - 1989) period

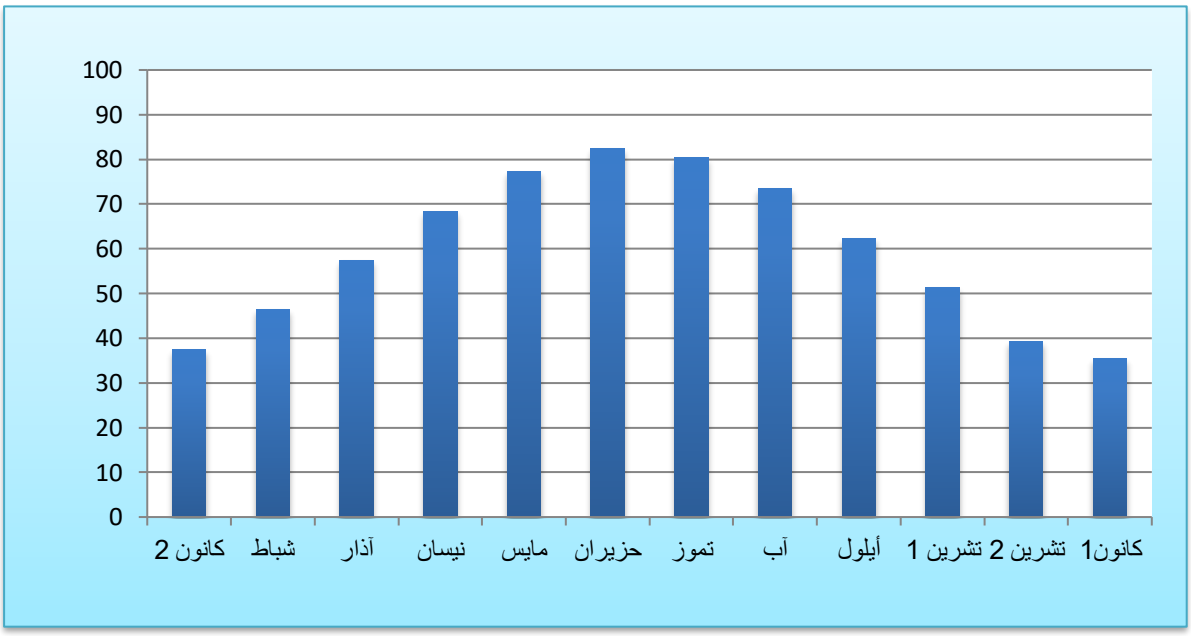
Actual brightness hours/day	**Theoretical brightness hours/day**	**angle of incidence of radiation**	**the month**
6.2	10.3	37.38	Canon 2
7.2	10.9	46.38	February
8	11.8	57.38	March
8.2	12.4	38 , 68	April
9.4	13.6	77.38	May
11.4	14.2	82.38	June
11.5	14	80.38	July
11.2	13.5	73.38	Father
10.2	12.2	62.38	September
8.2	11.2	51.38	October 1
7	10.6	39.38	2 October

6.2	10.4	35.38	Canon1
8.7	12	59.38	the average

Source: Ministry of Transport, General Authority for Meteorology and Seismic Monitoring, Climate Department, unpublished data, Baghdad, 2019

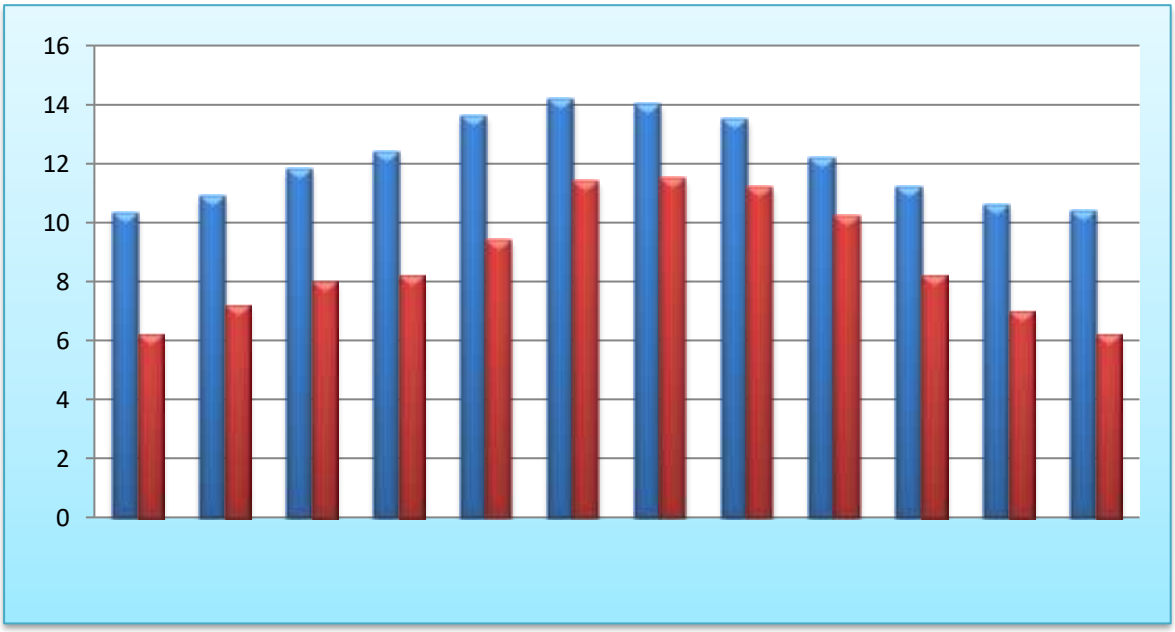
(1) Figure

(2018-1989) Diwaniyah station for the period-The solar radiation of Al



(based on Table (2 ,No :Source

Diwaniyah station-(hours/day) for Al Figure (2) Theoretical and actual brightness hours.



.(2) table based on B, not :Source

.(2) on table

2- Temperature

is a form of energy As for temperature , it Heat is the state of heating a substance and its The temperature is unstable [3] .intensity annually and daily, as the terrestrial radiation has a role in this, as the more the earth loses rays the terrestrial radiation), the greater the amount) of rays gained from the sun. Then the temperature decreases, and on the contrary, the [4] .temperature rises

It turns out that the (3) from the table temperature in its three forms, average , maximum and minimum, increases from March to reach the highest temperature in the months (June, July, and August) with an average m 36-36.5-temperature, respectively. (34.7° ,(m 44.5-44.7-the maximum (41.2°for each (respectively, and the minimum temperature (m 27.8-28.4-26.2°for each respectively, then (the temperature decreases from the month of September to the lowest Recorded temperature February) with an -January 2-in (January 1 (C °13.6-11.1-average temperature of (13.3 °. for each, respectively The maximum degree m 20.6-17.4-19.2)°for each of them, (-6.3-respectively, and the minimum degree (8.1 m 8.4°for each of them respectively, as shown (in Figure (3), which recorded the highest temperature in July, and the lowest temperature The reason for the difference in .in December temperature between summer and winter is the angle of incidence of solar radiation and the length of the day .

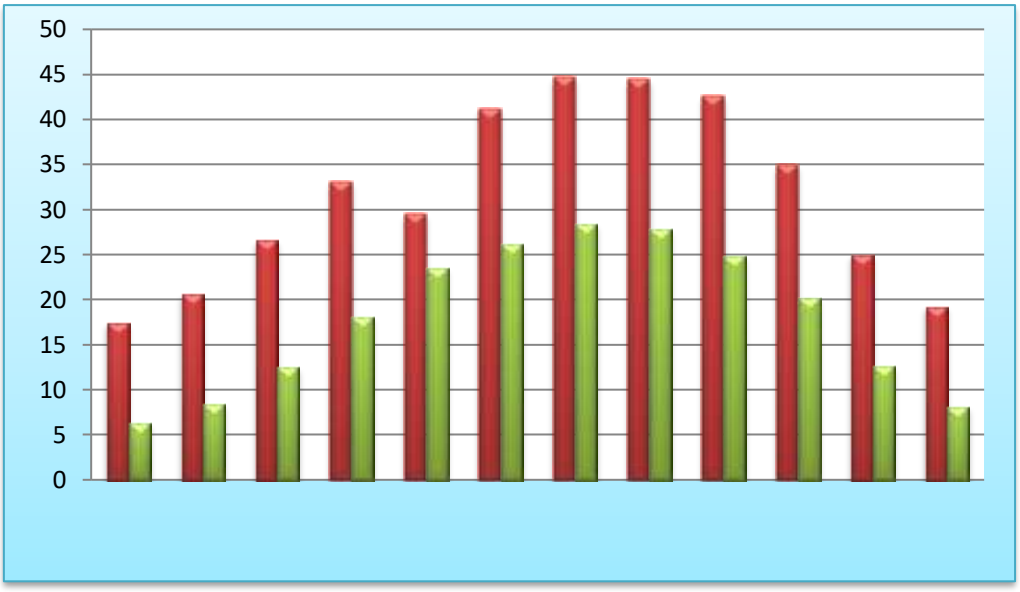
Diwaniyah station Average , maximum and minimum temperature (C) (3) Table

(2018 - 1989) For the period

the average	Great	Minor	the month
11.1	17.4	6.3	Canon2
13.6	20.6	8.4	February
19.2	26.6	12.5	March
18.1	33.1	25	April
30.2	29.5	23.5	May
34.7	41.2	26.2	June
36.5	44.7	28.4	July
36	44.5	27.8	Father
32.7	42.6	24.8	September
26	34.9	20.2	October 1
18.3	25	12.6	October 2
13.3	19.2	8.1	Canon 1
24.7	32.4	18.0	**annual rate**

Source: Ministry of Transport, General Authority for Iraqi Air Force , Climate Department, unpublished data, 2019.

for Diwaniyah station-For Al Figure (3) Average temperature , maximum and minimum (C) (2018-1989) the period



Source: the researcher, according to .(3) Table

3. The Wind

The winds in Iraq and the study area are characterized by low speed throughout the year Because conditions do not help the formation ; of high winds except in limited times with the movement of the Mediterranean depressions the northwest and atmospheric instability, and and northern winds are prevalent throughout the year Because of the effect of high pressure on the Anatolian plateau, and low pressure on the which makes Iraq and the study ,[(5)] Arabian Gulf area a regular corridor for these winds during the summer, while their blowing is interrupted during the winter due to the passage of hurricanes coming from the Mediterranean, and these winds North or Northwest significant impact in this area; Because it is characterized by its low temperature and dryness, and the sky is clear during the cold season, while in the hot season it leads to a decrease in the high temperature; This is due to its low temperature .

shows that there is no significant (4) Table variation in wind speed in the study area, so the -highest average winds were recorded in (June July) by 2.7 m/s, respectively, and the lowest October 2) for each -wind speed in (October 1 -January-month) 1.6 m/sec), and in (September -1.9-1.7-February) at a rate of (1.8-2-January-1 -April-m/sec) respectively, and in (March 2.2 m respectively) 2.4-2.6-May) at a rate of (2.5 (tha/ .

The reason for the increase in its speed in the summer in the study area is due to the spread of low pressure on the Arabian Gulf and the Indian subcontinent. The difference in wind capacity between summer and winter is due to the different values of atmospheric pressure .

Table (4)

Al Diwaniyah Station Wind Speed for (1989-2018)

average wind speed m/s	the month
1.9	Canon 2

2.2	February
2.5	March
2.6	April
2.4	May
2.7	June
2.7	July
2.1	Father
1.8	September
1.6	October 1
1.6	October 2
1.7	Canon 1
2.1	the average

Source: Ministry of Transport The Iraqi General Authority for Meteorology, Climate Department , unpublished data, 2019 .

4 - It is defined as the : **relative humidity** percentage of water vapor present in the air at a certain temperature and the amount at which the air is saturated with the same temperature and s ability to carry water vapor is directly 'the air [(6)] proportional to the temperature

show the highest (4) and Figure (5) Table -average humidity recorded in (Tishreen 2 February) for each of them, -January 2-January 1 ,(% 59.8 - % 68.6 - %65 - % respectively (58.1 July -low contagious to Humidity in (June and -August) for each of them, respectively (27. 4 - and accordingly the winter season , (7 .29 - 5 .27 is more humid than the summer ; Due to the difference in temperature and the amount of precipitation, and in general, the relative humidity in the study area is characterized by its lowness, where the annual rate was recorded at . (% a rate of (44.1

(5) Table

Al Diwaniyah Station Average Humidity (%) for (1989-2018)

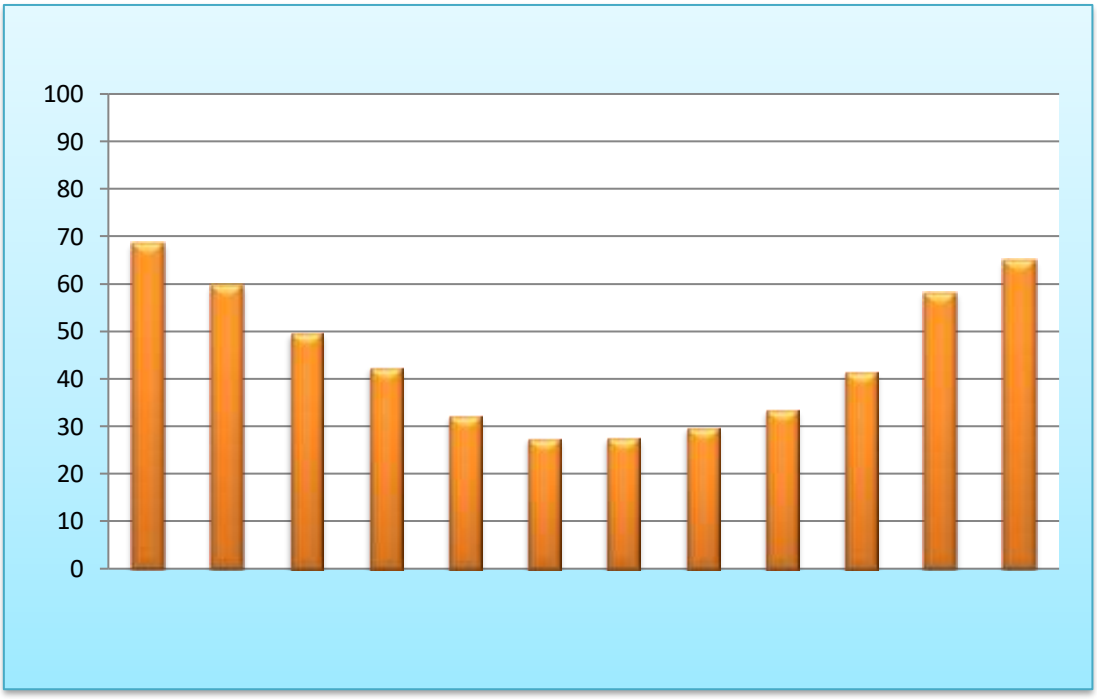
% Moisture	the month
6 . 68	Canon 2
8 . 59	February
6 . 49	March
3 . 42	April
1 . 32	May
4 . 27	June
5 . 27	July
7 . 29	Father

4 . 33	September
4 . 41	October 1
1 . 58	October 2
65	Canon 1
1 . 44	**annual rate**

Source: Ministry of Transport, General Authority for Iraqi Meteorology, Climate , Unpublished data .Department

(4) Figure

Relative humidityo ADiwaniyah station-l for the period (1989-2018)



5) Source: the researcher based on table).

5. Rain

The rainfall in the study area is characterized by fluctuation between one year and another, i.e. the rain is likely to fall on a day equivalent to a month, as well as in a month equivalent to a year . [7] and may not fall throughout the year

indicates that the total amount of rain (6) Table falls is (114.7) distributed over the months of the year, starting from October 2 until the end of March. The highest amount of rain was with a (recorded in (January 2 and October 2 mm) and the lowest amount 21.2-rate of (22.8 (1 of rain recorded In (September and October mm), while 4 -by a successive amount (0.6 -April -March -during the months (February January 1) with a successive amount -May mm), and the 14.8 - 3.2 - 15.4 - 12.0 - 11.2) the summer months (June, absence of rain For July, and August) , as shown in Figure (5), as the region is not affected by Mediterranean depressions ; for its direction northward to southern Europe ; Therefore, there is no rainfall ,in it during the summer, except in some times in an amount that is not important, which makes the region not depend on rainwater directly for

agriculture , but on surface water that is linked to precipitation in terms of increase and .decrease

(6) Table

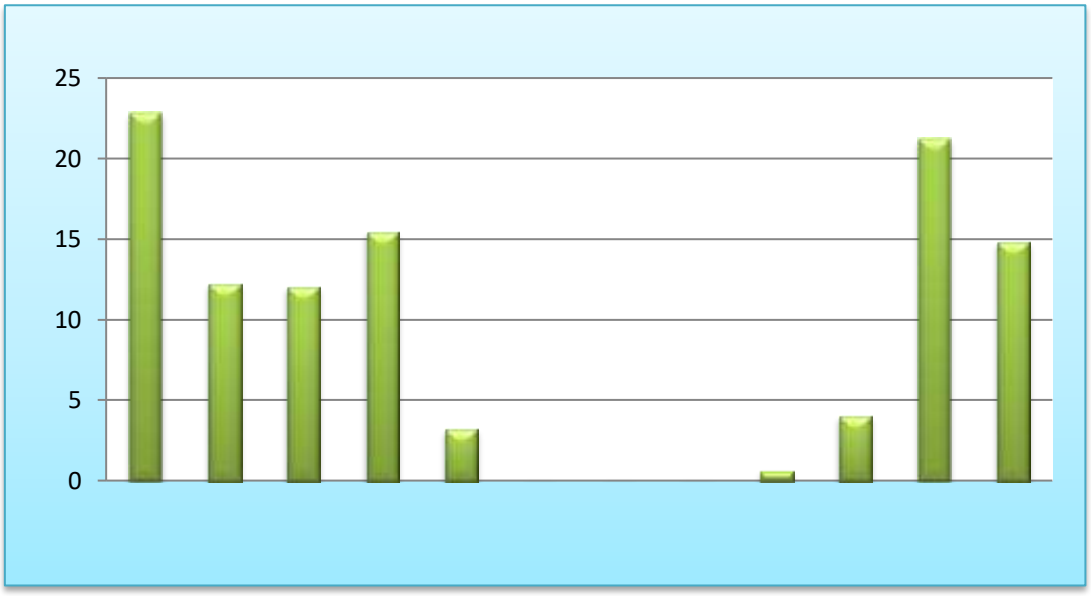
The Amounts of Rainfall in AL Diwaniyah Station for the (2018-1989) period

mm	the month
22.8	Canon2
12.2	February
12.0	March
15.4	April
3.2	May
zero	June
zero	July
zero	Father
0.6	September
4.0	October 1
21.2	October 2
14.8	Canon 1
8.5	**rate annual**
114.7	Total annual rate

Iraqi Meteorological Department, :Source Climate Department, unpublished data 2019 .

(5) Figure

Al Diwaniyah Station Falling Rain (mm) for the Period (1989-2018)



climatic requirements for -The second axis of cereal crops the cultivation

First, the optical requirements

The main grain crops in the study area are day crops, which include -divided into long (wheat and barley), which require a long period hours) per day . In both 14-ranging between (12 cases, the crop is affected quantitatively and [8] . qualitatively

day crops , they represent the -for the long As hours) 12-rice crop, which needs a daytime (10 per day. Early cultivation leads to increased vegetative growth ; Which makes flowering outside its time, as well as when planting it late, the plant, flowering and affects the shortness of maturity before its time, and the spikes are more . [9] affected by the vegetative growth

assuming that the farms invest time and achieve higher productivity than surrounding agricultural lands .

thermal requirements for cereal -Second crops

1- The minimum, maximum, optimum and harmful temperature for grains

Cereal crops vary in their need for temperature, as the rice crop is affected by a ,(7) as in Table crop affected by a decrease in temperature below (12 ° C°and when flowering, it does ,(not bloom and the fertilization process is not characterized, and therefore the grain becomes few in number and production is affected by the decrease in temperature below zero Celsius , and the ,then the crop cannot continue to grow temperature rises more than (38 °C° , (especially with high winds, the crop is affected, especially during the flowering period, which .deteriorates the characteristics of the crop °rising for a short period of time, The optimum temperature for the crop is (32°C°. [11] (

While the wheat crop is affected by a drop in temperature below (4°C°the branching ,(process stops, the leaves become infected and their color changes, and when the temperature C°4-reaches (° the tissues freeze and the plant ,(cannot live for a long time, or when the temperature rises more than (30). m°with a (decrease in soil moisture, especially in the spring , so the branches are affected, leading to a decrease in the number of spikes, and at a temperature of (38 °C°more, then it is more or (damaged and does not achieve an economic return, either the best temperature suitable for its growth at which it naturally achieves its vital activity reach (25 m°.(

As for the barley crop, it is affected by a decrease in the temperature below (4 C° , (which leads to the yellowing of the plant and the

plant is affected in the flowering and maturity especially In the ripening period, the crop is , C 2-stage, and at a temperature of (°and (exposed to great losses or lost when the without it, the plant cannot continue to grow, temperature rises more than (45 °C°while (20 ,(and the temperature rises to more than (30 C° (C°°. [12]) is the ideal temperature for the crop (

crops for temperature Table (14) requirements of grain

Like me	bad high	high	bad world	Donia	the crop
32	43	38	1-	12	the rice
25	38	30	4-	4	Wheat
20	42	30	2-	4	barley

: s work based on'Source: From the researcher Mohsen Muhareb Awad and Muhammad -1 Salem, Introduction to Agricultural Geography, Salam -2 Cultural, 1, 2002, p. 120 'Dar Shamou Jubouri, Basics of Applied -Tatif Al Adal -Climatology, 1, Baghdad, 2012, p. 23 . Abbas Muhair, A geographical analysis -Abd al the characteristics of the climate and its of relationship to agricultural production in the province of Babylon, a master's thesis (unpublished), College of Arts, University of . Kufa, 2010, p. 56

2- Growth season and cumulative temperature:

life, starting from germination to maturity, ' which is characterized by a temperature that does not drop from (zero growth)* . A specific growth through which the plant can complete its life and give productivity , and any defect in the period of the growth season leads to damage to agricultural and extracted by the . [14] the plant .following equation

Accumulated temperature = (monthly average (zero growth -temperature × days of the month . [15]

. fodder crop [a]

it was found that the highest ,(8) From Table temperature for the rice crop was (3428 °C° ,(and the lowest temperature was recorded for the wheat and barley crop (2326.6 ° C°which ,(indicates that rice needs accumulated heat more area was than wheat and barley, as the study characterized by a combined temperature. exceed the needs of the crop ; Therefore, it is not an obstacle to the expansion of cultivation .of these crops

Table (15) length of growing season and cumulative temperature of cereal crops

The heat collected in ***the study area	Aggregate ** Temperature	* Growth season length	the crop
3428	2800 – 2500	up to six months (2) October-June	the rice
2326,6	1600 – 1500	April -October (2)	Wheat
2326,6	1500 – 1400	April -October (2)	barley

The table is based on the : Source researcher's work

1- Levantine Agriculture Division, * up and Extension Department, with a -Follow -field interview with a group of farmers in Al .Saliha district-Mahnawiya and Al

2- Wajeez in the -Ali Hassan Musa, Al ** .Applied Climate, Damascus, 1982, p. 144

3- Based on: Table (6) temperature, *** minimum temperature, depending on the (14) equation

3- Soil temperature

The soil of the study area is characterized by varying temperatures during the months of the year and between the surface and the depths shows that the highest rate of soil (9) Table, temperature is in the months (June, July and m 38.7 - 38.4 - 36.4) August) at an average of °what is the difference between the surface ,(and the depths, as the temperature of the depths of the soil rises more than the surface in and Tishreen 2) and in winter, -(Tishreen 1 while in summer the difference is slight , as the average temperature was recorded in (January on The surface is (12.0 m 2°and at a depth of (cm) at a rate respectively 100 ,50 ,30 ,20 , 10 ,5) m 21.2 – 16.9 – 14.5 – 13.9 – 12.7 – 12.4)°and (was recorded in July on the surface at a rate of m 42.0)°-50-30-20-10-And at a depth of (5 .(– 39.2 –cm) at a rate, respectively (39.9 100 m 33.3 – 36.4 – 38.6 – 29.8°Accordingly, the (rise in temperature towards the depths increases from the surface temperature when the air temperature decreases, and the temperature of decreases from the surface the depths temperature with an increase in temperature

average soil temperature for the surface and depths of the study area (9) Table For the period 2018-2007

the average	cm 100	cm 50	cm 30	cm 20	cm 10	cm 5	the roof	Months
8 . 14	21.2	16.9	14.5	13.9	12.7	12.4	12.0	Canon2
2 . 17	20.9	18.5	17.2	16.3	16.2	16.1	15.4	February
7 . 21	22.7	21.1	21.8	21.7	21.4	21.3	21.9	March
4 . 27	25.1	26.2	26.9	27.8	29.5	28.5	27.8	April
4 . 32	28.3	30.8	32.3	33.1	33.5	34.1	34.9	May
4 . 36	31.2	34.4	36.3	37.2	37.9	38.6	39.8	June
4 . 38	33.3	36.4	38.6	39.8	39.2	39.9	42.0	July
7 . 38	34.9	36.7	38.3	39.5	40.1	40.3	41.7	Father
7 . 35	33.9	34.9	35.8	36.3	36.3	36.4	36.8	September
8 . 29	31.8	30.7	30.3	30.0	29.5	28.0	28.9	October 1
2 . 23	28.1	25.1	23.7	22.8	20.9	21.2	20.7	October2
8 . 17	24.4	19.8	17.3	16.0	16.5	16.8	14.3	Canon 1

Source: Ministry of Transport, Iraqi ,General Authority for Meteorology Climate Department, unpublished data, 2019.

While the soil temperature has an effect on seed germination, when the soil temperature rises , the number of days for germination decreases and the number of days decreases , and the soil temperature suitable for the germination of C° wheat ranges between (14°while the ,(barley reaches (18 °C°and the yield of , [17] (Rice requires a soil temperature that is approximately higher than the minimum AD 35-temperature for the crop (25°. [18] (

Third. The Wind

either it is positive when the wind is at a light , speed on all plants because it contributes to thermal balance, providing oxygen to plants,

and soothing temperatures in summer if the temperature is moderate . The effect is negative when the wind is characterized by a speed of up to (7 m/s) , to have its effect on all crops according to their ability, so grain crops are subject to sluggishness, especially with the presence of rain or high humidity in the soil in of the study area due to the weakness and height the stems of plants such as rice , which causes With the loss of a large amount of the crop and the winds suitable , the difficulty of harvesting it . [19] (m/s 3-grain crops are within (1 for

requirements of grain crops from - Fourth moisture and rain

Cereal crops require an amount of rain and moisture according to their need. Their need for rain, the time of their fall, and their quantity varies, causing damage to plants when they are strong showers and at harvest time to cause crop , as well as moisture great losses to the when it is higher than the need of the plant works to reduce the amount of photosynthesis and impede fertilization And cause a lot of empty grains (class) .

The rice crop needs abundant water, whether it shows the (10) is rain or surface water . Table 1200-water needs of the amber rice crop (600 mm) for submerged (amber) rice, a humidity of -not less than (30%) and a required humidity (80 The crop is .(%90 affected by a decrease in [20]) (%95) humidity below (40%) and more than .

The wheat crop cannot resist drought for a long time, and its cultivation succeeds in areas where rainfall reaches (600 mm), and its cultivation does not succeed with high temperatures, as the crop becomes infected with rust disease . What at the end of spring has a negative effect, and the crop can be grown in areas where there is a (mm 350-rain (250 . [21] or more

-And the moisture needed by the crop ranges (60 is a shortage in the amount so when there ,(%70 of moisture and it is not compensated, the grains are not fully ripened, and they do not achieve [22] . productivity

the amount of rain and moisture for grain crops (10) Table

rain	% Humidity	the crop
1200 – 600	90 - 80	the rice
250 -350	70 - 60	Wheat
300 -200	70 - 60	barley

Younis -Abdul Hamid Ahmed Al -Source: 1 and others, Grain Crops, Mosul University, Mosul, 1987, p. 45 .

A What is the barley crop , which is adapted to areas that are characterized by drought , as it does not need large amounts of rain, and table it is noted that it needs an estimated amount (30) mm) , but when the 300-of approximately (200 amount of water is less than the need of the plant then it is infected . It reaches its death or turns , into a weed used for the animal, and the required [23] . (%70-60) humidity is

the agricultural reality in the -The third axis study area

1. Rice

crop of great nutritional Rice is a summer importance to humans, as it provides nutrients a that there is (11) And by noting Table discrepancy in the areas exploited for cultivating the rye crop , the highest area was recorded in 2013 by (179801 dunums), and in the years 2006 and 2014 it increased, respectively. (132625 , 132129 dunums), and the lowest value of the area was recorded in at (1828 dunums) and for 2003 it was 2018 estimated (26,278 dunums), as in Figure (10) as this dispersion and heterogeneity of the invested area is related to the abundance of water or not as it intervenes The government when the , amount of water decreases to confine

agriculture to specific areas close to river sources, as happened in 2018, but the production varies, it is affected by area and productivity, where the highest amount of production was recorded in 2013 with an amount of (213,662 tons) and for the years

respectively (190439). , 155781 2014-2012 tons), and the lowest amount of production was amount of recorded for the year 2018 with the production (1483 tons) and for the year 2003 . with the production

-2002) The area, production and productivity of rice in the study area for the period (11) Table * (2018

Productivity / kg	production / ton	Area / dunums	the year
1274	97830	76778	2002
1100	28911	26278	2003
580	64408	110991	2004
650	78016	128889	2005
700	92898	132625	2006
1120	112245	100206	2007
826.2	88277	106826	2008
70.3	43638	60581	2009
793	63277	79800	2010
760.1	69874	91922	2011
1220.1	155781	127681	2012
1188.3	213662	179801	2013
1441	190439	132129	2014
1152.2	62782	54488	2015
1329.5	73190	55049	2016
1554.1	101803	65888	2017
811.3	1483	1828	2018

Source: Ministry of Planning, Central Agricultural Statistics, Agency for .unpublished data, 2020

, **Diwaniyah Agriculture Directorate** - Al Agricultural Statistics Department, unpublished was excluded (2001-data, 2020 , the year (2000 due to the low water .levels

tons), the productivity was recorded Its 28911) highest rate was in the year 2017 with an amount of (1554,1 kg/ -dunum) and for the year 2014 5,1329 -with a rate respectively (1441 2016

kg/dunam), and its lowest value was recorded in the year 2004 with productivity (58 0 kg/ year 2005 and 2006 by an dunam) and for the amount, respectively (650 and 700 kg/ dunum), which is related to the characteristics of the climate, the use of fertilizers and good seeds with the efforts made by the farmer .

This discrepancy in areas and productivity is for a variety of reasons, the most important of which is the change in climatic conditions between years with all elements of the climate, most of which is rain, which is the main source

of surface water on which rice cultivation .depends

B. Wheat

Wheat is planted in the study area in November and lasts for six months . It is planted before the the (12) rice harvest season. It is noted in Table noticeable variation in the cultivation of the crop between years, in terms of area, the highest value was recorded in 2016 with an area of dunums) and for the period from 2014 165471) -with an area respectively (160492 2015- 'dunums), as a result of farmers 160,751 tendency to invest most of the lands to achieve economic gains instead of the decrease in rice production and the availability of an adequate amount of water. 58800 dunums), due to negligence and lack of government support, and to produce the highest value A record in 2016 of (139,513 tons) and for the year 2015 with a and for the year (production of (131,031 tons dunums), figure 121010) the amount of ,2017 for the capacity of the exploited area and (11) the use of improved seeds and fertilizers supplied by the agricultural divisions in the administrative units and the relevant authorities, and the lowest values of production in 2011 amounted to (9076 tons) and for the year 2003 amounted to (19051.2) , due to The crop was exposed to pests and diseases that led to a low .crop production

productivity , as in A , recorded its highest value kg 843.1) in 2016 by/ dunum) and for the years / kg 818-by (815 ,2017 and 2015dunum , (respectively, and the lowest value of productivity recorded for the year 2003 was kg 324)/ ,2007-dunum). And for the year 2006 kg 326 -respectively, (333 / .(dunum

(2018-2000) Study area area, production and productivity of wheat crop in (12) Table

Productivity / kg	production / ton	Area / dunums	the year
442	52045	117750	2000
454.7	43600	95886	2001
350.8	33545	95625	2002
324	19051,2	58800	2003
354.9	35624	100374	2004
429	47469	110640	2005
333	37616	112887	2006
326	37796	115683	2007
563.9	76671	135966	2008
499	65402	131051	2009
565	79036	139,740	2010
419.5	9076	21636	2011
428	57786	135,025	2012
569.4	62949	110559	2013
471.6	75680	160492	2014
815	131031	160,751	2015
843.1	139513	165471	2016

818	121010	147921	2017
717.2	78796	109872	2018

Ministry of Planning, -Source: Based on 1 Central Bureau of Statistics, unpublished data, 2020 .

2 - Diwaniyah Agriculture Directorate, -Al Agricultural Statistics Department Unpublished data, 2020..

Through the analysis of the table, the discrepancy in area, production and productivity, especially the resulting productivity, increased wheat cultivation or vice versa as a result of climatic changes. As for the geographical distribution of the wheat crop area in the study area and according to .administrative units

C. Barely

The barley crop in the study area comes after rice and wheat, and it varies annually, and from it is noted that the largest area (13) table exploited for the crop in 2015 amounted to dunums), and for the year 2011, 2014 an 31301) dunums) .), 21,272 -area respectively (21,636 to obtain a fodder crop and to contribute to land reclamation due to its high salinity , and to meet the water scarcity and the increase in commercial demand for it, its area increased. The reluctance to cultivate it due to the significant decrease in the amount of water due to the lack of rain and the tendency to other employment . -activities such as trade or self The variation in the production of the barley crop in the study area is due to a difference in area, productivity and production . The highest production was recorded in 2016 with an tons)) and in 2015 with a amount of (11630 production of (9366 tons), and the lowest value of production was recorded in 2018 with (969 tons) and in 2003 with a production (2805 tons), which is related to area, productivity and For the care by the farmer. Productivity varies crop , the highest rate was recorded for the year by (581,4 kg 2016/ dunum) and for the year kg 499.4) 2017/ dunum), and the lowest level of productivity in 2003 was (207 kg/ dunum), and for the year 2006 it amounted to (264 kg)/ .(dunums

area, production and productivity of barley crop for the study area (13) Table For the period (2018-2000)

Productivity / kg	production / ton	Area / dunums	the year
369	3866	10450	2000
355.8	4253	11950	2001
328	3795	11565	2002
207	2805	13547	2003
380	5994	15754	2004
418	6305	15075	2005
264	4248	16050	2006
310	4882	15620	2007
344.6	5496	15950	2008
380	6190	16250	2009
340	5953	17500	2010

419.5	9076	21636	2011
300.3	5544	18464	2012
367.1	7371	20079	2013
345.4	7347	21272	2014
299.2	9366	31301	2015
581.4	11,630	20003	2016
499.4	6983	13983	2017
387.9	969	2498	2018

Source: Ministry of Planning, Central Agency for Agricultural Statistics, unpublished data, 2020

Evaluating the effect of climatic -Fourth Axis elements on the productivity and production of grain crops:

1. Evaluation of climatic factors on the productivity of rice:

It appears from Table (14) that during the regression analysis of the study variables , we note that the multiple simple linear regression model for the study variables showed its results in varying degrees, as the independent variables had a negative and positive impact on the dependent variable (productivity) . Relative most effect with a correlation humidity had the coefficient (0.50) and a significant effect, while the least effect was the actual brightness with a correlation coefficient (0.25) and had an insignificant effect , and the other elements minimum and maximum temperature, soil) temperature, wind and rain) had an insignificant effect on productivity . .

Table (14) The relationship between climatic elements and rice yield

nature of relationship	R 2 %	regression coefficient	T tabularp <0.05	Arithmetict	correlation coefficientr	climatic elements
-Weak non significant inverse relationship	0.06	- 234.5	2.13	- 1	- 0.25	Actual brightness
-Weak, non significant positive relationship	0.03	67.3	2.13	0.67	0.17	minimum temperature
-Weak, non significant positive relationship	0.08	137.8	2.13	1.17	0.29	Great heat
-Weak, non significant positive relationship	0.11	180.2	2.13	1.35	0.33	average temperature

-Weak, non significant positive relationship	0.21	218.3	2.13	2.01	0.46	soil temperature
-Weak, non significant positive relationship	0.17	451.2	2.13	1.74	0.41	wind
Strong positive correlation	0.25	25.7	2.13	2.24	0.50	relative humidity
-Weak, non significant positive relationship	0.003	0.28	2.13	0.19	0.05	rain

On the climatic requirements of the :Source . (crop, Table (11) and Appendix (1

2 - Evaluation of the effect of climatic factors on the productivity of wheat crop

There is a discrepancy in the influence of climatic elements on wheat productivity The , was ,(15) Table in most influential of them, as the average temperature with a correlation coefficient (0.77) with a significant effect, while the least influential was rain with a correlation with an insignificant effect, (0.02-coefficient (while the minimum and maximum temperature and soil temperature had a strong relationship with a significant effect. On productivity, and significant -other factors, a weak non .relationship

(15) Table and wheat yield climatic factors The relationship between

nature of relationship	R 2 %	regression coefficient	T tabularp <0.05	Arithmetic t	correlation coefficient r	climatic elements
significant -Weak non inverse relationship	0.006	- 39.5	2.11	- 0.33	- 0.8	Actual brightness
Strong positive correlation	0.38	138.8	2.11	3.25	0.62	minimum temperature
Strong positive correlation	0.42	182.2	2.11	3.52	065	Great heat
Strong positive correlation	0.59	249.5	2.11	4.96	0.77	average temperature
correlation a positive	0.41	177.4	2.11	3.43	0.64	soil temperature
significant -Weak non inverse relationship	0.008	-50.4	2.11	-0.37	-0.9	wind
significant -Weak, non positive relationship	0.02	23.5	2.11	0.54	0.13	relative humidity

significant -Weak non inverse relationship	0.0004	-0.05	2.11	-0.08	0.02	rain

Source: . On the climatic requirements of the crop, Table (12) and (1) Annex

3- Evaluation of the effect of climatic elements on the productivity of the (barley) crop of the study area

It was shown from the analysis of Table (16) that there is the effect of climatic elements on the productivity of the intimate crop, so the maximum temperature was recorded with a correlation coefficient (0.45) with an and the least ,insignificant effect on productivity effect was the actual brightness with a correlation coefficient (0.03) with an insignificant effect, as well as the minimum temperature and average temperature Soil temperature, wind, rain and humidity had an insignificant effect on productivity .

(16) Table Evaluation of the effect of climatic elements on the productivity of the barley crop

nature of relationship	R2 %	regression coefficient	T tabularp <0.05	Arithmetict	correlation coefficientr	climatic elements
-Weak non significant inverse relationship	0.0009	6.6	2.11	0.12	0.03	Actual brightness
-Weak, non significant positive relationship	0.02	15.1	2.11	0.58	0.14	minimum temperature
-Weak, non significant positive relationship	0.20	60.02	2.11	2.08	0.54	Great heat
-Weak, non significant positive relationship	0.08	44.03	2.11	1.2	0.28	average temperature
-Weak, non significant positive relationship	0.10	42.1	2.11	1.39	0.32	soil temperature
-Weak non significant inverse relationship	0.04	-50.4	2.11	-0.8	-0.19	wind
-Weak, non significant positive relationship	0.02	6.3	2.11	0.62	0.15	relative humidity

-Weak non significant inverse relationship	0.04	-0.3	2.11	-0.84	-0.20	rain

On the climatic requirements of the :Source .(1) and Annex (13) crop, Table

4- Evaluation of the effect of climatic elements on production For the crop (rice) for the study area :

The climatic elements vary in the production of The relative (17) rice, as it is noted from Table humidity is the highest with a correlation coefficient (0.66) with a significant effect on productivity, and the least influential is the maximum temperature with a correlation with an insignificant effect, (0.09-coefficient (0 elements of actual brightness, while the other minimum and maximum temperature, average, soil temperature, wind and rain have an insignificant effect on productivity. production .

(17) table The relationship between climatic factors and rice production

nature of relationship	R2 %	regression coefficient	T tabularp <0.05	Arithmetic t	correlation coefficient r	climatic elements
significant -Weak non inverse relationship	0.23	- 83566	2.13	- 2.11	- 0.48	Actual brightness
significant -Weak, non positive relationship	0.01	7582	2.13	0.43	0.11	minimum temperature
significant -Weak non inverse relationship	0.008	- 7872	2.13	- 0.35	- 0.09	Great heat
significant -Weak non inverse relationship	0.06	- 24631	2.13	- 1	- 0.25	average temperature
significant -Weak non inverse relationship	0.07	- 23627	2.13	- 1.08	- 0.27	soil temperature
significant -Weak, non positive relationship	0.07	52856	2.13	1.08	0.27	wind
Strong positive correlation	0.44	1401	2.13	3.42	0.66	relative humidity
significant -Weak non inverse relationship	0.01	- 112.4	2.13	- 0.43	- 0.11	rain

On the climatic requirements of the . : Source (1) crop, Table (11) and Annex .

5 - Evaluation of the effect of climatic elements on production for wheat crop

The effect of the climatic elements on the production of the wheat crop in varying We note that the .(18) proportions, as in Table most influential climatic elements on the production of the crop are the soil temperature with a (with a correlation coefficient (0.81 significant effect on productivity, and the least influential is rain with a correlation coefficient with an unfavorable effect. Significant, (10.-0) while the other elements of actual brightness, maximum temperature, wind, rain and humidity

significant effect, while the rest of the -a non had
.elements had a significant effect

(18) Table climatic factors and crop production Wheat The relationship between

nature of relationship	R 2 %	regression coefficient	T tabular p <0.05	Arithmetict	correlation coefficientr	climatic elements
-Weak non significant inverse relationship	0.01	- 3163.8	2.11	- 0.46	- 0.11	Actual brightness
Strong positive correlation	0.34	28,367	2.11	2.94	0.58	minimum temperature
-Weak, non significant positive relationship	0.20	25170	2.11	2.07	0.45	Great heat
Strong positive correlation	0.49	47588	2.11	4.04	0.70	average temperature
A very strong positive correlation	0.66	45294	2.11	5.73	0.81	soil temperature
-non ,Weak significant positive relationship	0.002	41129	2.11	0.17	0.04	wind
-Weak, non significant positive relationship	0.02	5703	2.11	0.58	0.14	relative humidity
-Weak non significant inverse relationship	0.01	36.04	2.11	- 0.41	- 0.10	rain

on the climatic requirements of the :Source . (1) crop and in Table (12) and Appendix

6 - Evaluating the effect of climatic elements on production of the crop (barleyfor the study area).

The influence of the climatic elements on the production of the barley crop in varying We note that the . (19) proportions, as in Table most influential climatic elements on the production of the crop are the maximum temperature with a correlation coefficient (0.39) with an insignificant effect on the productivity, and the least influential is the actual brightness -with a correlation coefficient (0.08) with a non significant effect. Significant, and all climatic factors have an insignificant effect on the .productivity of barley crop

The table of the results of the regression analysis Diwaniyah station -for the time series data of Al for barley product is given below

(19) Table Climatic elements and barley production The relationship between

nature of relationship	R2	regression coefficient	T tabularp <0.05	Arithmetic t	correlation coefficient	climatic elements
significant inverse -Weak non relationship	0.006	- 541	2.11	- 0.33	- 0.8	Actual brightness
significant positive -Weak, non relationship	0.02	465.7	2.11	2.58	014	minimum temperature
significant positive -Weak, non relationship	0.15	1574.7	2.11	1.74	0.39	Great heat
significant positive-Weak, non relationship	0.001	158	2.11	0.12	0.03	average temperature
significant positive -Weak, non relationship	0.1	1232.6	2.11	1.35	0.31	soil temperature
significant inverse -Weak non relationship	0.07	-2138.4	2.11	-1.15	- 0.27	wind
significant positive-Weak, non relationship	0.04	199.5	2.11	0.84	0.20	relative humidity
significant inverse -Weak non relationship	0.20	-19.1	2.11	- 2.07	- 0.45	rain

On the climatic requirements of the :Source .(1) crop, table (13) and appendix

Results

1- The climate with all its elements influences the agricultural process and has the first role in the emergence of grain crops without others. The strength of solar radiation and the long day have prepared the growth of What is the .plants that need these characteristics temperature that was characterized by high summer and moderate winter and an annual rate Rain is unstable annually and ,((24.7) seasonally , but it has an impact on the agricultural process, through the direct effect by of irrigations for their reducing the number contribution to increasing soil moisture , and washing plants from the soil when they fall with force and moderate quantities that do not expose the crop to damage, and the indirect effect For stock that its contribution to providing a water supplies rivers with water , whether inside Iraq or outside it in Turkey and Iran when it is abundant in large quantities, and with its scarcity, the amount of surface water decreases, the relative humidity is low and the amount of transpiration is high, and the / evaporation winds in the judiciary in general are moderate in speed . It exceeds (3) m / s to have a good effect on agriculture, except in some weather disturbances when the winds are severe and sudden or laden with dusty phenomena . and reduce the available water resources .

2- The results of the statistical analysis of the relationship between climatic r equirements and climatic characteristics showed :
Relative humidity has a significant effect on -A of rice with a the productivity and production correlation coefficient of (0.50) in productivity

and (0.66) on production and the rest of the significant relationship-elements, a weak, non . Average temperature, minimum and - **B** maximum temperature, and soil temperature are a strong relationship with a significant effect on the productivity of the wheat crop, the most of which is the heat rate with a correlation coefficient (0.77), while the minimum temperature, average heat and soil temperature the ,are a significant relationship in production highest of which is the soil temperature with a correlation coefficient (0.81). And the rest of the .significant relationship-elements is a weak non. Climate elements had no significant effect - **C** on the production and productivity of barley, the most significant of which was the maximum temperature with a correlation coefficient of for production, and (0.54) for (0.39) .productivity .

Appendix (1) Average climatic characteristics of agricultural crops

rain m/ m	Hu mid ity %	wi nd m s/	soil temp eratur e m	temp eratu re	Sola r brig htne ss q/da y	the cr op
4.3	36.2	2	33.7	30	12	the ric e
16. 8	53.6	2. 1	20	.167	11	W he at
16. 8	53.6	2. 1	20	16.7	11	ba rle y

Source: Depending on the climatic characteristics of the region and the season of growth for crops

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