ASSESSMENT OF AGRO-CLIMATIC REGIONS FOR THE CROP OF WHEAT IN IRAQ FOR THE PERIOD (2010 - 2020)

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ABSTRACT
Modern technologies are means that give sufficient ability to find agricultural climatic zones for wheat crop in Iraq based on (temperatures and amount of precipitation) technology (Gis) was able to represent the amount of information in objective maps of quantity and quality with high accuracy and analytical ease.the amount of annual rainfall for the study years ranged from (360- 86) mm for the Ramadi and Mosul stations, respectively, and the very high investment of wheat crop in the governorates (Ninawa, Diyala and Wasit) and the weak investment in the governorates (Karbala and Basra).

the study found after matching the maps of the agro – climatic regions (temperatures and amount of rainfall) for the wheat crop that the optimal region appears in a connected way that included the northern part of Iraq represented by most parts of Mosul governorate, the northern part of Kirkuk governorate and part of the northern Salahuddin governorate to constitute an area (38688) km² only the eastern part of Anbar province and most parts of the governorates (Baghdad – Karbala – Najaf – Babylon – Wasit – Qadisiyah – Maysan – Dhi Qar – Muthanna-Basra) with an area of (206,115) km² with (54.2)% of the area of the study area, which explains that most of Iraq's provinces have an extreme climatic region for growing wheat crop included most of Iraq's provinces in the center and the South.

Keywords: wheat, Argo-climatic

I. INTRODUCTION
The study of climatic regions is of great importance in climate studies because it explains the nature of the climate prevailing in a region and the extent of its impact on the natural and Human Factors of the region, as it is determined according to several considerations and criteria that determine the region's personality, which distinguishes it from other regions in terms of in addition, the climate is not the same in all geographical regions, but each region has its own unique climatic characteristics.this depends on the geographical location, the astronomical location, the nature of the surface in terms of elevation and drop below sea level, the type of vegetation prevailing, water resources and soils[1]. There have been several studies in this regard, such as Khaled Atiyah al-Karbouli & apos; s 2020 Study on the thermal climatic requirements and suitability of cereal crops in Iraq[2]; Salar Ali Khadr Al-dziyi & apos; s study on rain regions and Demian agriculture in Iraq in 2019[3]; and Mohammed Musa Khadr Al-luizi & apos; s 2020 study on the impact of effective rain in determining the scale of Demian agriculture (wheat and barley) in Ninawa governorate[4].

cartographic representation of any natural or human geographical phenomenon is therefore one of the recent studies that express spatial variability for successive periods of time, especially when using modern technologies (g-i-s) and using data analysis and optimization to produce composite linear models that express a spatial correlation between two or more elements)[5].

therefore this research is called to a proposed regional classification is an attempt by the researcher to devise a modern classification so that it can equate any region to three agricultural climatic regions (ideal – average ideal – extreme) according to the type of climate prevailing in the region where the researcher relied on two climatic elements (temperature and rain) Analysis of the wheat crop in Iraq and showing its role in the spatial variation of production quantities of the crop cartographically and relying on analytical capabilities with modern technologies (Gis).
The study Problem
Can prepare and produce maps capable of showing agricultural climatic regions (temperatures and rainfall) of the wheat crop in Iraq and analyze and study their role in the variance of production quantities in Iraq depending on Geographic Information Systems (GIS) and statistical methods.

Research Hypothesis
the research assumes that the technology (Gis) has the ability to identify agro-climatic regions (temperatures and rains) of wheat crop until it is presented in the form of high-resolution maps for its high ability to analyze and prepare conclusions and give a clear picture of the reality of Agriculture for wheat crop in Iraq.

Objective and importance
The research aims to prepare high-resolution thematic maps of the agro-climatic regions of the wheat crop in Iraq through the cartographic representation and design technology (Gis) with high ability to communicate cartographic knowledge, which sings about reports, tables and large files the importance of the research is to prepare a Geographical Information System (Gis) to study the agro-climatic they are marked by maps.

Research study area
Iraq is located in the southwestern part of the continent of Asia between two viewing circles (37°22", 29°05") East and linear (48°22", 45°) East, but administratively the boundaries of the study area are defined in the Iraqi governorates (15). Excluding Iraqi Kurdistan Region (data not available).

the climate of Iraq was analyzed through the data of the Stations of the(15) governorates, which included the study where most parts of Iraq (Table (1) and map (1)).

<table>
<thead>
<tr>
<th>Station name</th>
<th>Height</th>
<th>latitude</th>
<th>Longitude</th>
<th>Terrain region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosul</td>
<td>223</td>
<td>36 19</td>
<td>43 09</td>
<td>Semi-mountainous</td>
</tr>
<tr>
<td>Kirkuk</td>
<td>331</td>
<td>35 28</td>
<td>44 24</td>
<td>Semi-mountainous</td>
</tr>
<tr>
<td>khanaqin</td>
<td>202</td>
<td>34 21</td>
<td>45 23</td>
<td>Semi-mountainous</td>
</tr>
<tr>
<td>Baiji</td>
<td>115.5</td>
<td>34 54</td>
<td>43 32</td>
<td>Semi-mountainous</td>
</tr>
<tr>
<td>Rutba</td>
<td>630.8</td>
<td>33 02</td>
<td>40 17</td>
<td>Western plateau area</td>
</tr>
<tr>
<td>Ramadi</td>
<td>48</td>
<td>33 27</td>
<td>43 19</td>
<td>Western plateau area</td>
</tr>
<tr>
<td>Baghdad</td>
<td>31.7</td>
<td>33 18</td>
<td>44 24</td>
<td>Allurial plain area</td>
</tr>
<tr>
<td>Hila</td>
<td>27</td>
<td>32 27</td>
<td>44 27</td>
<td>Allurial plain area</td>
</tr>
<tr>
<td>Hai</td>
<td>17</td>
<td>32 08</td>
<td>46 02</td>
<td>Allurial plain area</td>
</tr>
<tr>
<td>Najaf</td>
<td>53</td>
<td>31 57</td>
<td>44 19</td>
<td>Allurial plain area</td>
</tr>
<tr>
<td>Diwaniya</td>
<td>20</td>
<td>31 57</td>
<td>44 57</td>
<td>Allurial plain area</td>
</tr>
<tr>
<td>Nasiriyah</td>
<td>5</td>
<td>31 01</td>
<td>46 14</td>
<td>Allurial plain area</td>
</tr>
<tr>
<td>Eimara</td>
<td>9.5</td>
<td>31 50</td>
<td>47 10</td>
<td>Allurial plain area</td>
</tr>
<tr>
<td>Basra</td>
<td>2</td>
<td>30 31</td>
<td>47 47</td>
<td>Allurial plain area</td>
</tr>
</tbody>
</table>

Techniques used in research:
1 - geographic information systems (GIS)
2 - program (ArcMap -10.5)
3 - statistical program SPSS.
4. the transaction log and \( \log_b(n) = X \)
5 - equation correlation coefficient (Pearson)

\[
r = \frac{n \sum X_i Y_i - \sum X_i \sum Y_i}{\sqrt{n \sum X_i^2 - (\sum X_i)^2 n \sum X_i^2 - (Y_i)^2}}
\]

The first topic: the spatial variance of annual temperatures in Iraq for the period (2010-2019)
Notes from Figure (1) that the annual average temperature for the years of study ranges from (28.5, 20.8) °C for both Mosul and Nasiriyah stations respectively during the years of study so the difference for the annual temperature rate is (8) °C and a clear gradient from North to South (24.3) °C as the highest annual temperature rate during the years of study within the semi-mountainous region, as the western plateau region and the sedimentary plain we note the gradient in the rise of annual rates from the north-west towards the south and South-East, as both the wet and gray stations recorded the lowest annual rates ranging from (21.2) °C at Nasiriyah station recorded an annual heat rate of (28.5) °C, which is comparable to the annual heat rate of Basra station as it reached (27.3) °C as shown in Figure(1).

Source: Iraqi Ministry of transport and communications for Iraqi weather and Seismic Monitoring/ Department of climate for the year 2020.

Second topic: (annual spatial variance of rainfall amounts in Iraq for the period (2019-2010))

The overall average of rainfall amounts during the study period (2019-2010) ranged between (86,360) mm for each of the two stations (Mosul and Ramadi) as shown in Figure (2), we note the variation of the annual distribution of this amount between one station and another, the highest rainfall rate was received by Mosul station, followed by Kirkuk station in second place in terms of receiving rainfall amounts, while the annual precipitation rate at Baiji station fell to (155) mm the highest rate for stations in the western plateau region and the sedimentary Plain was (191) mm at Amarah station. the average rate was (86) mm at Ramadi station as the minimum annual rate, followed by Basra station in terms of receiving the lowest amount of rainfall, as its annual rate reached (89) mm during the study period due to its desert location compared to other stations located within the two regions.

Form (2) total annual rainfall in Iraq stations studied for the period (2019-2010)
The wheat crop is a winter field crop belonging to the najali family and is one of the most widespread crops due to its ability to grow in wide climatic conditions, and is more widespread in semi–dry areas due to its suitability for the amounts and times of rainfall and its origin is in the Near East region starting from Turkey, western Iran and north–eastern Iraq[6].

Wheat crop also needs thermal, water and light requirements the temperatures necessary for the growth of the great wheat crop (43) °C, Micro (5) °C and optimal (29) °C. As for the light requirements wheat for its growth requires a light period of at least (12) hours per day[7].

With regard to water requirements, the estimated water requirement for the crop is (500-300 mm) [8]and to reveal the nature of the spatial variation of wheat crop production in the governorates of Iraq (except the Kurdistan region) was divided into four patterns (categories), Shape (3) and map (2) during the study years.

1 - very high investment (6.21-5.79)

And includes each of the governorates (Ninawa) with an average area planted (726493)dunams, the production rate (414333) tons, and(Diyala) (709696)dunams, the production rate (413549) tons and(Wasit) (702886) and the production rate (417638) tons, so the production rate of the category (1923164) tons 44.28%.

2 - the high investment (5.78-5.36)

Focus in each of the provinces (Kirkuk) at the rate of area planted (714461) acres and production (412123) tons(Anbar) (708155) acres and production (414422) tons(Babylon) at the rate of area planted (704617) and output (414646) tons(salads) (697941) acres and production (418712) tons(Al Qadisiyah) (662527) acres and production (441342) tons(DHI) Average area planted (692629) acres and production (1956547) tons amounting to the rate of production category (1923164) tonnes by (45.05)%.

3 - average investment (5.35 - 4.93)

Concentrated in each of the governorates (Baghdad), which reached the cultivated permit rate (706128) dunams and the production rate (413833) ton, (Najaf) (694631) dunams and the production rate (418084) ton, (Muthanna) (692488) dunams and the production rate (419761) ton and(Maysan) 692061 dunams and production rate (420444) tons, so the category production rate (381070) tons, or 8.77%.

4-weak investment (4.92 - 4.50)
Concentrated in both Karbala and Basra governorates where the average cultivated area of Karbala governorate reached (704026) dunams and the production rate of (331286) ton the cultivated area of Basra governorate reached (690374) dunams and the production rate of (420050) ton reached the production rate of (82692) ton, i.e. (1.90)\%.

Table (2) logarithmic categories of areas planted with wheat crop in Iraq for the period (2019-2010)

<table>
<thead>
<tr>
<th>Categories</th>
<th>Logarithmic rang</th>
<th>Investment type</th>
<th>The provinces</th>
<th>Production/ton</th>
<th>Percentage%</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>6.21 - 5.79</td>
<td>Very high</td>
<td>Nineveh-diyyala-wasit</td>
<td>1923164</td>
<td>44.28</td>
</tr>
<tr>
<td>The Second</td>
<td>5.78 - 5.36</td>
<td>Higher</td>
<td>Kirkuk-anbar-babylon-salahuddin-qadisyah-dhiqar</td>
<td>1956547</td>
<td>45.05</td>
</tr>
<tr>
<td>The Third</td>
<td>5.35 - 4.93</td>
<td>Medium</td>
<td>Baghdad-najaf-almothana-maysan</td>
<td>381070</td>
<td>8.77</td>
</tr>
<tr>
<td>The fourth</td>
<td>4.92 - 4.50</td>
<td>Weak</td>
<td>Karbala-Basra</td>
<td>82692</td>
<td>1.90</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>4343473</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: General Authority for Iraqi Meteorological and seismic monitoring / climate Department (unpublished data) for the year 2020. And apply the results of the logarithm equation.

Map (2) logarithmic distribution of areas planted with wheat in Iraq for the duration (2019-2010)

Source: Table (2). Based on the Arc-map-10.5 program
3-topic III: statistical analysis of the relationship between temperature, rainfall and wheat crop in Iraq for the period (2010-2019)

The simple correlation model Pearson coefficient is one of the statistical methods used to measure the degree of correlation of linear correlation between two variables[9].

The Figure (3) shows that the values of the correlation between temperature (range, micro, super and annual) of the study stations and the yield of dunm (wheat productivity) have reached the thermal range (0.716) which is a strong centrifugal correlation, micro temperature (0.686) which is a medium centrifugal correlation, Super temperature (0.748) which is a strong centrifugal correlation and annual temperature (0.786) which is a strong centrifugal correlation. Thus, this relationship shows the extent to which the impact of wheat crop production is strong at temperatures and the variability of production quantities in Iraq. this explains the fact that Iraq can be divided into regions according to the temperatures of the wheat crop. Figure 3 also shows that the correlation and direction between the amount of rainfall for the same plants during the study years and the yield of dunum (wheat productivity) has reached (0.901), which is a very strong correlation. this relationship illustrates the extent to which wheat crop production is strongly affected by the amount of rainfall and the variability of its production quantities in Iraq. this explains that Iraq can be divided into regions according to the amount of precipitation required for the wheat crop.

Form (3) Pearson correlation coefficient between dunum yields (wheat productivity) and climatic characteristics in Iraq for the period (2019-2010)

Source: from the work of the researcher based on the data of the Iraqi Meteorological Department/Department of climate and seismic monitoring for the year 2020 and using the Spss program.

4- fourth topic: agro-climatic regions of wheat crop in Iraq for the period (2019-2010)

The researcher did the work (Shap Fill) and then determine the locations of the climatic stations within the study after which the researcher entered the climatic data for the temperature rate and the amount of precipitation for all the study stations during the years covered by the study G.I.S-10.5) then devise a form showing the match of temperature rates and the amount of rainfall for the study area, consisting of a layer (Layer) within the program notes from the map (3) and Table (6) and Form (4) that the boundaries of agro-climatic regions for wheat crop (temperatures and rains) as follows:

1-optimal territory

From the north of Salah al-Din governorate, it included parts of the semi-mountainous area, making up the province (10.2)% of the area of the study area with an area of (38688) km2, and the province included both the stations (Mosul and Kirkuk) located within the study.

Source: from the work of the researcher based on the data of the Iraqi Meteorological Department/Department of climate and seismic monitoring for the year 2020 and using the Spss program.
2 - ideal middle territory.

The territory appeared separately included the northern part of Iraq and the north-eastern part of the western part of it the territory included most parts of the province (Kirkuk) except a small part of the northern, North-Eastern and north-western part of it and Salahuddin province except part of the eastern and southern part of it and limited to the northern part of Diyala province 35.6% of the area of the study area with an area of (135,200) km² thus the territory formed one third of the area of the study area, and the territory included the climatic stations (Baiji, khanqin, Ramadi and wet) located within the study.

3. extreme territory.

The extreme region of temperatures and rainfall has emerged in a continuous manner, extending from the eastern, southern, South-Eastern and south-western parts of Iraq to include parts of the eastern and southern parts of Salahuddin province, the eastern and south-eastern parts of Anbar province and most parts of the governorates (Baghdad, Karbala, Najaf, Babylon, Wasit, Qadisiyah, Maysan, Dhi Qar, Muthanna and Basra).

thus included part of the semi-mountainous area and the western plateau and most parts of the sedimentary plain to constitute the territory (54.2)% of the area of the study area with an area of (206115) km² so the extreme territory has represented half of the area of the study area the extreme territory includes climatic stations within the study.

<table>
<thead>
<tr>
<th>Item</th>
<th>Area/km²</th>
<th>Percentage%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimum region</td>
<td>38688</td>
<td>10.2</td>
</tr>
<tr>
<td>The idea average region</td>
<td>135200</td>
<td>35.6</td>
</tr>
<tr>
<td>Extreme region</td>
<td>206115</td>
<td>54.2</td>
</tr>
<tr>
<td>Total</td>
<td>380003</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: measurements were extracted using Arc software. Map. 10.5).

Form (4) percentages of temperature and rainfall regions in Iraq for the period (2019-2010)

Source: Table (3)
II. CONCLUSION

1. There is a spatial variation of the annual temperature rate of the study stations ranging from (28.5, 20.8) m° for both (Mosul and Nasiriyah) stations respectively.

2. There is a spatial variation of the annual average rainfall amounts of the study stations ranging from (86,360) for each of the stations (Mosul and Ramadi) respectively.
3-the very high investment pattern for the wheat crop appeared in both governorates (Ninawa, Diyala and Wasit), while the weak investment appeared in the governorates (Karba la and Basra) and the rest of the other governorates ranged between these two.

4-shows that the correlation between the annual average temperatures during the years of study and wheat have reached (0.786) is a link expelled strong therefore it explains how power influenced the production of wheat crop, temperature and quantities you need in Iraq.

5-it was found that the correlation between the average amount of rainfall during the study years and the wheat crop was (0.901), which is a very strong correlation, therefore this explains how strongly the production of the wheat crop is affected by the rains and the varying amounts of its production in Iraq.

6-the study proved that the optimal territory for growing wheat crop according to the matching of temperatures and rains appears in parts of northern Iraq in a continuous manner to include most parts of Mosul governorate, the northern section of Kirkuk governorate and a small part of northern Salahuddin governorate, thus forming the optimal territory an area of (38688) km2.

7-the study proved that the extreme territory for the cultivation of wheat crop according to the conformity of temperatures and rains appears in a continuous manner extended from the eastern part of Iraq, South, South- East and south-west to include part of the eastern and southern Salahuddin province, the eastern and south-eastern part of Anbar province and most parts of the governorates (Baghdad, Karbala, Najaf, Babylon, Wasit, Qadisiyah, Maysan, Dhi Qar, Muthanna and Basra the two territories.

REFERENCES